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W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

GETTING ORIENTED

A trip to Korea, Taiwan, Hong Kong, Guam, and Japan in October helped put things into sobering perspective as far as the US leadership in technology is concerned. Oh, the evidence was there without the trip—on my wrist in the form of a digital watch with built-in calculator from Japan, two or three more Casio calculators always at hand, a Sansui hi-fi system at home, Icom, Kenwood, Tempo, and Yaesu ham gear at every turn, Hitachi and Sanyo televisions, VTR systems made in Japan, etc. Even my new rechargeable pencil sharpener says Sanyo.

While traveling through the Orient visiting consumer electronic shows in Seoul, Osaka, Taipei, and Hong Kong, I got the full brunt of the competition the US faces from this area. It is no wonder that these countries have taken over 80-90% of the production of high technology electronics equipment being sold in our country . . . they're ahead of us in just about every field except computers and microwaves.

Can anything be done to reverse this worsening situation? I think it can, and I think that you, the readers of *73 Magazine*, can have a profound effect on the position of the US in electronics over the next few years. I don't think this is a situation which can be helped by setting up trade barriers. I do think it is high time the US did get vigorously to work to break down the one-way Japanese trade barriers . . . in essence, forcing them to fight us on more equal terms.

My visits to the electronic shows and Japanese electronic firms had me in contact with Asian amateurs at every turn. While this was no surprise, it did back up what I have been writing in my editorials for many years. Byron Kretzman W2JTP recently dropped me a letter reminding me of an editorial I published in the June, 1969, issue of *73*, pointing out that if our ham clubs did not get busy and get the amateur radio ranks growing again (growth had stopped for a six-year period at that time as a result of the FCC handling of the so-called "incentive licensing" proposals), the US dominance of the electronic industry worldwide could be lost within twenty years. I missed my guess; we lost it within ten years.

If amateur radio had been permitted to continue to grow at the rate it had established during the years after WWII until 1963, at which time it was proposed that we go back to the pre-war Class A and Class B licensing system and all growth stopped, we would today have well over 1,500,000 licensed amateurs and I sincerely believe that the US would be making 80% of the electronic equipment instead of Japan and their off-shore workshops in Hong Kong, etc.

Let's look at the situation carefully and think about it. Statistics (ARRL) show that about 50% of the new licensees are either 14 or 15 years old. We also know that about 80% of these newcomers to amateur radio get involved enough with electronics so they choose it for their career. This means that if our ham growth had not been brought to a halt in 1963 by the FCC failure to immediately dismiss the "incentive licensing" proposals, we might expect to have 166,000 new hams just in 1980. This would also result in about 133,000 of these new people entering the electronics industry within about five years.

Now, look here, don't come whining to me about how crowded the ham bands would be with 2,000,000 or more hams trying to use them. We have so damned many UHF and microwave bands that we aren't even using and so many techniques for getting more use out of the low bands that I don't think a big ham population would be anything but a big plus which would force more inventing and pioneering on us.

If you, the readers of *73 Magazine*, make it your business to see that your ham club gets busy and starts filling up those Novice classes with high school kids, we'll start having some good technicians and engineers flowing into our electronics industry within ten years. We want to get the kids at this time of their lives and infect them with one of the most virulent of viruses . . . amateur radio. If you get their attention at 14 and 15 years of age, you'll have most of them for life.

But we need a 20% growth rate or better, not a puny 11% that we had for the years prior to 1963 and the licensing debacle. We have to catch up so we can eventually get back our high technology industries. This means that your club must find some way to get into the nearby high schools and put on demonstrations of the wonders of amateur radio . . . repeaters, satellite communications, DXing, emergency service . . . the dozens of facets of our hobby which have made it one of the most important in the world.

With only about 30% of the licensed amateurs belonging to clubs, we need to have some vigorous club promotions. It's been some time since I have run articles in *73* on how to build up clubs, so perhaps it is time for you to write about this aspect of the hobby. There are some relatively simple rules for promoting club growth which I can pass on . . . such as making sure that your club meetings are fun to attend. That may sound too simple an idea, but unfortunately, I have been to far too many club meetings which were anything but fun. Long battles over buying paint to spruce up the clubhouse will not bring the membership back to the next meeting.

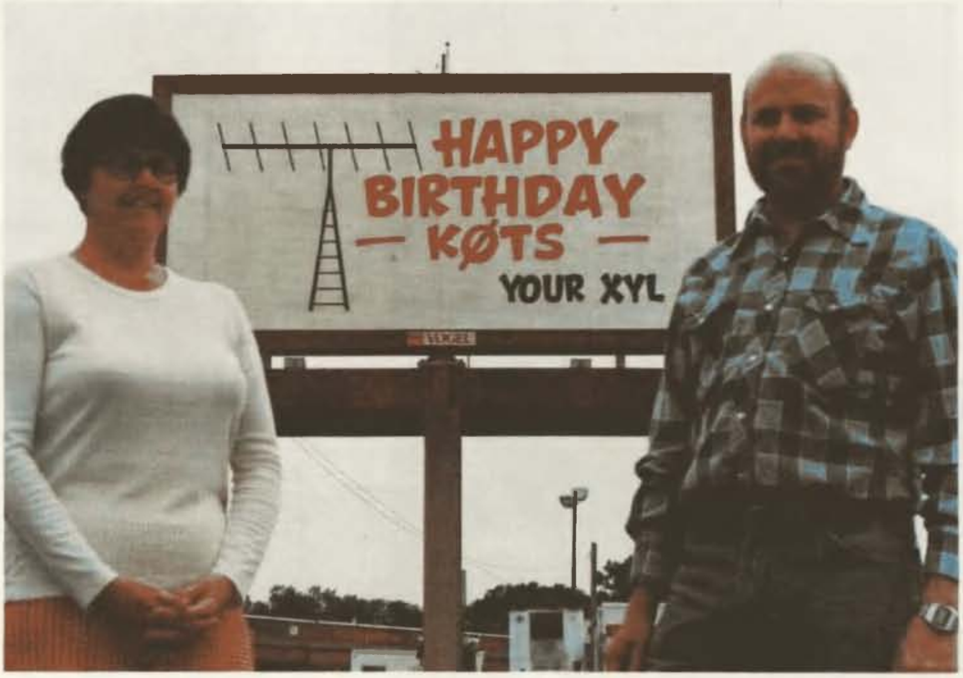
Let me provide some basic rules for getting clubs to grow. I

Faces, Places

John Shideler WAØNEV piloted the plane from which Dale Monaghen WØHSK photographed the DaVinci transamerican balloon on September 30, 1979. While they circled at 2500 feet about 30 miles northwest of Topeka, they used 2m to speak with the craft.

Say hello to the new Avanti Amateur Radio Club (Addison IL) and you'll receive their attractive QSL card. Members (left to right) are: Howard Van-Valzah WB9IPG, Joe Krusa WB9PIT, Dale Parfitt WA2YPY, Herb Blaese WB9PXD, Bob Steinhofer KA9FPB, Louis Martino W9DSG, Marty Linke WD9ABG, and Jack Pickering KA9FNR.

Alice Fishburn of Rochester MN presented her OM, Joe KØTS, with a 12-by-25-foot 35th birthday card in August.



Bill Allsopp W5TJI and his XYL, Mary WB5DVA, headed up the CAREN radio club (Little Rock AR) team at the annual Arkansas State Fair in October. (Photo by Paul J. Kirsch WA8ASQ/5)

Ham Help

I need help in obtaining a repair/service manual with schematics for a Micro Match swr wattmeter, model NBR 263.11. The meter was manufactured by M. C. Jones Electronics Co., Bristol CT.

I will pay for the manual or copies of the manual and any shipping.

Nick Marsala AB5M
5339 East 97th Street South
Tulsa OK 74136

I need a manual for an Eico model 324 signal generator. I will pay for copies.

Bill Morehouse
PO Box 214
Waukesha WI 53187

I'm interested in contacting anyone who owns a TRS-80.

Sam Martinez N3SM/HK1CWB
PO Box 8814
Baltimore MD 21224

I have just purchased an older-type dc supply manufactured by Universal Electronics of Santa Monica, California. It is a Transistorized Power Supply, Model LQ35, 15 Amps, 0 to 35 volts.

If anyone has a schematic or service manual to sell or copy, please contact me. Any help will be greatly appreciated.

John Pisarski
114 Evans Rd.
Norristown PA 19403

DX

The new month, new year, and new decade get off to a rousing start if all goes as planned: one major DXpedition in progress and one commencing the first week of January.

David Schoen N2KK should presently be operating from the Indian Ocean, on Juan de Nova, through about January 8; then he's on to Mauritius, an unnamed (at this time) island in the 3B group, the Malagasy Republic 5R8 on the 20th, and the pièce de resistance, the Somali Republic, around January 30. Dave is mainly interested in operation on the "low bands," but he plans to be wherever the demand is, 160-10 meters. N2KK is a professional photographer on assignment and should have an incredible slide show to present when he returns.

Since "becoming a country" in 1974, Kingman Reef has hosted two operations: the first in 1974 and another in June, 1977. At today's rates of amateur population growth, three years is enough time for a country to pass from not-needed status by most DXers into a slot on the "most-needed" lists again. In the case of Kingman, this may be rectified in the next couple of weeks, with Palmyra as a bonus.

January 4, 1980, is the starting date for operation from Kingman and Palmyra by WA2FIJ, W2TDQ, WA6YQW, K6LPL, and K2HFX. The operations will be simultaneous, with one group signing a KH5 callsign from Palmyra and another using a KH5K callsign from Kingman. Five days of operation are planned.

October, 1979, was a wild 31 days of DX by several well-known individuals and groups. Expeditions were mounted to FP8, 3D2, YJ8, FO8, FC, TF, HB0, KC6, 3C1, and CQ Zone 23. Here's a rundown of this extravaganza of a month.

DK6XR and DK7XN operated from the New Hebrides as YJ8XR the first week of October, then activated Tahiti for four more days. They were joined in the Pacific by Darrell Bevan N6DX, who finished a venture begun in September operating from the Fiji Islands. Darrell treated many DXers to contacts from the various islands on 6 meters.

In North America, K2RW and W2BHM vacationed on St. Pierre Island and put FP8AA and FP0VI on all bands. Meanwhile, during the first week of October, Lloyd and Iris Colvin, W6KG and W6QL, were plotting the next YASME Foundation jaunt through the Caribbean, with help deciding provided by attendees of the Houston Com-Con convention.

Boston hosted the annual New England DXCC meeting, featuring K1MM, KP4AM (of Desecheo fame), and former *West Coast DX Bulletin* editor WA6AUD. About 80 DXers showed up for this event.

In Europe, while HB9NL was accommodating 40- and 80-meter country chasers looking for Liechtenstein (HB0), DL1RK operated CW on all bands from Corsica (FC). Meanwhile, a large group of Ukranian operators were en route to Siberia, to Tana Tuva, which is in CQ Zone 23. They appeared on the bands mid-October for a one-month slay, and, by putting that zone on for the *CQ* Worldwide Phone Contest, made it possible for contestants to work all 40 zones during the contest. Zone 23 turned out to be a snap; the toughies were 34 and 37.

As if all this wasn't enough to make DXers happy, although busy, the two most important operations were yet to come. At mid-month, the long-awaited operation from the West Carolines group came to pass: JE1JKL and JA7FFN stayed four days on Yap Island and made 5278 contacts . . . 3738 were on CW on HF, with another 1540 on 6 meters! They must have had a 50-MHz pipeline home to Japan. JE1JKL has his QSL-handling chores cut out for him.

Finally, after weeks of rumors and counter-rumors, Equatorial Guinea came on the air to the delight of many. A Spanish DX contingent opened up with 3C1AA on October 13 and operated for several days. Their plans to proceed to Annobon Island ran into some snags, but persistence prevailed. After a fly-over the island, during which the pilot ruled out landing on the overgrown runway, the operators regrouped on the continent, hired a boat, and took the waterway to 3C0.

Annobon finally showed up on the bands on Saturday, October 27, during the *CQ* Phone Contest. The operators wisely stuck close to CW during the weekend. A full two weeks had passed between opening gun from 3C1 and starting mark for 3C0. Never say die! QSLs for 3C1AA to EA4MY, and for 3C0AB to EA4LH.

Politics often rears its head in the world of DX, especially on the continents of Africa and Asia. Last spring's expedition to Spratly Island (1S1DX) satisfied much of the demand for that country and may have been the last hamming to be done from there for some time. In its September 25 issue, *The DX Bulletin* out of Vernon, Connecticut, presented material demonstrating the tensions surrounding Spratly and the South China Sea area in general. Late last winter, the Philippines quietly annexed the major parts of the Spratly group, contrary to claims on the islands already made by Vietnam, China, and Taiwan. The main Spratly island is occupied by Vietnamese troops, while Taiwan uses three of the islands and the Philippines six.

Those who have attended a convention and seen the slide presentation by one of last year's 1S1DX operators can vouch for the uninviting nature of this "country." If you worked it, be glad. If not, you are in good company.

Franz Josef Land of the USSR is a much-needed DXCC country, and activity there has picked up. Look for UK1PAA, UK1PGO, and UA1PAL on 20 meters, both phone and CW.

Other than the Japanese, who regularly make business trips into China, the best bet for someone's foot getting in the BY door for amateur radio appears to be Thomas Wong VE7BC. He was in China in October for his twice-yearly business visit and stopped off to see JA6HOZ en route. JA6HOZ, you may recall, put BY on the air for an hour in August as part of a demonstration to city officials. VE7BC is scouting the territory and testing the waters, but the word from Chinese officials and from JA6HOZ is that it will "be a long time" before amateur radio comes to fruition in China.

Jim Bullington N4HX may be active from Chad (TT) by the time you read this. Jim works for the US government. Don Riebhoff of XV5AC, XU1DX, and CT4AT fame has his bags packed for Czechoslovakia. He visited Prague In October, showed some slides to the DX crowd at OK1ADM, and hopes for an OK8 callsign.

Bangladesh came back on the air in early autumn, after a short hiatus; S2BTF was found on 20 meters at various times

Continued on page 156

JR1AIB.

JA3MNP.

Awards

Bill Gosney WB7BFK
2665 North 1250 East
Whidbey Island
Oak Harbor WA 98277

The holiday season has come again. Now that you found that new radio or antenna packed under the Christmas tree, it's about time you got it out and gave it the old smoke test. How about a contact or two with our Middle Eastern friends where some booming signals have been originating lately?

Just this week I received a letter from Bruce Blackburn JY9BB, who is the Communications Advisor for His Majesty King Hussein of Jordan. As maybe you know, King Hussein and the Royal Jordanian Family are avid amateur radio operators. Perhaps you have heard their calls on the air, JY1 and JY2.

Mr. Blackburn writes to share three very spectacular awards being sponsored personally by King Hussein and the Arab Radio Amateur League. Of course, upon receipt of this letter, the very first thing I did was go through my own card file to see if I qualified. Much to my disappointment, I still need one more contact, that being with either JY1 or JY2. Perhaps, just perhaps, if they read my column this month, they'll sympathize with my need and arrange a future sked.

As you can see by the requirements of the three Jordanian awards, none was meant to be accomplished in one sitting. Naturally, that creates an even greater incentive for those of us wishing to pursue their goals.

THE ARABIAN KNIGHTS AWARD

This award is issued by the Arab Radio Amateur League (ARAL) members and presented by His Majesty King Hussein (JY1) of Jordan.

To qualify for this recognition of achievement, amateurs must have proof of having contacted at least ten (10) Arab countries, and one contact must be with either JY1 or JY2. All contacts must be made on or after January 1, 1971, on any authorized mode of communications. There are no special endorsements.

JY1	King Hussein
JY2	Royal Jordanian Family
A4X	Oman
A6X	United Arab Emirates
A7X	Qatar
A9X	Bahrain
CN	Morocco
HZ, 7Z	Saudi Arabia
J2	Djibouti
JY	Jordan
OD5	Lebanon
ST	Sudan
SU	Egypt
YK	Syria
YI	Iraq
3V8	Tunisia
4W	Yemen
5A	Libya
5T5	Mauritania
6O	Somali
7O	South Yemen
7X	Algeria
9K2	Kuwait

To apply for the Arabian Knights Award, the applicant must prepare a list of claimed contacts in prefix order. Each entry must also include the date and time in GMT, the band and mode of operation, and the and station worked.

Do not send QSL cards, as photocopies will be accepted. As an alternative, you may have your list verified by two local amateurs, a local radio club secretary, or a notary public.

Enclose this list along with an award fee of ten IRCs and send to the attention of: JY1 Award Manager, PO Box 1055, Amman, Jordan.

THE ROYAL JORDANIAN AWARDS

To amateurs throughout the world who qualify, JY1, His Majesty King Hussein I of Jordan, will issue a very elegant award of achievement to recognize one of two levels of accomplishment.

First, the Silver Award is offered in recognition of having worked six different JY prefixes. There are no band or mode restrictions; however, all contacts must be on or after January 1, 1971, to count.

The second and probably the toughest award of all to obtain is the Coral Award, which is issued to amateurs who visit Jordan and make a QSO from Aqaba. Simple, huh? Anyone for a charter trip this winter?

As with all awards sponsored by our Jordanian friends, applicants must prepare a list of claimed contacts made citing the usual logbook information including RS(T).

Forward this list, stating which award it is you are applying for, along with an award fee of ten (10) IRCs to: JY1 Award Manager, PO Box 1055, Amman, Jordan.

While you have your beam in that direction, why not turn it a few more degrees and see if perhaps propagation doesn't allow a few contacts with our friends in Switzerland. Here would be your chance to qualify for the very attractive award being offered by the union of Swiss Short Wave Amateurs

Continued on page 145

Microcomputer Interfacing

Peter R. Rony
Jonathan A. Titus
Christopher A. Titus
David G. Larsen

Most eight-bit microprocessors such as the 8080A, Z-80, 6800, 6502, and F-8 can add and subtract only eight-bit numbers, which can represent only decimal quantities between 0 and 255. This is not enough resolution or dynamic range for many applications. Consequently, *multiple-precision* and *floating-point numbers* are used.

The term multiple precision refers to the use of two or more computer words to represent a numeric quantity. In the above-mentioned microprocessor chips, a computer word is called a *byte*, and is eight bits long. A double precision number, therefore, contains two bytes, or 16 bits, and can represent any unsigned integer number between 0 and 16,777,216. Despite this ability to represent very large numbers, multiple-precision numbers do have their limitations, especially when units such as picograms, liters/second, and kilograms all appear in a single equation.

Floating-point numbers are frequently used for scientific and engineering calculations because they can represent quantities that vary greatly in magnitude. The term floating-point number refers to a computer quantity that is usually composed of two parts, a *mantissa* and an *exponent*. For eight-bit microprocesses, a floating-point number is often represented by a 16-bit mantissa and an eight-bit exponent. Since the exponent and mantissa may be either positive or negative, one bit in each is used as a *sign bit*. This means that the three-byte floating-point number (15-bit mantissa plus sign bit, 7-bit exponent plus sign bit) can represent numbers between 32,767 x 2^{-127} and 32,767 x 2^{+127}, which correspond to the decimal number range, 1.93 x 10^{-127} to 5.58 x 10^{+42}. it is quite common for the mantissa to contain an implied binary decimal point, and thus to represent binary numbers between 0 and 1.000 or between 0.500 and 1.000.[1]

Unfortunately, a *floating-point package*, which is a collection of subroutines that perform the addition, subtraction, multiplication, and division of floating-point numbers, is a complex program. The Intel 8080 floating-point package,[1] which was written by O. C. Jelich and had its origin in an earlier 8008 floating-point package written by C. E. Ohme, requires 865 bytes of read-only memory (ROM) and 24 bytes of read/write memory. Few programmers write floating-point packages because they are available from computer manufacturers of their respective users' groups.

Integer, or *fixed-point*, mathematical programs are relatively easy to write. For 8080A-based microcomputers, the add (ADD) and add-with-carry (ADC) instructions are used to write integer addition subroutines and programs. These instructions are used not only to add eight-bit numbers, but also 16-bit, 24-bit, and larger numbers. The add-with-carry instructions are particularly useful in this regard, since they add the content of the *carry bit* to the sum of two eight-bit bytes. The carry bit is also either set or cleared as a result of this addition.

A typical triple-precision integer-addition subroutine for an 8080A microcomputer is shown in Fig 1. The subroutine adds two three-byte (24-bit) numbers that are stored in memory and returns the sum back to memory. When subroutine ADD3 is called, register pair D must contain the memory address where the least significant byte (LSBy) of one of the numbers is stored in memory. The more significant bytes of the three-byte number must be stored in consecutive memory locations at the next two higher memory addresses. At location ADD3, the C register is loaded with the number of bytes that are to be added, in this case, three. Register pair H is then loaded with the memory address where the other 24-bit number is stored. The first of the three memory locations used for this storage is assigned the symbolic address IACC (Integer ACCumulator). It should be noted that it is always possible to use a group of consecutive bytes in memory to create a multi-byte accumulator, which contains one of the operands and in which the final result of an arithmetic or logical operation is stored.

The next instruction that the 8080A executes, XRAA, clears the carry to a logic zero. This instruction must be included in the subroutine because you have no way of knowing what the state of the carry is when the subroutine is called. You do not want to add the carry from some previous operation into the 24-bit result.

At ADDAGN (ADD AGaiN), a single byte is moved to the A register from the memory location addressed by register pair D. The content of the memory location addressed by register pair H is then added to the content of the A register, and the result of this addition is copied into the memory location addressed by register pair H. Both register pairs, D and H, are then incremented by one with the aid of the INXC and INXH Instructions, respectively. The *byte count*, which is contained in the C register, is then decremented by one.

When the content of the C register is decremented to zero, the 8080A returns from the subroutine. If the content of the C register is not zero, the 8080A jumps back to ADDAGN and adds the next two bytes in sequence. Note that the XRAA instruction is used to clear the carry to a logic zero only when the subroutine is first called.

Subroutine ADD3 can be easily modified to add a four, seven, or even a 200-byte number simply by changing the immediate data byte of the MVIC instruction. Of course, if four-byte numbers are to be added, you must provide a four-byte integer accumulator to store the *accumulated* result.

A triple-precision integer-subtraction subroutine for an 8080A microcomputer is shown In Fig. 2. The program is almost Identical to the integer addition program given in Fig. 1; the instruction ADCM in Fig. 1 is replaced by SBBM in Fig. 2. Note that the content of the integer accumulator is subtracted from the content of memory addressed by register pair D, with the result of the subtraction stored in the integer accumulator.

In the next column, we shall discuss integer multiplication and division subroutines. A subsequent column will describe the application of these subroutines to the *smoothing* or *filtering* of data acquired from an analog-to-digital converter (ADC).

```
ADD3,    MVIC     /LOAD THE C REGISTER WITH THE
         003      /NUMBER OF 8-BIT BYTES TO BE ADDED.
         LXIH     /LOAD REGISTER PAIR H WITH THE
         IACC     /MEMORY ADDRESS WHERE ONE OF THE
         0        /ARGUMENTS IS STORED.
         XRAA     /CLEAR THE A REGISTER AND CARRY
ADDAGN,  LDAXD    /GET ONE ARGUMENT INTO A
         ADCM     /ADD THE OTHER ARGUMENT TO IT
         MOVMA    /SAVE THE RESULT BACK IN MEMORY
         INXD     /INCREMENT ONE MEMORY ADDRESS AND
         INXH     /THEN INCREMENT THE OTHER.
         DCRC     /DECREMENT THE BYTE COUNT IN C
         JNZ      /IF THE COUNT IS NON-ZERO,
         ADDAGN   /PERFORM THE ADDITION AGAIN
         0
         RET      /OTHERWISE, RETURN FROM THE SUBROUTINE
```

Fig. 1.

```
SUB3,    MVIC     /LOAD THE C REGISTER WITH THE
         003      /NUMBER OF 8-BIT BYTES TO BE SUBTRACTED
         LXIH     /LOAD REGISTER PAIR H WITH THE
         IACC     /MEMORY ADDRESS WHERE ONE OF THE
         0        /ARGUMENTS IS STORED.
         XRAA     /CLEAR THE A REGISTER AND CARRY
SUBAGN,  LDAXD    /GET ONE ARGUMENT INTO A
         SBBM     /SUBTRACT THE OTHER ARGUMENT FROM IT
         MOVMA    /SAVE THE RESULT BACK IN MEMORY
         INXD     /INCREMENT ONE MEMORY ADDRESS AND
         INXH     /THEN INCREMENT THE OTHER.
         DCRC     /DECREMENT THE BYTE COUNT IN C
         JNZ      /IF THE COUNT IS NON-ZERO,
         SUBAGN   /PERFORM THE SUBTRACTION AGAIN
         0
         RET      /OTHERWISE, RETURN FROM THE SUBROUTINE
```

Fig. 2.

Ham Help

I would like to get in touch with anyone who had had experience getting a computer (OSI C1P, 4K) set up and running on the ham bands sending and receiving RTTY and Morse code. Thank you.

Larry Herbert WB3HEX
2315A 14th Street
Ft. Eustis VA 23604

Leaky Lines

Dave Mann K2AGZ
3 Daniel Lane
Kinnelon NJ 07405

Phlukey phonetics are back with us again. For a brief while it appeared that the forces of Alfa, Bravo, Charlie, and Delta had prevailed; one heard the preferred phonetics and only occasionally ran into those of the humorous (or not so humorous) variety. But now they are all over the place. The bands are full of Hot Water Bottles, Soggy Tennis Sneakers, Aunt Maggie's Drawers, Jersey's Ugliest Quad, Mississippi Pea Picker, and Always Going Zigzag (you see, I'm in there, too).

I must confess that I like this sort of thing. Granted, such frivolities shouldn't be used on MARS or RACES, where a certain decorum and protocol must be observed, but what's wrong with injecting a bit of informality where it isn't out of place?

Some callsigns defy all efforts, however. As a wordsmith of somewhat lengthy experience, especially in the pop song field, I think that I'm pretty good at devising fairly clever phonetics. But when somebody hits me with those Qs, Zs, and Xs, I generally shrug my shoulders and give up. Good ones seem to come spontaneously. The very first time I ever worked Tony W2IOO, it didn't take five seconds for me to bestow upon him the sobriquet, Italy's Oiliest Olive. Whether he approved or not is an entirely different matter. I never promised him a rose garden! But it's a heckuva lot easier to remember than India Oscar Oscar, isn't it? And as for Ida Oboe Oboe, forget it!

On Christmas Day of 1964 or 1965, I've forgotten which, and I'm far too lazy to pull the appropriate logbook from the disreputable looking pile of rubble in the bottom of the shack closet to find out, I hooked up with a guy who signed We Broke 4 Plate Glass Windows. QSB was closing in fast, and we lost each other very quickly. I haven't heard him since, but I guarantee that I'll know him at once if ever I hook up with him again. How in the world could anyone ever forget We Broke 4 Plate Glass Windows? But I don't think I'd be able to remember Whiskey Bravo 4 Papa Golf Whiskey.

I'll admit that there are times when it can get confusing. I used to work a certain Horses, Ponies, & Zebras. I am now acquainted with Horses, Zebras, & Ponies. The latter happens to be a musician, and I've decided to suggest that he use Hungarian Zither Player. It doesn't matter that he's not of Magyar descent. You can't have everything.

Quarters, Dimes, & Nickels ... Pints, Quarts, & Gallons ... April, May, & June ... Jacks, Queens, & Kings—all friends of mine, all instantly recognizable on the ham bands. So are Ugly Lover, Hot Little Hands, and Red Hot Electrons, not to mention one of the most well known of all, Never Say Die, who, I'm told, has something to do with this magazine.

We not only apply phonetics to our callsigns, but to many things. Who has not heard a thousand guys calling, "CQ, CQ, CQ Dog X-Ray," and what ham is not familiar with Heathkit's Hot Water series of equipment? Sometimes it's not very flattering; some AM enthusiasts still refer to sideband as Slop Bucket. And who among us has not sometimes said of another service, Criminal Band, Chicken Band, or Children's Band?

Once in a while you will hear someone use trick phonetics to clarify his name. I suppose that almost all the Floyds have used Funny Little Old Yellow Dog, and all the Bobs spell out Broken Old Bottles.

Please, I beg you, don't infer that just because I've done a little bragging here about my facility with phonetics, I'm ready, willing, and able to dig one up for you. Don't ask me to assume the burden ... I've got enough troubles of my own. I once had the temerity (and stupidity) to offer to help someone select a name for a forthcoming blessed event, and I got into the middle of a horrendous family argument that is still going on. The mother's family is sore because they think the kid should have been named after a maternal grandfather, and the father's family is sore because he was named after a wealthy uncle who promptly changed his will in favor of the kid, thus cutting them out of their anticipated bequests ... the kid got it all! In point of fact, he isn't even known by the name I helped to select. Everybody calls him Red, since his hair is the color of a ripe tomato.

But I resolved that I would never get inveigled into such a situation again, and I am just as adamantly determined to avoid helping with callsign phonetics. So please don't ask me for any help ... as I say, I've got enough troubles of my own.

***

A serious note: Some weeks ago, while sitting in the living room, I became aware of a faintly acrid odor which seemed to be wafting in from the radio shack, about thirty feet down the hall. I went to investigate and found the room blanketed in a vast, impenetrable cloud of yellowish smoke.

The first thing I did was reach for the convenient circuit-breaker switch, just inside the doorway. Then I slammed the door shut, went into the bathroom, saturated a towel in cold water, and draped it over my mouth and nose. I took a very deep breath, opened the door, ran over to the windows and threw them open (it was a chilly night and they had been closed), and turned on the exhaust fan. I then reclosed the door and waited for about two hours before venturing back into the shack.

The surface of my operating desk was covered with an ugly, dark brown film of goop, vile-smelling and extremely viscous, like molten tar. Evidently, all the potting compound of a transformer had melted and run out through the apertures in the bottom of my prop pitch rotator control. But the worst of it had been due to the burn-up of some selenium diodes. The gas generated from these is noxious enough to be used in the California lethal death chamber!

I had been under the distinct impression that this device was adequately protected against short-circuit damage. It was designed with a power main fuse and with the appropriate interlocks and so forth. It ran on 110 V ac and its sole function was to provide 36 V dc to run the motor and to switch from clockwise to counterclockwise rotation ... a very simple device indeed. But its power supply contained selenium diodes, and these are not to be taken lightly.

A tragedy was averted. But I am chilled by the realization that I frequently used to leave all my gear running on standby overnight, and if this malfunction had occurred while the family was asleep, we might all have been asphyxiated in our beds!

At nine o'clock on the very next morning, I drove over to my handy-dandy local hardware store and purchased a number of smoke detector alarms. One of them was promptly installed in the radio room, and others are placed in strategic locations all over the house. I do not intend to run the risk of a recurrence.

Every radio shack should be equipped with certain basic items. We have been aware of the necessity of a dependable fire extinguisher, a dummy load, certain test equipment, and so forth. But every ham should make sure that he adds to this list of fundamental necessities a good smoke detector alarm. Don't put it off ... It may save your life and the lives of your loved ones.

***

If you have a strong stomach and can withstand disgusting things, go down to 14.195 when a rare DX operation is working split. I always thought that this frequency was off limits for us, but I was amazed to learn that it is a gathering place, not only for a flock of self-appointed monitors, but for one of the foulest-mouthed groups of morons and idiots I've ever had the displeasure of running into.

The usual procedure followed when DXpeditions operate split frequency is for the operator to announce his listening frequencies. He will invariably do this, and for people to insist upon calling him on his transmit frequency is bad enough, but for fifteen or twenty big mouths to feel that it is their prerogative not only to inform others that they are out of the US phone band, but to call them vile names in the bargain, is really too much. This generally occasions a retort by either the offending station or by the other filth peddler and the result is pretty chaotic.

The DX station is not bothered by the carrier throwers, the tuner-uppers, and the occasional excitable QSO seeker who forgets to flip his band-switch ... he is listening up the band for callers. All these guys do is make it impossible for the station being recognized by the DX operator.

Most of their voices are recognizable by their friends and associates. In all good conscience, they should be told to knock it off. And their friends need not take the trouble to be tactful or diplomatic about telling them. They are perfectly aware of the trouble they cause, and if they persist in these sorts of carryings-on, they *ought to* have their heads handed to them.

There's absolutely no excuse for it, and the sooner they are exposed and given what they deserve, the better. Imbeciles who do this sort of thing deserve *no* consideration, because they give none to others, and the very last thing their friends should provide them with is anonymity. This only enables them to continue the misbehavior.

I had occasion, even though I did not need it, to listen to the most recent operation on Mount Athos, and despite the fact that I am a guy who's been around and who's been exposed to some pretty filthy talk in my day, I was appalled at the foul talk that I heard. It's an intolerable

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Contests

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

QSL EXCHANGE CONTEST
Starts: 0000 GMT January 5
Ends: 2359 GMT January 6

While there are many efficient, inexpensive ways by which QSL cards can be exchanged with DX stations, exchanging QSLs within the US is an expensive proposition. This contest was proposed to eliminate the high cost of QSLing and to provide an opportunity to work those rare states, counties, etc., knowing that you will actually receive a QSL card for each contact. In making a contact in this contest, you agree that you are actually filling out the other station's QSL card as the contact is being made. The objective is to receive as many QSLs as possible for contacts in the contest period.

The contest is open to all single-operator stations. Contacts may be made with the same station more than once, provided that they are made only once on each band on each mode. All modes are permitted.

EXCHANGE:

The contest exchange is an exchange of callsigns and signal reports, accompanied by the statement "I have completed your QSL card" (or "QSL DONE" on CW), or its equivalent. I suggest on phone that you actually read the time, date, band, etc., as you fill in the blanks on your QSL as a part of the exchange, but that is optional. On CW, a QRX can be used to free the hand to write the card, followed by the "QSL DONE," but again that is optional. The QSO should, in any event, be completed only when both stations have completed their QSL cards. Make sure the other station is actually in the QSL Exchange Contest and is filling out your card at the same time. Only one QSO per QSL card should be used to provide easier counting by the contest committee.

SCORING:

Scoring is the count of QSL cards which are received for you at the contest address by February 6th. Cards will be sorted and mailed to their new owners by March 6th. For each call district and for foreign countries with sufficient entrants, a trophy will be awarded the highest scorer. For each state, province, or country, the highest-scoring station will also receive a certificate.

ENTRIES

All QSL cards must be mailed as described below to: H. W. Barry Merrill W5GN, 10717 Cromwell Drive, Dallas TX 75229. The mailing must include an SASE which is at least as large as your outgoing envelope. You can use your own outgoing mailing to determine the amount of postage on the return envelope, being careful if your QSL cards are thin to add enough postage. You must sort your QSL cards in the same order that is used by the *Callbook*—by call district, then by suffix, and then by prefix. Use the station callsign, disregarding any portable callsigns for this sort. Finally, you must accompany your entry with $1.00 for every 100 QSL cards, preferably by check.

INTERNATIONAL ISLAND DX CONTEST
Starts: 0000 GMT January 12
Ends: 2400 GMT January 13

The object of this contest is to work as many stations worldwide with special emphasis on DXCC countries which are designated IDX Islands. A complete list of IDX Islands is available from the contest committee. Maximum operating time is 36 hours for single operators and 48 hours for multi-op stations. No crossmode contacts are allowed. Operating categories include phone only, CW only, or mixed mode. Entry classes include single operator/single transmitter, multi-operator/single transmitter, or multi-operator/multi-transmitter.

EXCHANGE:

All stations give RS(T) and consecutive contact number. DXCC countries which are designated IDX Islands must also give their island name.

SCORING:

Score 1 point for contacts within your own DXCC country, 2 points for contacts outside your own DXCC country. Score 1 bonus point for contacts with stations located in a DXCC country which is a designated IDX Island. Hawaii and Alaska are considered separate DXCC countries from the continental US. A station may be worked only once in the contest for point value, but may be worked on a new band for multiplier credits. The multiplier is the number of DXCC countries worked on each band. Final score is total QSO points times the total multiplier.

FREQUENCIES:

Lower 50 kHz of each phone and CW segment of the US amateur bands on 6 through 160 meters.

AWARDS:

Contestants must operate a minimum of 12 hours to be eligible for awards. Awards will be issued to those qualifying high-score entries for each operator class and mode in each US state, each DXCC country, and each IDX Island.

ENTRIES:

All entries must be postmarked no later than February 15th and must include a logsheet(s) for each band and indicate stations worked, date and time in GMT, frequency, mode, and points per QSO. Each entry must include a multiplier list for each band, a dupe sheet for contacts of 100 or more, and a summary sheet which is available from the contest committee. All entries or inquiries concerning the IDX Contest must enclose a business-size SASE or 3 IRCs and be sent to: Gary Pierson WA7GVM, Box C, LaConner WA 98257.

HUNTING LIONS IN THE AIR CONTEST
Starts: 1200 GMT January 12
Ends: 1200 GMT January 13

The contest is sponsored by Lions Clubs International and is coordinated by Lions Club Rio de Janeiro ARPOADOR, Brazil. Participation in the contest is open to all duly licensed radio operators, Lion and non-Lion, except members of the Contest Committee of the Lions Club Rio de Janeiro. There are two operating modes: phone and CW. Participation in both modes is allowed, but points are counted separately. All participating stations must operate within their licensing regulations. Categories include single operator and radio clubs (multi-op). Points of radio clubs and radio societies will be

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Calendar

Jan 1	ARRL Straight Key Night
Jan 5-6	QSL Exchange Contest
Jan 12-13	International Island DX Contest
	ARRL VHF Sweepstakes
	Hunting Lions In The Air Contest
Jan 19-20	North and South America RTTY Flash
Jan 26-27	French Contest—CW
Jan 27-28	Classic Radio Exchange
Feb 1-10	ARRL Novice Roundup
Feb 2-3	South Carolina QSO Party
Feb 9-10	QCWA QSO Party—CW
Feb 16-17	ARRL DX Competition—CW
Feb 23-24	French Contest—Phone
Mar 1-2	ARRL DX Competition—Phone
Mar 8-9	QCWA QSO Party—Phone
Mar 9-10	Europe and Africa RTTY Giant Flash
Mar 22-24	BARTG Spring RTTY Contest
Mar 29-30	YL International SSBers QSO Party—CW
Apr 19-20	YL International SSBers QSO Party—Phone

Results

RESULTS OF THE 1979 RHODE ISLAND QSO PARTY

COUNTY AWARD WINNERS

County	Call	QSOs	Points	Mult.	Score
Bris	KA1BBY	201	434	42	18,228
Kent	W1GOG	39	99	24	2,328
Newport	WA1OSL	82	180	33	5,940
Providence	WA1TAQ	268	536	51	27,336
Washington	K1QFD	52	120	24	2,880

SECTION AWARD WINNERS

State	Call	QSOs	Points	Mult.	Score
Conn.	WA1HYN	5	10	3	30
Maine	WA1WRI	9	40	4	160
Penn.	WA3ZGL	12	32	4	128
Georgia	AI4X	7	22	2	44
Ken.	KA4AZT	33	99	5	495
Tenn.	WB4WHE	4	8	2	16
Calif.	WA6JGB	10	28	3	84
Idaho	WB7URE	14	39	5	195
Oregon	KA7EOG/N	1	10	1	10
Wash.	WB7QEL	17	53	5	265
WV	WB8BMX	5	18	3	54
Ill.	W9QWM	14	28	5	140
Colo.	KA0CLS	4	16	2	32

New Products

THE AZDEN PCS-2000

Amateur-Wholesale Electronics is proud to announce its superior new Azden PCS-2000 2-meter FM transceiver. The PCS-2000 covers 144-148 MHz in 5-kHz steps (800 channels). It features six memory channels and scanning of memory or the full band in "free," "busy," and "vacant" modes. All frequency control functions are performed by a microcomputer.

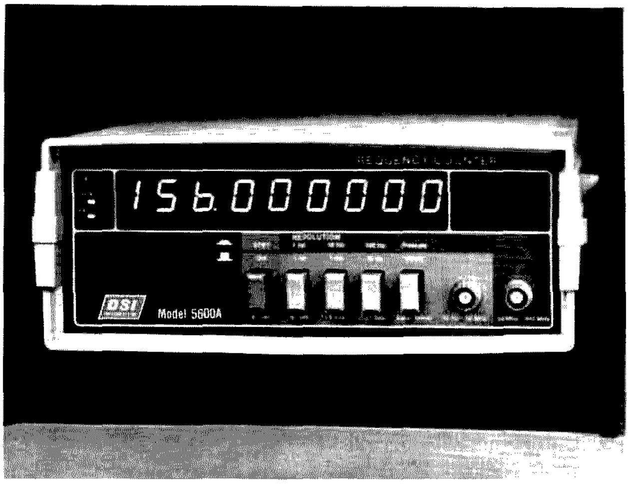
Upon inspection, the most striking feature is the absence of a large knob for frequency control. In place of a knob, there is a 12-button microcomputer control keyboard. The desired frequency is programmed into the radio digit by digit. Simplex, −600-kHz, or +600-kHz operation is selected by pushing a keyboard button. Using a front-panel rotary switch, three additional offsets become available: +400 kHz, +1 MHz, and +1.6 MHz.

It won't take an observer long to notice that the unit comes apart into two pieces: the control head and the main unit. With an optional connecting cable, the two units can be located as much as 15 feet apart. This allows great flexibility for mobile and portable operation.

The microphone contains a volume and squelch control, two frequency control buttons, and a button for instant recall of memory channel 1. By using these controls, the necessity of reaching down to the control panel while driving is greatly minimized.

The PCS-2000 has a huge ½-inch LED display that makes frequency determination easy. The S-/rf meter is digital, using LEDs instead of the usual, often-troublesome mechanical movement. There are two selectable power output levels: 5 Watts and 25 Watts. Low power is internally adjustable from 3 to 7 Watts. Frequency deviation is ±5 kHz maximum. Azden units significantly exceed FCC regulations limiting spurious emissions.

An external speaker jack is provided on both the control head and the main unit. Optional accessories include external speaker, remote cable, desk microphone, and touchtone™ microphone kit. Both the desk microphone and the touchtone kit provide the same remote-control functions. For additional details, contact *Amateur-Wholesale Electronics, 8817 SW 129 Terrace, Miami FL 33176.* Reader Service number A21.



DSI's Model 5600A counter.

50 HZ-550 MHZ 9-DIGIT FREQUENCY COUNTER

DSI Instruments, Inc., of San Diego, has announced its new Model 5600A frequency counter. Its large-character, bright-clarity, 0.5-inch-high 9-digit LED array—with automatic zero blanking—provides enhanced readability at a distance and at wide viewing angles, even under high ambient light conditions.

Two input channels are provided. One covers the 50 Hz-to-50 MHz range while the other is for the 50 MHz-to-550 MHz frequency spectrum. High-visibility indicator lights for "Standby," "Oven-Ready," and "Gate-Time" status are included as standards rather than extra-charge options. The user can quickly select a desired resolution from 0.1 Hz to 1.0 kHz with convenient push-button ease. Additional features include an rf preamplifier and a 550-MHz prescaler.

Housed in a compact, high-impact-resistant portable cabinet with a coordinated multi-position combination carrying handle-easel, the 5600A operates directly from an internal 8.2-to-14.5 V dc battery or a 115 V ac adaptor. It measures 3.25 inches high by 9.5 inches wide by 9.0 inches deep, including a self-contained battery holder compartment, facilitating convenient and quick adaptation to field or bench usage.

Cost-effectively priced options include a 10-hour rechargeable battery pack, as well as an audio multiplier that allows up to 0.001-Hz resolution, and a 25-dB preamplifier with a variable sensitivity control.

The 5600's low-cost to high-performance quotient and convenient portability make it ideally suited for measuring, troubleshooting, calibration, and servicing applications—on the bench or out in the field.

For additional information, contact *DSI Instruments, Inc., 9550 Chesapeake Drive, San Diego CA 92123; (800)-854-2049, (800)-542-6253 (California).* Reader Service number D25.

THE AEA MORSEMATIC™

At last, a computerized electronic keyer is available that combines virtually all the features of all the other keyers in the marketplace. The AEA MorseMatic utilizes two custom state-of-the-art microcomputer chips to perform functions that were previously only a CW operator's fantasy.

For serious contest enthusiasts, the MorseMatic offers the most flexible automatic serial number generator on the market. For VHF DXers, it offers the exclusive automatic beacon mode for precise moonbounce, scatter, or tropospheric DX scheduling. To utilize the beacon mode, the MorseMatic can be instructed as to how long to transmit any selected message and how long to pause before the message is automatically transmitted again. The computers will automatically set the message code speed to fit the desired transmit window. The beacon mode can also be used for contest operating and for VHF beacon transmissions.

The MorseMatic keyer is the

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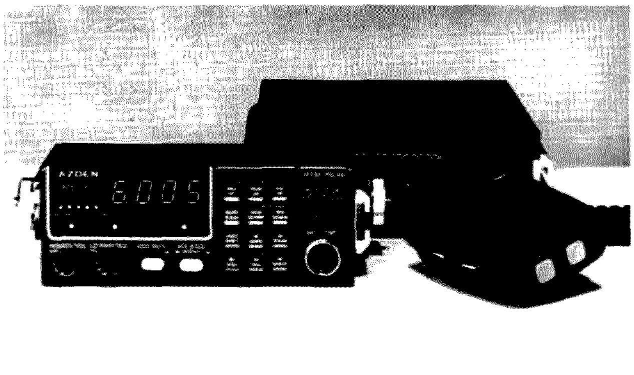

The Azden PCS-2000.

The MorseMatic™.

LETTERS

DO SOMETHING

I have just subscribed to *73 Magazine*, but I only did so in order to obtain some fine technical and operating articles which I have had the pleasure to read in the past. The editorials are, however, another item.

Now, I realize that our government has its problems, but it is ours. We elect its representatives and it is our civil right to improve it. The ARRL is our national amateur organization and it is the right of its members to improve it. My observations have shown that when it comes to ARRL decision making, *73* is quick to criticize, but lacks either the ability or the capability to do something about it. Mr. Green, if you are intelligent enough to discover a problem, gather your band of followers and run for League president! Hams should not point fingers if they are incapable of trying to correct the problem. The ARRL is *our* organization and we should do our best to improve it rather than belittle it. For myself, I am proud to be an ARRL member.

My second point of friction concerns a segment of your September, 1979, editorial concerning "Spreading the Word." Mr. Green, this nation has had enough economists and Ralph Naders to keep our heads spinning for the next century. Tattling on grocery store chains is not our normal form of amateur activity. Besides, many factors go into the price of differing items, such as wholesale prices, middleman prices, operating and maintenance costs, taxes, wages, and, of course, a profit which is usually less than 10% of the store's actual income. If we are to develop a strong picture of amateur radio to the public, let us continue to do so as we have in the past: teaching classes, speaking to groups, giving school demonstrations, appearing at local fairs, monitoring track events, passing traffic, and, of course, working to *save lives* in the event of natural disasters, and allowing the media to know of it. *This* will continue to develop the public relations we need. Saving lives will always be more important than saving pennies!

Finally, I would like to comment on the "ARRL Line" which also appeared in the September issue. I have only been licensed three years, and I am currently an Advanced. I was not around when the ARRL pushed for this dividing line at 14.275 MHz, but I would have supported it, even as a General. What would be the use of upgrading if I would have had the chance to operate on the elite part of 20 meters? This line keeps SSTV for those who have adequate knowledge of it (i.e., Advanced and Extra). Using callsigns as the only means of incentive is all too foolish. You mentioned that this line was also the cause of losing the old manufacturers of amateur radio such as Hallicrafters, National, and Hammarlund. These companies died because of a lack of distributors, not the dividing line. Local radio dealers of the 1960s could not continue to cut their prices in order to beat the dealer down the street. Profits were lost, and the local dealer was among a vanishing breed. The manufacturers therefore lost their distributors, which caused their collapse. Another piece of evidence: The dividing line is still with us, yet names like Kenwood, Swan, Icom, Den-Tron, Yaesu, Drake, and Ten-Tec have prospered.

In closing, Mr. Green, please get your facts straight, do something rather than nothing, and keep up the great technical and operating articles. I assure you that I'll never say die.

Edward Middlebrook WD5BCI
West TX

NOT FOR SALE

The FCC column in the October, 1979, issue (p. 29) clarified a most irritating point for me. Apparently the struggle between freedom of reception and greedy commercialism was bent towards commercialism in Section 605 of the Communications Act of 1934. It is hard to believe that in this supposedly free country, artificial (fiat) restrictions would be legislated against citizens entirely for the purpose of creating a commercial market for a minority.

In order to correct the situation, I believe that a statement of the ideal for a reception law in a free country should be made and then possibly adopted as a new Constitutional amendment. I propose the following:

1. There shall be no law passed or action taken to abridge the citizen's right to receive transmissions of communications or entertainment material which are broadcast, by any means, through the citizen's private property or through public property.
2. No means of reception shall cause interference with any other reception.
3. Any broadcast material shall, during the real-time broadcast, become public domain to be disposed of at the discretion of the citizen receiving the broadcast. No copyright shall exist for material which has been broadcast.

In the foregoing, I would define broadcast to mean transmission by any means which are not shielded from radiating.

The proposal would affect zoning, mobile scanner, satellite, MDS, unscrambler, and Fuzzbuster™ restrictions, along with any other attempts to conceal from the public, deceive the public, or profit from fiat restriction of the public. It would allow all present forms of commerce to continue, except without the protection afforded by artificial law.

In my opinion, transmission must be regulated to maintain order, but reception must remain uncompromised.

I presently hold a commercial operator's license which would allow me to profit from the restrictions of the public's right to receive, but I am appalled to think that a citizen could be arrested and fined or jailed for receiving transmissions which are broadcast through his own private property. Compromise of the right to receive opens the door to all forms of censorship, greed, and tyranny. By any reasonable sense of ethics, Section 605 is out of line and MDS is out of business. The airwaves are not for sale!

Carl B. Rayman WAØRLY
Austin TX

WINDMILLS

The conversations, editorials, letters, strong words, and anger about CBers on 11 meters all seem a little fruitless to me. The false premise is that something significant can be done about it.

The FCC choices really are: Shall we waste $100,000 trying to enforce present regulations or shall we legalize the 11-meter facts of life?

Isn't it perfectly obvious that nothing of value is being gained through present levels of enforcement? And isn't it equally obvious that Congress isn't going to fund a vastly increased enforcement effort? Besides, 11 meters will be dead in a couple of years anyway. It seems, to me, more productive to worry about unlicensed operators on the bands that will be open.

I have no statistics to support my belief that 7, 14, and 21 are loaded with Novice operators who can't master code or who haven't the engineering background to upgrade. Nor do I have any statistics to support my guess that as 11 meters dies, thousands of CBers will convert their ham rigs back to the ham bands. It's either that or junk some very expensive equipment.

Of course, ham ranks have grown greatly as CBers upgraded. I would expect this to continue, but not to the exclusion of unlicensed operators.

Hams now operating on 11 meters—some think it's more fun than the typical signal report—will go back to legal operation, but the amateur bands will never be the same.

I would expect the next step to be, as ham frequencies become vastly overloaded, hams going outside the bands. Won't that be embarrassing?

Old hams will battle against the new boys. Amateur radio will never be the same—whether that's for the better (vastly increased use by citizens of their airwaves) or for the worse (pollution of those airwaves).

It's a matter of opinion, but one thing is for sure: It *will* be different! And tilting at windmills is just as fruitless today as it was in the days of Don Quixote.

Name withheld
by request

NITPICKING

This letter is about the comments in *73* Letters concerning the ARRL.

It is likely that the things they say are true, but I have yet to hear of any of these characters recommending an outstanding ham for election to the ARRL Board of Directors. Criticism without constructive countermeasures accomplishes nothing. Seems more like the writers are just jackals on an ego trip.

I'd sort of like to see a good "Bismarck" in ARRL headquarters. They tell me the only good time to live in Europe was when he ruled with an iron fist.

The mass of hams in the US are too diversified a group to be governed in such a manner that all hands will be content with everything. I have doubts that a good Bismarck will ever be found, so I guess hams will have to depend on the Board of Directors.

How many more years are

Continued on page 154

Tim Daniel N8RK
73 Magazine

NBVM: Dawn of an Era or Promotional Hype?

—the performance and politics of Narrow Band Voice Modulation

In December, 1977, a well-known radio organization announced the development of "Narrow Band Voice Modulation," a breakthrough that would "revolutionize" voice communications. In the months that followed, two feature articles in *QST* and a chapter in the *Radio Amateur's Handbook* were devoted to NBVM. A prototype was developed and tested, and now a commercially-produced version of the system is in the hands of approximately 300 amateurs. If you are curious about the future in store for one of amateur radio's most publicized developments, read on.

At first glance, NBVM proponents have presented a number of highly beneficial reasons for adopting the system. Among those listed are:

1) Savings in spectrum. This is accomplished by reducing the bandwidth of your SSB signal to one-half its original size.
2) Significant improvement in the signal-to-noise ratio as a result of reducing bandwidth.
3) Better adjacent-channel rejection. This means cutting down on QRM.

In an age where our frequency allocations are threatened and the number of hams is growing, it is hard to criticize any proposal that would reduce congestion in the "overcrowded voice segments of the high-frequency amateur bands"—as one editor put it.

As a bonus, NBVM is supposed to increase your capability per Watt and reduce the bother of QRM! However, it is important to remember that performance, not promotional tactics, will be the deciding factor for the acceptance by the amateur radio community of any new communication system.

This article discusses the theory behind NBVM, evaluates the only commercial unit available, and offers some insight into the politics surrounding amateur radio's newest mode. Readers who are not technically inclined may want to skip the "How It Works" section and go directly to the later material on the performance and politics of NBVM.

How It Works

Narrow Band Voice Modulation is based on two methods of audio processing. The amplitude-compandor portion of the system compresses the amplitude of the signal. Expansion of the audio takes place at the receiving end. The concept of amplitude companding has been around for many years but did not become economically feasible until the development of large scale integrated circuits. The signal's bandwidth is compressed by using a frequency compandor. NBVM pioneer Dr. Richard W. Harris claims that this is a newly developed technique of audio processing.

The concept behind the amplitude compandor is a familiar one to many SSB operators. More efficient use of the transmitter power is obtained when the audio signal is compressed before it reaches the modulation stage. Compression and clipper circuitry have been the mainstay for most amateur speech processors. The problem of a noisy waveform arises when compression goes beyond the first few decibels of improvement. Characteristically, most hams using processors keep the level of compression low enough to avoid this problem. The NBVM system allows a greater level of compression since the receive station has an expander that reduces the noise level during the quiet part of the voice passage.

Many of the NBVM benefits rely on a reduction in bandwidth. Normal single sideband techniques use the voice information between 350 and 2400 Hz. The

lower and upper responses are determined by the characteristics of the microphone and the filters built into your transmitter. The resulting carrier contains about 2100 Hz of usable audio.

I doubt if most audiophiles would praise the fidelity of a typical SSB signal, but the quality is more than adequate for everyday amateur use. Since SSB is the most effective method of rf modulation for voice communication presently in use, any conservation of bandwidth must take place in the audio frequency range. Accordingly, NBVM is known as a "baseband communications system." This allows any required processing scheme to be interfaced to the microphone and speaker lines of your rig, a much more pleasant concept than the alteration needed for rf processing.

Analysis of speech has shown that there are several parts of the audio spectrum that carry the information needed for acceptable intelligibility. Three such formants lie below 2500 Hz. It is important to remember that these formants are separated with noncritical spectrum between them. By removing these gaps, the frequency compandor portion of an NBVM unit is able to reduce the required audio bandwidth. The vocal chord sounds between the 400-Hz system rolloff and 600 Hz are passed through unaltered. The second and third formants are composed of voice sounds between 1000 and 2500 Hz. By mixing this audio with a 3100-Hz sine wave and filtering the output, the 1000- and 2500-Hz segments are folded into the 600-to-2100-Hz spectrum.

A further savings in bandwidth can be achieved by inverting and translating only the 1500-to-500-Hz segment. This means the output will fall between 600 and 1600 Hz. Fig. 1 shows a block diagram for a 1600 Hz frequency compandor.

The frequency compandor theory may look fine on paper, but the ability to translate it into a working model is what counts. The most important element of the design is the need for extremely sharp filters. Dr. Harris chose to use active-type filters for his prototype. Filter theory has been thoroughly discussed in previous amateur articles, so I will mention only the most important characteristics.

With the exception of a 700-Hz high-pass device, the filters in the commercial model are of the low-pass variety. The *QST* "construction" article states that they are based on 0.1-dB Chebyshev prototypes. They must exhibit a very small delay yet remain selective. The crucial 1600- and 2100-Hz filters have 16 poles each, while the remaining three use either 6 or 8 poles.

The resulting circuitry involves approximately 20 operational amplifiers. In order to ensure low noise and uniform gain, high quality TI074 bi-FET quad op amps are used. The resistors and capacitors used in the filters should have no more then one percent tolerance for best results. A great deal of attention must be paid to eliminating potential audio and rf feedback as well as troublesome ground loops.

Due to the complexity of the frequency compandor and the problems associated with discrete layouts, Dr. Harris and the VBC corporation developed six hybrid chips that contain most of the necessary circuitry. In addition to the filters, the VBC chips contain the 3100-Hz oscillator, balanced mixer, preamplifier, and buffers. Because the filters become saturated if the audio level gets too high, the voice signals

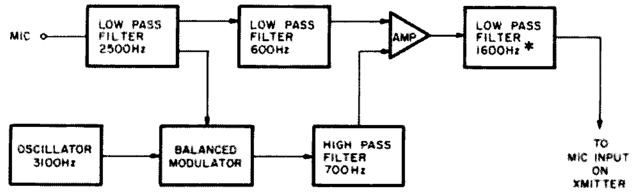

*Fig. 1(a). 1600-Hz frequency compandor used to transmit narrow band voice modulation. *2100-Hz low-pass filter is used in the wider frequency expander mode.*

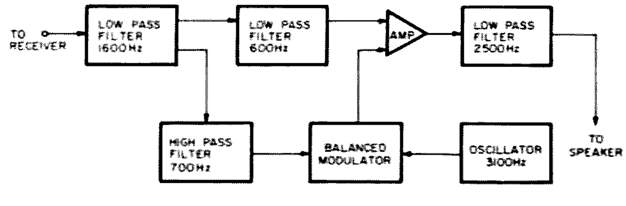

Fig. 1(b). 1600-Hz frequency compandor used to receive narrow band voice modulation.

are kept at around -10 dBm.

Several standard ICs are incorporated in the VBC design. These include an LM380 that gives one Watt of audio output during receive and an NE571 for the amplitude compandor. The power supply uses two garden-variety regulator chips. All of the system's active components reside on a 4.5" x 5.5" circuit board. A 44-pin edge connector provides connection to the inputs and outputs as well as to the switches and gain controls.

Theoretical and Test Performance

The *QST* articles on NBVM stressed the idea of ham experimentation to evaluate and improve the NBVM system. Prior to the availability of the VBC-3000 unit, very few high-frequency tests were conducted. Most of the performance data resulted from a study by the FCC's Land Communications Office. Their tests were oriented towards channelized SSB applications in the VHF commercial radio bands. The Commission's findings give some numerical indications of the effectiveness of NBVM.

When a 1600-Hz method (1300-Hz bandwidth) is used, the bandwidth of a normal SSB signal is cut in half. The broader 2100-Hz method (1800-Hz bandwidth) gives only a 33% savings. The smaller bandwidth can be interpreted as an improvement in the signal-to-noise ratio. The log (base ten) of the bandwidth in kilohertz is multiplied by 10 to obtain a comparative value. An unaltered SSB signal is computed to be 10 x log 3.2 = 5.05 dB.

Calculating the bandwidth factor for the 2100-Hz system gives 3.22 dB, and when the 1600-Hz setup is used, the value is reduced to 2.04 dB. The NBVM numbers are subtracted from the SSB value to give the improvement resulting from frequency companding. With the 1600-Hz filter, a theoretical improvement of 3 dB is achieved. Dr. Harris's description of the FCC results states only that a net improvement in the SNR was found. No numerical figure was given.

FCC tests also showed a 12- to 15-dB increase when only the amplitude compandor is used. Unlike the frequency compandor mode, improvement occurred when the received signal was measured straight through, without

expansion. The *Radio Amateur's Handbook* states that amplitude companding becomes effective when the signal is several decibels above the noise level. Apparently, the expander requires a signal that is strong enough to act as a reference.

The VBC Model 3000

There were a number of comments in the early NBVM write-ups which suggested that many amateurs could get involved in NBVM tests by building their own baseband unit. Unfortunately, the detailed technical information dealt only with a system based on the VBC hybrid chips. Since most hams lack the ability or initiative to design and build a project of this magnitude, the only practical way to get involved was by purchasing a commercial NBVM transceiver. Only one model is available, the VBC Model 3000 Baseband Transceiver.

The 3000 is manufactured by Dr. Harris's company, VBC, and is marketed to amateurs by Henry Radio. One of the first units available (serial number 12) was acquired by *73* early last spring. Since then several cosmetic changes have been made in the 3000's design, but our unit functions identically to the newer ones.

The 6.5"W x 2"H x 9.5"D size is slightly smaller than a typical two-meter rig, and the Model 3000 weighs approximately two pounds. The two-piece grey cabinet contains the circuit board described previously plus the necessary controls and jacks that interface it to the real world. The user must supply 12.5-20 volts dc. VBC offers an optional wall-plug transformer that will meet this need. A 40-page operator's manual gives a thorough functional description and hookup information. The manual provides a number of tips for the NBVM, but it appears to be written hastily and includes a number of spelling mistakes.

There are two receive inputs, three receive audio outputs, two microphone inputs, and two transmit audio output lines. It is very important that the 3000 be properly matched to the microphone, speaker, and transmit/receive apparatus in your station. I found out the hard way! Attention must be paid to impedance matching if you want decent results. The amateur compatible microphone input can be varied to match a 500-50k-Ohm microphone by clipping two jumpers inside the cabinet. The stereo phone jack was factory wired to be used with a 600-Ohm rig. By swapping the 600-Ohm line with the high impedance output at the circuit board connector, I was able to hook the VBC system to a Kenwood TS-820 microphone input. An Astatic D104 microphone was used during the *73* tests.

Care must be taken to avoid applying dc to the Model 3000's audio connections. For example, the Icom IC-701 transceiver microphone line has a nine-volt potential used to power a preamp in the microphone. If you were not aware of this, serious damage might result to the baseband transceiver's protective capacitors when the 701 was turned on.

On the Air

The operator's manual suggests that a Model 3000 owner familiarize himself with the NBVM functions by using a tape recorder, before going on the air. Frequency-companded speech sounds far different than normal SSB when it has not been expanded at the receiving end. I found the tape recorder practice to be well worth the time. Once I was familiar with the unit and was ready to go on the air, I had to find another station with NBVM capabilities. Since there were no widely publicized NBVM nets or frequencies, I resorted to using the telephone to set up the first few contacts. Needless to say, NBVM is not in wide use.

The initial QSOs were very unsatisfying since the transmitter was not getting enough drive from the NBVM transceiver. This problem was solved by checking for and finding an impedance mismatch. When the gain controls on the 3000 and the transmitter are properly adjusted, there should be plenty of drive. This can be checked on most rigs by using the alc meter. I found that these adjustments were somewhat critical, and it was easy to overdrive the system, causing distortion.

When receiving NBVM signals, it is important to experiment with different rf and af gain settings on the receiver as well as the volume control on the Model 3000. The best copy was achieved when the rf gain was substantially reduced, although there was then degradation of the agc action. If good performance is desired, it is necessary to readjust the three receive and two transmit audio controls constantly. This is not a "set it and forget it" system.

Early narrow band publicity stressed that the frequency-companded signals could be copied by a station not equipped with NBVM. Since the second and third formants of the voice are inverted, they will be on the opposite sideband compared to the conventional signal. If the NBVM is transmitted on lower sideband, these formants can be understood by tuning in the signal on upper sideband. A more complete explanation is given in the "Listening to NBVM" box.

It is important to note that this is a very compromised situation. The level of intelligibility is low, and the advantages of NBVM aren't being used. It would be extremely awkward to conduct a QSO between an NBVM and non-NBVM station due to the need to change sidebands and turn the frequency compandor on and off. The ability to listen to NBVM without having a compandor is of little practical consequence.

The *73* tests were carried out under a variety of actual operating conditions. Although we did not perform a laboratory-style evaluation, several NBVM claims were confirmed. The amplitude compandor provides at least 12 dB of improvement, as long as the signal-to-noise ratio is positive. The amplitude compressor offers a number of advantages for everyday use. Simple tests on bandwidth savings showed that the 1600-Hz mode (1300-Hz bandwidth) provided no noticeable improvement. This result was confirmed by several other NBVM users, and the general consensus is that the 1600-Hz mode is the only beneficial one in terms of spectrum savings.

The most obvious benefit occurs during QSOs with stations which are weak and where adjacent channel interference (QRM) is causing problems. Provided the other station has NBVM, it may be possible to conduct a QSO when it would not be possible using conventional sideband. For day-to-day strong signal amateur activity, the VBC Model 3000 does not offer much in the way of improvement.

Bells and Whistles

One of the selling points of the 3000 is its multipurpose nature. A number of uses besides NBVM are suggested. These include having the unit serve as an

audio amplifier or perhaps as the filter-power amplifier for a simple receiver. At one time, VBC was investigating the possibility of providing hybrid chips for such a receiver. If you experiment with digitally-based voice communications, the frequency compandor might offer some interesting possibilities. Commercial owners are using the 3000 to combine voice and data information on the same telephone line.

A more practical ham use of the 3000 could be as an auxiliary filter. Front-panel switches allow the user to select this option for receive only. The high quality of the filters make them useful for non-NBVM use. However, they are not specifically meant for this, and provide a compromise in this respect. The alternate functions do enhance the Model 3000's value, but they should not be considered when evaluating NBVM.

Pound for pound, the VBC Baseband Transceiver is probably not one of the better electronic buys available. The Model 3000 costs $349.00. A circuit board configuration is available for $279.00. The early model tested at *73* has poor quality switches which do not enhance the unit's value. The later version uses better parts, and as a result, it looks and handles better. The amplitude compandor is centered around an NE571 IC which has a single unit price of about $5.00. The major reason for the $349.00 price tag lies in the frequency-compandor circuitry. The overall dollar value of the 3000 is a subjective matter. I don't think the price is right to encourage widespread amateur use.

Another subjective area is the evaluation of the NBVM sound. I am certainly not a high-fidelity freak, but the frequency-companded speech does not have nearly as pleasing a quality as traditional sideband modes. As a result, I found it more difficult to fully comprehend the other stations. Any NBVM test should consider the factors of operator fatigue and enjoyment. Like any new system, it takes time to adjust to NBVM.

A Commercial Gold Mine?

Technological breakthroughs are not an everyday occurrence in amateur radio. No matter what the result is for the art of communications, politics is sure to be involved. NBVM is no exception. The circumstances surrounding its role in the amateur world has both current and historical implications.

Long before the first amateur test of NBVM, the system received careful scrutiny by the FCC. VBC, in cooperation with Stanford University and the FCC, tested NBVM as a possible means to reduce the size of channels needed for commercial VHF communication. In this scenario, the present FM land mobile systems would be replaced by SSB using narrow band voice modulation. This would allow between three and six times the current number of users.

Conflicting reports were presented to the Commissioners. The one referred to in the *QST* articles supported the NBVM claims and suggested further study. A second report raised a number of questions about the effectiveness of SSB/NBVM. It said there was a need for far greater frequency stability and that many intermod problems may occur if a narrow channel scheme is used. Although the report did not totally dismiss the idea of SSB/NBVM, it raised a number of objections. The industry reaction to NBVM has been cool, at best.

The current NBVM system is not the final version. VBC is developing a pilot carrier system that will automatically take care of frequency and gain control. It should be stressed that this is a substantial improvement over what is available now, but it is not readily applicable to HF

Listening to NBVM

If you do not own a frequency compandor, it still is possible to listen to the gang on NBVM. The results will depend on the receiver you use and your ability to comprehend less than ideal audio. The two formants of speech lying between 1000 and 2500 Hz are inverted into the spectrum lying between 600 and 2100 Hz. In the case of the narrow frequency compression, usable speech will be found between 600 and 1600 Hz. By tuning your receiver to the opposite sideband, it is possible to listen to these two translated formants. Tune slowly; a 20-Hz difference in frequency can be enough to make the signal unintelligible. If your receiver has a tunable passband filter, it may be possible to eliminate the first formant, below 600 Hz. It is in the other sideband and acts as QRM when you are trying to tune in the 600-to-2100-Hz segment. The 2100-Hz mode is not too difficult to eavesdrop on. The 1600-Hz mode requires you to have a good receiver and sharp ears. Remember, use the opposite sideband.

The best results for receiving NBVM obviously occur when you have a frequency compandor. If possible, establish contact on conventional sideband first. Carefully tune your receiver for the most natural sounding audio. If the transmitting station is using an amplitude compandor and you have an expander, adjust the receiver af gain (volume) so that no difference in the audio output level is heard when you switch the expander in and out. Then set the volume on your NBVM unit to a pleasant level. If the signal seems to blank out the expander, reduce the drive.

Now go to the frequency-companded mode. It will be possible to copy a compressed signal using either the 1600- or 2100-Hz filter in your expander, but the best results occur when your mode matches the transmitted signal. It may be necessary to make slight adjustments in frequency. This is best accomplished using RIT, a separate vfo, or a receiver/transmitter pair. It is essential to be able to tune within 20 or 30 Hz of the other station's frequency. Older receivers and some of the new synthesized rigs may present problems.

Readjust the rf and af gain controls on your receiver to obtain the best sounding audio. It may be necessary to turn off the agc if there is a strong signal on an adjacent channel. The i-f filtering in different rigs can influence the quality of the NBVM. Remember that a frequency-companded system will not offer the same intelligibility found on conventional SSB. Experimentation is the name of the game.

Following are some frequencies where NBVM activity is centered. The number of users is very small, so don't be surprised if there isn't much activity.

80 meters

3.850 MHz, Wednesdays at 0000 UTC (Tuesday night). This net meets prior to the East Coast AMSAT net on the same frequency.

40 meters

7.175 MHz, Saturdays at 0030 UTC (Friday night). This is an informal net of eastern stations.

20 meters

14.210 MHz—International calling frequency for NBVM.

14.235-14.242 MHz—Stateside NBVM QSOs can sometimes be found between these frequencies.

15 meters

21.302 MHz—Several DX NBVM stations have reported using this frequency.

amateur use.

Careful readers will remember that VBC has a system patent for parts of the NBVM system. At least one major corporation disputed the claim that Harris's frequency compandor design was original. It is easy to sympathize with VBC in its David vs. Goliath battle with the FCC and the big corporations, but the stakes are high. An FCC follow-up grant totalled $54,000, while production of 25 units a week for amateur use means a gross of $455,000 a year if all the units are sold. The private land mobile industry represents a potential market on the order of $12 billion if the FM gear currently in use is replaced. Obviously, VBC is very interested in being the sole supplier of NBVM hardware.

NBVM Is Dead and the ARRL Slew It?

It is easy to see how NBVM differs from earlier amateur radio developments like SSB and FM repeaters. The American Radio Relay League's involvement (or lack of it!) in these previous breakthroughs provides an interesting comparison to their NBVM affiliation. It was clear in the beginning that the ARRL would be the major backer of NBVM. Early publicity stressed that this was an experimental system that could be built and tested by amateurs. The much awaited *QST* "technical" information tarnished those claims. Since then, the Newington-based spokesmen for ham radio have quietly dropped NBVM.

Rumors abound concerning the League's involvement. It is clear that the initial support was based on a VBC demonstration tape which was not necessarily the most unbiased source. The *QST* articles and the *Handbook* chapter were published before the League staff had seen or tested a prototype. When tests were finally conducted, the inability to achieve the claimed benefits apparently left the ARRL in a corner. No W1AW tests have been conducted for the membership, and the League has turned its attention to other spectrum-saving techniques.

Despite the lack of independent supporting evidence, ads are appearing which claim that NBVM is the "most important innovation in amateur radio since SSB." Even though no concrete numbers showing the actual benefits to an HF amateur user are available, we are assured that the system is bound to succeed. Conflicting reports are given about the number of Model 3000s owned by hams. It is clear that many of the units are being tested by non-amateur users. The approach by those people commercially involved with NBVM is characterized by a lack of organization, poor technical documentation, and, in some cases, evasion.

Although early NBVM publicity urged us to exercise the ham tradition of experimentation, Model 3000 owners are cautioned by VBC not to "attach improvised circuitry anywhere on the printed wiring board." Despite the appliance operator's approach taken by VBC, there is amateur involvement in baseband communications experimentation. At least one ham has built an NBVM unit based on digital filters, and there are several designs being tested that don't rely on single-source chips.

Conclusions

During our on-the-air testing with other amateur stations equipped with the VBC Model 3000, we did not encounter a single situation in which NBVM was superior to ordinary SSB, although a few of the operators we contacted said they had found an advantage to using NBVM under certain conditions. Another point to remember is that the spectrum-saving frequency-companded mode is useful only when the stations at both ends of the QSO are equipped for NBVM.

Reception of frequency-companded signals on an ordinary receiver is possible, as outlined in the accompanying "Listening to NBVM" box, but the process is cumbersome and the fidelity is quite poor. A successful contact between an NBVM station and a non-NBVM station is an extremely unwieldy method of communication. It's doubtful that amateurs without NBVM will have much interest in participating in NBVM testing. Although such participation was suggested in the September, 1978, issue of *QST*, there is little useful information which non-NBVM stations can gather by listening to frequency-companded signals.

It would be shortsighted simply to dismiss a technology that promises more efficient use of the amateur bands. However, it is equally shortsighted to jump at the first new technique to come along and begin promoting it as the most important innovation since single sideband. This tends to discourage exploration of other promising methods such as digitalized speech, time multiplexing, and synchronous detection.

Regardless of the methods used to achieve a savings in spectrum, the advantages of reduced bandwidth, power savings, and signal-to-noise ratio improvement must be weighed against the increased complexity, loss in fidelity, and higher cost. When SSB was introduced, most amateurs were skeptical of the new mode, much as they are now skeptical of NBVM. In the case of SSB, though, its clear superiority over AM convinced the skeptics; the benefits obviously outweighed the costs. After our tests, we at *73* do not believe that NBVM, as applied in the VBC Model 3000, offers that same clear superiority over our present modes of communication.

More experimentation with reduced-bandwidth techniques is needed. Also, it's important that ideas be shared among experimenters. If you are having success with any reduced-bandwidth system, including VBC's Model 3000, be sure to document your work, write it up, and send it to us for publication in *73*. Let's all work together to develop a viable system.■

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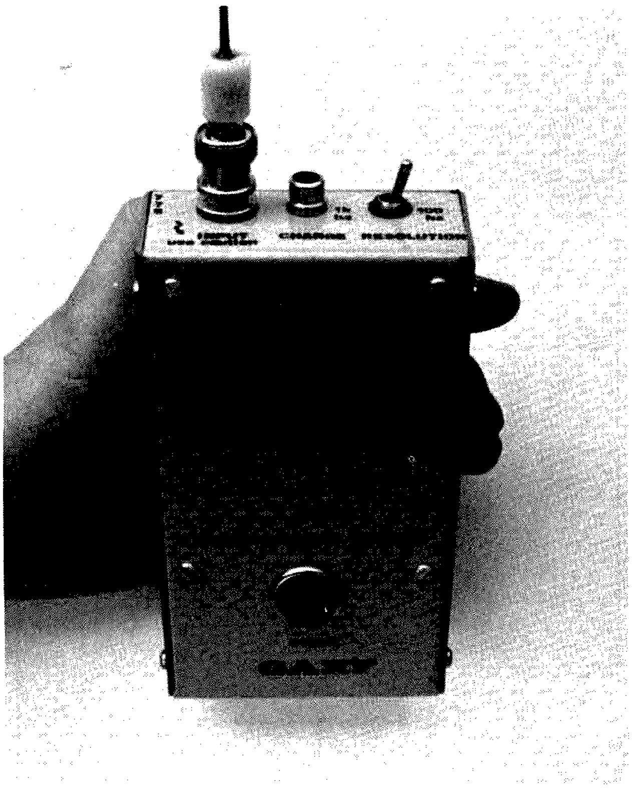
Frequency Counter Survival Course

—use that gadget wisely

My article in *73*, "DMM Survival Course," (May, 1978, page 62), was so well received that I thought a continuation of the articles on test equipment would be helpful to the public. I was (and still am) surprised at how much ignorance there is in using modern test equipment; however, that may not be the fault of anyone but the people who write the equipment operating manuals! This is true in the industry where test-equipment manufacturers assume that the user already knows how to use, at least basically, a DMM, counter, scope, or whatever. So the manuals are usually very general, and that doesn't help out the average ham-radio user, an occasional test-equipment user, very much! Anyhow, that's my impression of some manuals I have seen on new test equipment, plus the general consensus of a lot of input from hobbyist users. Since those new test instruments cost so much more than in the old days, but do so much more for the money, it pays you to learn about your equipment! And that is what this article is about. We will primarily deal with the pitfalls seldom discussed in operating manuals and learn how to get the most in performance out of our frequency counter.



The shape of things to come... a pocket-sized 135-MHz counter.

If you are one of those who just bought a counter, congratulations! Congratulations, that is, for surviving all those advertising blitzes for units with nearly every feature and for buying a device you'll wonder how you ever did without. Counters are popular to make because they are easy to build (Intersil makes a 2-chip counter set) and easy to calibrate. That means a relatively low overhead investment is possible for the manufacturer.

Counters are pretty easy to use on the surface; just connect power, a signal to be measured, and read off the frequency. Great! That is where your troubles can begin. First, let's look at your power supply. If the unit is battery-powered, a slight error can be introduced by weak or overcharged batteries. Usually, this is on the order of a few parts per million (ppm) or, say, 1-2 Hz out of 1 MHz. The counters using the Intersil chip set, widely used in ham counters, are stable to within 1 ppm, but I have evaluated other counters with errors of 10 ppm (10 Hz/1 MHz) and worse. This is especially apparent with weak batteries. Also, your input sensitivity (sensitivity to the input signal being measured) may drop with weak batteries. This can cause errors in your measurement if you are measuring a weak signal. The input picks up only *part* of the signal being measured; your frequency reading will be *low*. Play it safe and always keep your batteries fully charged! Or use the charger to power your counter. Ac-powered units are less prone to power problems, but there is one type of counter that is sen-

sitive to the line frequency. You don't see many of these counters anymore; they are cheapies, but, for a time, Hewlett-Packard and several surplus dealers offered units that derived their clock timebase (determines the accuracy of your counter) from the power line. These units are only about ±0.033% accurate when powered from a wall outlet, and accuracy is zilch if the unit is powered from a generator or inverter in the field. Needless to say, if you have one of these units, power it off the ac line or build a crystal-controlled clock generator for it.

The signal you apply to your counter is important, too. In fact, I could write a book on the subject. But I'll cover only the most important areas that will affect you in this article.

The type of signal is very important. If you feed your counter a signal that is varying in amplitude, or contains some FM, you will get a changing, often inaccurate reading. That is because your counter measures or counts the number of cycles in your unknown signal in a given length of time. The time is called "gate time" and is usually 1 second, 0.1 second, and so on. Some counters even have a 10-second gate time for audio signal measurement.

The point is, your accuracy depends upon the stability of your signal to be measured! If your are measuring the frequency of a transmitter, you must use the CW position. No AM, FM, or SSB allowed. Modulation causes changes in the signal and a shifty reading on your counter. Also, play it safe and use a dummy load on your transmitter to prevent QRM. I might add that there are special counters with phase locked loops that will track FM signals, but they are still too costly for home use. If you are experimenting with circuitry on the bench, such as with an oscillator circuit, you may find the counter causes drift when it is connected directly to the circuit. In this case, couple your counter to the output of the circuit with a small value capacitor/resistor combination (I found that a 5-pF/100-Ohm combination is okay at VHF frequencies). Or, if your frequency is below about 60 MHz and your counter has a 1-meg input impedance, use a x10 oscilloscope probe. You'll lose sensitivity, but you'll make a big gain in stability. The idea here is to couple your circuit as loosely as possible to the counter (a dummy load) to reduce drifty readings. Coax cable becomes a load as the frequency goes up, so try to avoid using cable between your oscillator and the counter. Instead, put the coupling cap/resistor between the circuit and your counter's input cable. Luckily, this type of stability problem doesn't come up often, but you should be aware of it.

The amplitude of your signal is important, too. It must not be too low or your counter will count only part of it, or worse, noise on it, and give a false reading. At the same time, the signal must not be too great or you'll run the risk of damaging the input of your counter. Since a sick counter generally must be sent to the factory, fixed, and returned, you'll be saving yourself a lot of trouble if you pay attention to the level of the signal you apply to your counter!

Weak signal can be quite a problem, first in the fact that you must be aware of it. Most counters will display a frequency *higher* than the true frequency—if they read at all. This is due to noise spikes that ride on top of the signal. Needless to say, a weak signal can fool you.

The secret of success is to be sure you have enough signal! On most counters, this is a level above 50 to 100 mV rms. If you aren't sure, increase the signal level to the counter by coupling better to the source. If you are measuring a transmitter and using a whip antenna on your counter, move the whip closer to the feedline or transmitter antenna. If you are experimenting with a circuit, try another pickup point and compare readings. You will find that increasing the signal beyond a certain point determined by the counter will cause no further change in your readings.

I can't emphasize too strongly how important your minimum signal level is; it plays a big factor in the accuracy of your measurements! The signal level must not be too great or you will damage the front-end circuitry in your counter. This is very easy to do around transmitters (more to follow).

Ideally, the owner's manual will spell out the maximum signal voltage to apply to your counter. You should find that it is related to frequency; 120 volts ac, 60 Hz, and on down to 20 volts at 30 MHz is a typical spec. If you aren't sure how much the maximum level is, use 10 volts rms as a rule of thumb. Also, any dc offset in that signal must be tolerated; most counters are limited to about 100 volts dc plus the signal peak value. Check your manual for any info on dc offsets; if there is no mention that the counter will take dc voltages, put a 0.1 uF capacitor in series with the input lead whenever you measure signals at the collector of a transistor, or anyplace else dc-plus signal would be present. If you don't block out the dc component, the counter input stage may be biased on so hard that it won't count your signal. This is especially important as most service/hobby grade (the ones in the plastic cases) counters are affected by dc offset.

An area that must be explored is the relation between counters and radio transmitters. Usually, the operating frequency is measured by sampling off a signal in a low-powered stage in the transmitter, which is run in the CW (tune-up) mode. Since it usually isn't practical to do this with existing transmitters, you must do the next best thing and use a whip antenna on the counter. This works well, but noise pickup can be a problem with high-impedance inputs. This problem shows as random counting with no signal, and the cure is to tie a 1-mH rf choke across the input. With low-impedance inputs, this is no problem, however. In operation, the counter/whip is placed near the transmitter or its antenna, if possible, and the frequency is read off the counter display when the transmitter is keyed. This is easy and convenient to do. However, someone is sure to connect the counter directly to the transmitter. Don't!

Let me illustrate what happens: Several years ago I was an NCO in an instrument shop at an Army post. One of the troops connected a counter to a 1 kW linear and transceiver under repair. When he pressed the mike button, both the linear *and* the counter went up in a big cloud of smoke. Needless to say, that was a very expensive accident! And the Fort Huachuca instrument lab lost a budding (but misguided) technician!

Never make the costly mistake this guy did. And one more thing: Use a dummy load whenever possible.

After you have power and a signal to be measured, you are set to read the frequency off the display. To get the most accurate reading, you must take full advantage of all digits you have. Try to fill up as much of the display as possible; a readout of, say, 60.0000 MHz is much more accurate than 0060.00 MHz. Remember that the larger the number, the more accurate your reading will be. This is because you will have several forms of error in the two right-most digits; there is a ±1 count error (or ±1) in the right-most digit, and any errors in your timebase will show up in this and the next digit. So, if you refer to the frequency illustration just made, the errors would show up in the 1k and 100 Hz positions, and that is better than having your errors show up in the 100k and 10k positions. To fill up the display, just set your timebase switch for longer gate time, which gives you more numbers. Generally, a 1-second gate time will provide optimum accuracy in your measurements. Also, most non-switchable counters have this gate time built in, so you are all set. However, this holds true only for rf signals. If you are measuring audio or other low-frequency signals, you will run into trouble with a 1-second gate time. Why? Suppose you are measuring 100 Hz. With a 1-second gate time, you will measure "100". In reality, you will see readings like "099", "100", "101", "100", and so on. This is the result of the ±1 count error mentioned earlier. That is a ±1%error! If you can live with 1%, fine! But if you are fussy like me, you'll switch your counter to the 10-second timebase position and read "100.0" Hz and get an error of only 0.1%. Of course, if you don't have a 10-second timebase position, you are stuck. But more counters have them, and better yet, many have a method for even greater accuracy —*period measurement*. In this mode, you measure frequency in terms of period, then convert from time back to frequency. If your frequency is stable, you can push out your accuracy at least to 0.001%. If you have a counter-timer with period measurement, use it for speedy, accurate measurements of frequencies below 10 kHz.

As an interesting sidelight, I worked with an interesting application of time-period counters several years ago. Digital watches must be calibrated after they are assembled. The watch is placed over an electrostatic pickup and energized. The "noise" from the LED display (*LCD* watch in my case) is picked up and counted. It is then measured on a period counter and converted to numbers showing % deviation from the correct frequency. The operator adjusts the watch so that the reading is 00. And the result is a very accurate watch! This idea isn't new; I believe it was used with analog watches, but it is still simple and clever. And fast, too. We built a unit like this in 1973 thinking the idea was original, but it wasn't.

Now that you have a good idea of how to get the most accuracy out of your counter and have read about the pitfalls most counters have, let's concentrate on other areas that affect the performance of your counter.

First, the operating temperature your counter is used in affects accuracy. Ideally, that counter should be used as close to the temperature it was calibrated at as possible. Why? The crystal used to generate the clock or timebase is temperature sensitive. Also, the oscillator circuit used in conjunction with it is, as well. If you use the counter at a different temperature than what is calibrated at (hopefully 25° C.), error will creep into your readings. The amount of error can be as high as 20 ppm, enough to affect your readings. And the effects of the error really show up when you are measuring low frequencies. Also, at VHF frequencies, the error can throw you off. So the best thing for you to do is operate your counter as close to 25° C. as possible. I might add that the more expensive counters have temperature-compensated oscillators (medium-cost units) or temperature-controlled ovens (high-priced units). The oven-controlled counters are normally left plugged in with the oven and oscillator left running at all times, so accuracy is optimized. Regardless of what type of counter you own, it should be turned on for at least a half hour before use. This will allow the internal temperature to rise and stabilize, allowing the best accuracy. If you own a battery counter, this isn't possible, of course, but using it at room temperature will still give you the best accuracy.

You should know that the crystal in your counter is also subject to aging. That means that with time and use its frequency will drift. Also, changes in the oscillator components will probably result in the same effect, in even greater magnitude. So, if you are going to be making a highly-accurate measurement, calibrate the counter on a frequency standard first, then use it as soon as possible (hopefully without turning it off if the counter is ac-powered). This one step can often "buy" you an extra 20 Hz of accuracy or so. It's an important step! This mag-

Square-Wave Input Signals and Your Counter

This is one section that deserves special mention and that is why it is in a section of its own. Sooner or later, most counter users try to measure square-wave signals with a counter. The result is error in the readings, with a display of double the correct frequency being typical. There are several reasons for this, the most important being the fact that most counters will trigger on both the positive and negative edge of each half cycle of the waveform, effectively giving a reading of double the correct value.

Also, the harmonic-rich signal can cause ringing in your cables and, in some cases ringing in your input circuitry. The counter may trigger on these "rings" and give you a completely false reading.

The solutions to these problems are fairly simple and straightforward. If your problem is cable ringing, connect (terminate) the *counter end* of the cable with a 50-75-Ohm resistor. The value is to match the characteristic impedance of the cable. Or use the low-impedance input (often VHF prescaler input) on your counter for best results. If the resistor drags down your signal too much, eliminate or sharply reduce the size of the cable; longer cables aggravate ringing. If your counter front end is at fault, and at HF frequencies this will often be the case, try to "soften" the *edges* of the waveform you are measuring by using a x10 scope probe between the counter input and your signal. This simple step will often work with high-impedance counter inputs and TTL level signals. Try it!

azine has described several methods of calibrating counters using the TV chroma subcarrier ("In Search of the Ultimate Counter Calibrator," R. Bloom, April, 1978, *73*), and I can't think of a better use for a TV. Pick a show you hate for best accuracy. Note that it must be a *live* network show!

Surprisingly, the place in which you keep your counter can affect accuracy. Most hams love to stack their equipment, and that may mean the counter goes on top of a hot receiver or transmitter. The result is a slow drift in the displayed frequency as the counter case warms up. Try not to do this!

There are a number of miscellaneous hints for you to remember in using your counter. First, place the counter in a place where it can easily be seen, and yet is not likely to fall on you or into a live piece of equipment. If the counter is dropped, always recheck its accuracy, as shock changes the crystal-frequency and oscillator-trimmer settings. Use a x10 probe, or set the counter's attenuator for x10 if it has one, when measuring large signals over a few volts. And keep the counter display away from sensitive pieces of equipment. Modern counters have multiplexed displays and the noise they generate can drive a receiver up the wall!

Let me sum this up by saying it is always worth your time to use the suggestions I have made and to avoid the pitfalls I have mentioned. By doing so, you should be able to get longer life and better accuracy from your counter.■

DX with a Difference: the Utility Stations

—when the ham bands get frustrating, give SWLing a try

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With the recent emergence of general frequency coverage added to high quality ham transceivers, we hams may find ourselves drifting the dials beyond our band edges. In fact, our ability to listen and our right to listen to anything we please may bring us to stop the dial on what are known as utility stations.

A utility station is any station (excluding ham radio) which does not beam its transmissions for the general public. These broadcasts are limited to specific audiences and may be run by worldwide government or commercial enterprises.

By now, we all know of public service broadcasts of fire, police, and ambulance services which, by nature, are best trapped in the VHF and UHF world, where mostly they have migrated. However, there is a world of interest and excitement hiding between the ham bands on the commercial and military channels, available on any general-coverage transceiver or receiver.

One note of warning: Although you are allowed to listen as you please, Secrecy of Communication laws generally prevent you from revealing what you have heard.

What can you hear? There are at least four distinct types of services which make up the utility stations. These are time- and frequency-standard stations, aeronautical and weather stations, coastal stations, and fixed point-to-point stations.

Time- and Frequency-Standard Stations

Most of you are familiar with the transmissions from WWV and CHU. These are the main North American time and frequency stations. In the case of WWV, propagation and weather information to a degree is included with the regular time information. There are, however, other stations, near and far, which operate like "clockwork." A list of some of the more interesting ones (some easy, some hard to hear) is included with this article (see Table 1).

Call and Location		Frequency	Air Schedule (GMT)
BPV	Shanghai, China P.R.	9368	5 min. before 0600, 1100, 1300, 1500, 1700, 2100, 2300
CCV	Valparaiso, Chile	8558	5 min. before 2000, 0100
CHU	Ottawa, Canada	3330, 7335, 14670	24 hours French & English
FTK77	Pontoise, France	10775	5 min. before 0800, 2000
DAM	Elmshorn, Germany F.R.	8638.5, 16980.4	1155-1206
NPN	Mariana, Guam	4955, 8150, 13380	5 min. before 0600, 1200, 1800, 2400
PLC	Jakarta, Indonesia	11440	5 min. before 0100
VWC	Calcutta, India	4286	5 min. before 1630
		12745	5 min. before 0830
NSS	Annapolis, Maryland	5870, 8090, 12135	5 min. before 0500, 1100, 1700, 2300

Table 1. Interesting time stations.

The Aeronauticals

The aeronautical stations, especially the weather stations, utilize announced frequencies on a time-shared basis. It is quite possible, given the right propagation condi-

tions, to hear several different aviation weather stations on a single shared frequency within an hour's time. Gander, Newfoundland, and New York aeroradio share four common frequencies. Each signs on immediately after the other signs off. (See Table 2.)

Call and Location	Frequencies (kHz)	Time Past the Hour (mins.)
WSY70 New York, N.Y.	3001, 5652, 8868, 13272	00-20 & 30-50
VFG Gander, NFD, Canada	3001, 5652, 8868, 13272	20-30 & 50-60
KSF70 Oakland, Calif.	2980, 5519, 8903, 13344	05-10 & 35-40
JMA Tokyo, Japan	2980, 5519, 8903, 13344	10-15 & 40-45
-- Hong Kong	2980, 5519, 8903, 13344	15-20 & 45-50
KVM70 Honolulu, Hawaii	2980, 5519, 8903, 13344	20-25 & 50-55
KIS70 Anchorage, Alaska	2980, 5519, 8903, 13344	25-30 & 55-60

Table 2. Aviation weather for Atlantic and Pacific areas.

In addition to the easy catches, some African broadcasts may be heard on 8896 and 11279 kHz—and try listening on 5561, 8819, or 10017 for a broadcast from Asia. These are by no means all the frequencies used, but if fate is kind, you may hear Singapore or Beirut and a host of others.

One other fact is that most of these stations will QSL if approached politely and return postage is included with your report. Sometimes it is advisable to include a prepared form QSL so that someone at the station can simply fill in a few blanks, sign the card, and drop it in the mail.

It may be helpful to include return postage from the country heard back to you. US stamps are not valid for this purpose in most countries. All is not lost for the QSL hunters, however. George Robertson is a gentleman who conducts a DX stamp service for hams and SWLs. For an SASE, George will send you a listing of prices and countries for which he stocks stamps. His address is DX Stamp Service, 7661 Roder Parkway, Ontario, New York 14519. Tell him that *73 Magazine* sent you.

While on the subject of weather broadcasts, I might mention that the US Coast Guard also transmits broadcasts of about 10 minutes duration several times daily. The station at Portsmouth, Virginia, has been known to use 6505, 8765, and 13113 kHz (approximate), and you should listen around 0400, 1130, 1600, 1730, and 2200 GMT. Again, these are just some of their broadcasts, but if you stay tuned, you may hear others at different times.

Getting back to strictly aeronautical stations, we find that most long-haul international air traffic is still conducted on the high frequencies. Airports, aircraft, and beacons all can be heard within certain bands. Some of these stations, such as San Juan on 8945 and Piarco Trinidad on 8847, have been known to QSL usually by the prepaid-form card method. Listen especially in the bands 6525-6765 and 8815-9040 kHz for this air traffic.

The Coastal Stations

Coastal stations also are either commercial or military. The commercial stations may relay telephone communications, telegrams, weather, or other information for the ships in the merchant fleets, or even to pleasure vessels still in harbor. Whereas many stations of an aeronautical nature use phone only, the coastal stations use phone and CW fairly equally. Like us hams, their bands have been divided into separate CW and phone segments. The phone usage may be either AM or SSB. For CW, expect speeds of 15 wpm and up. Try listening in the bands 6345-6495, 8459-8705, and 12690-13070 kHz. For phone transmissions, the best bets are 6515-6525, 8725-8815, and 13170-13200 kHz.

The entire world is represented by coastal stations. Some of the more readily heard are CUL, Lisbon, Portugal; DAN, German Federal Republic; WSL, New York; IAR, Rome, Italy; WCC, Chatham, Mass; GKE, Great Britain; and VCS, Halifax, N.S., Canada.

The CW band on 8 MHz is perhaps the most active. Sometimes these stations will send marker transmissions. These markers take two or three recognizable forms.

Look first for the V marker. A typical exchange might give 3 Vs followed by the call of the station. Sometimes a chain of calls might be heard. In this case, several stations are hooked electronically to a master operator, human or otherwise, and several transmitters are being keyed at once, on different frequencies. Usually, each frequency is licensed with a different assigned call. It is done this way so that stations with traffic may tune into the best signal receivable for band conditions. Often a V marker by the same basic station may be heard on several bands at once. This also makes for more use of our radio spectrum and is one of the reasons that commercial interests will be attempting to secure more and more frequencies at future World Administrative Radio Conferences. Many of the coastal commercial stations will QSL if the prepared-form card method is used.

The military also has its share of the coastal stations. In the United States, the Coast Guard handles the military coastal traffic. The Guard regularly schedules broadcasts on 2670 kHz. Depending on location, you may hear weather advisories, including ice conditions. Sometimes vessel operators are told of naval operations in specific geographical areas. (Listen then for the Navy on 6723 kHz.)

Some of the popular Coast Guard frequencies are 6506, 8710, 8765, and 13113 kHz. Other types of coastal station markers include the popular CQ when actually looking for a call and the simple DE identification marker. The DE marker is used for transmitter adjustments and sometimes is used interchangeably as a V marker. Often the CQ marker will say QSX and give reference to the band being tuned by the station for responding calls. Some of the popular coastals like WSL generate so much QRM on the return calls that you would sometimes think they are rare DX in a contest!

FPTP or Else

Our final category of stations are those in the fixed point-to-point service. These stations offer a real variety of listening and are sometimes challenging because it may be difficult just to be able to copy such a feed. These utility stations, as the name implies, are directing their transmissions to one particular receiving site.

These stations are operated by commercial, aeronautical, or military sources. (Even spies, I guess!) The vast majority

Selected Air Bases	kHz
Andrews—Forrestville, Maryland	6756, 13247
Clark—Manila, Philippines	8993, 11226
MacDill—Florida	8989, 8993
Yokota—Tokyo, Japan	8967, 11236

(Note: Above frequencies mostly SSB, but some AM may be used yet on all frequencies. Some other USAF frequencies in general worldwide use include 6738, 6753, 11179, 13201, and 18019.)

Table 3. Aeronautical calling frequencies, USAF.

of them don't appreciate our reception reports, but legally they can't stop you from listening.

Some of the international shortwave broadcasters use point-to-point feeders to give programming to their relay stations around the world. Some communist nations may refuse to admit they are on the air on feeder frequencies, yet they want the world to hear it all as relayed. (The games people play!) Although there must be 30 specific bands allocated to the point-to-point service, these bands are spread out over the HF radio spectrum. I have had a fair amount of fun listening for these stations in the range of 10-13 MHz.

Help Is Nearby

If I have got you to the point of being interested in doing a little tuning between the ham bands, good!—as I'm sure you will find it great listening. There is more information available for the person who wants to get into the serious side of utility listening.

At least 3 US radio clubs give fair coverage in their bulletins to the utility stations. The oldest of these clubs is the Newark News Radio Club, P.O. Box 539, Newark, New Jersey 07101, which was founded over 50 years ago and currently devotes four of its 36 pages monthly exclusively to utility DXing. The *NNRC Bulletin* often contains information on other utility reference works and identifies many of the popularly-heard utility stations by frequency, mode, type, call, and, when available, station location.

Another organization with an excellent utility section is SPEEDX, P.O. Box E, Lake Elsinore CA 92330. Utility coverage could run as high as eight pages monthly with military station information, publication notes, QSL reports, and station loggings. It should be noted that SPEEDX is shortwave broadcast and utility coverage only, while the *NNRC Bulletin* covers all major shortwave listening interests, including ham radio and TV/FM.

One other club with utility station coverage is the American Shortwave Listener's Club, 16182 Ballard Lane, Huntington Beach, California 92649. ASWLC's coverage may run to four pages monthly. Any of these clubs will be happy to send you a sample bulletin for one dollar shipping and handling charge. All of these clubs are accredited through the Association of North America Radio Clubs (ANARC), 557 North Madison Ave., Pasadena CA 91101. For an SASE, ANARC will send a listing of all clubs in the association along with a list of publications offered by the various clubs.

Books and Things

The main reference book for utility DXers has to be the *SPEEDX Utility Guide*. This book has 239 pages of detailed utility station information, including 40 pages devoted to the US Coast Guard and listings of high frequency beacon stations, and, perhaps most important for the serious utility DXer, station addresses. Present cost is about $7.00 shipped prepaid.

Another reference aid (for those who can afford it) is the ITU's International Frequency List. The list is in several volumes and the cost is a modest $1500.00, or more by the time you read this. These rather large books are divided into frequency spectrum groupings, and the first four volumes take you from 10 kHz all the way through 28 MHz.

The ITU has many other publications for sale at substantially lower prices. Some of these include lists of coastal stations, lists of ship stations, *The Telecommunication Journal*, and more. If interested in further information on these, write directly to ITU, Place de Nations, Geneva 20, Switzerland, asking for their *List of Publications* catalog.

The Superintendent of Documents, Government Printing Office, Washington D.C. 20402 also publishes several books listing beacons and US Coast Guard radio stations. These are divided into US geographical areas and may be purchased separately. Write the GOP for availability and prices before ordering.

Communications World Magazine, Davis Publications, 229 Park Ave. South, New York NY 10017, often has valuable information for the utility DXer.

Finale

It doesn't take a great receiver or a super antenna to cash in on the fun of utility DXing. And when the ham bands are phooey from too many stations, it might be just the ideal time to spin the receiver dial and discover for yourself what lies beyond. You might be glad you did.■

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How to Write a RTTY Program

—machine language is easier than you think

As a result of my article published in the April, 1977, issue of *73* ("CW for the 6800"), one of the letters I received assumed that I was into ham RTTY. This caused me to wonder if I was missing something. I was. A large percentage of the RTTY operators are running micros or discrete logic gear for the generation and reception of Baudot. Furthermore, very few of these operators are totally dedicated to signal reports and QSL cards. Most of them are hacking away at the frontiers of microcomputer applications in general. So you could learn quite a bit with a RTTY receiving setup, even if you do not have a ham license.

Machine-language programming is not as difficult as it looks! In fact, if you can program in BASIC, you can program in machine language. There are two major attributes of machine language that make it immediately worthwhile:

1. It is more efficient in its usage of memory space because it doesn't have to go through a series of lookup tables just to determine what you have commanded it to do.
2. Because of reason #1, it can execute programs with fantastic speed and accuracy.

No, I am not suggesting that interpreter basics should be junked. In fact, at my place of employment, I have installed a microcomputer as a plant demand monitor/controller (millions of Watts) and have it running a BASIC program.

In writing any program, M/L, BASIC, or whatever, I think it necessary as a first step to write out the programming objectives, or a general description of what the program is to accomplish. From the description, a flowchart should be drawn next. From the flowchart, a program can be written. The program must, of course, address specific items of hardware for input/output (I/O), so a brief description of my setup follows:

1. Old model SWTPC M6800 mainframe.
2. 16K of 21L02 memory.
3. One parallel interface card (PIA) at location 8000.
4. One serial interface card (ACIA) at location 8004.
5. MIKBUG has been replaced by SWTBUG.
6. A C-30 cassette interface.
7. CT-1024 terminal system, 16 lines, 32 characters.
8. 12-inch black and white Zenith, modified for composite video entry.
9. HAL ST-6 RTTY terminal unit (MOD/

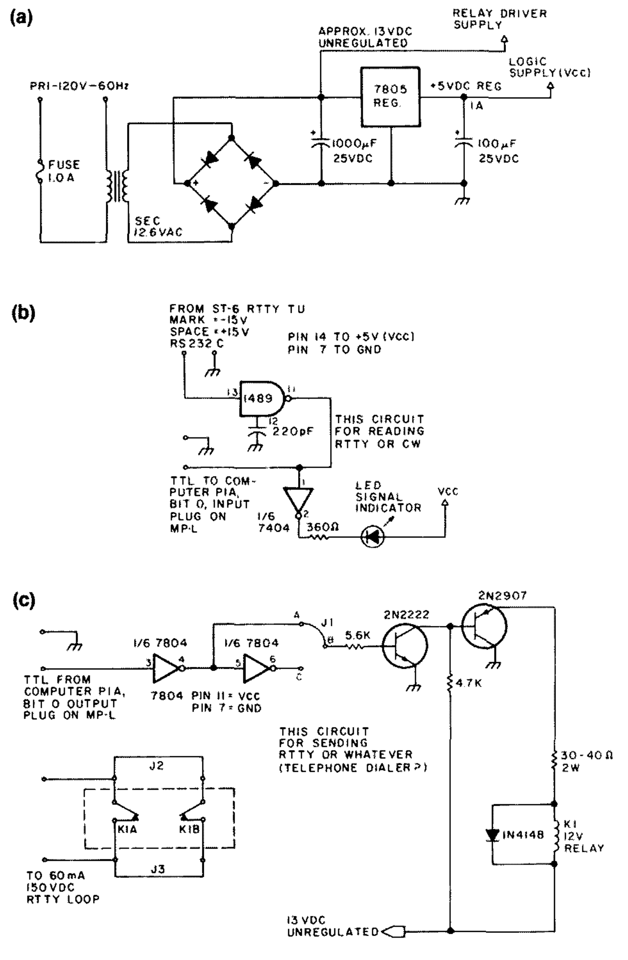


Fig. 1. Interface box with power supply. (a) Power supply. (b) Input switching. (c) Output switching.

DEMOD).

10. Small interface box, RS232-C to TTL for input to computer, also contains a computer-driven relay with two paralleled sets of NC contacts in series with the 60-mA RTTY local loop for output. (See Fig. 1.)

11. Ancient Model 19 Teletype™.

12. Drake TR4-C transceiver (with a muffin fan positioned directly over the finals).

Now let's define what we want to do:

1. The program is to accept interrupt from the ASCII keyboard via the ACIA interface.

2. Convert the incoming ASCII character to Baudot and store it in a "circular buffer," that is, a page of memory from XX00 through XXFF. By doing this, when a character is eventually stored at XXFF and the storage pointer is incremented, the storage pointer then contains 00, and we are back at the start of the buffer area.

3. Get the Baudot character pointed to by "Print next pointer" and send it out via the PIA.

4. Utilize the Baudot stop bit as a delay between characters by making it much longer than normal.

5. Enable IRQ only during the stop bit, allowing the delay to be interrupted, the incoming ASCII character stored, and then the delay finished.

6. Print something at the end of each delay period. If no characters remain to be printed, print a Baudot blank.

7. Keep count of the characters stored in the buffer. After (decimal) 67 characters, look for the next incoming space character, then store a carriage return line feed immediately following the space in the buffer.

There are any number of other goodies we could have this program do, but beyond this it would tend to get lengthy. You will note that we don't use any of the computer's resident monitor routines. This means the program should run on any 6800-based machine, possibly requiring a bit of adjustment on the delays in the "bit timer" and maybe relocating the IRQ vector.

This brings up another point: You might have to adjust the delays in any case, because the loop-keying relay requires a small, but finite, time for armature travel. Your relay armature might be heavier or lighter than mine, the contact gap might be more or less, etc. No problem; change the delay constants up until the printer garbles, then down until it garbles, and then set the number between these two values.

I have installed a switch that allows my CT-1024 to be switched to either 300 or 1200 baud. This program runs equally well on either baud rate. If you want your keyboard input to be displayed on your video display, you should enable your data terminal's internal "echo," as this program does not contain routines to accomplish this.

Now let's do a flowchart to accomplish all the things we have described, not necessarily in the order they were enumerated.

A few words about Fig. 1: Since I am not an engineer, these circuits are probably somewhat unorthodox, but they are working in my gear. Unless I have let a drawing error slip by, they will work in yours.

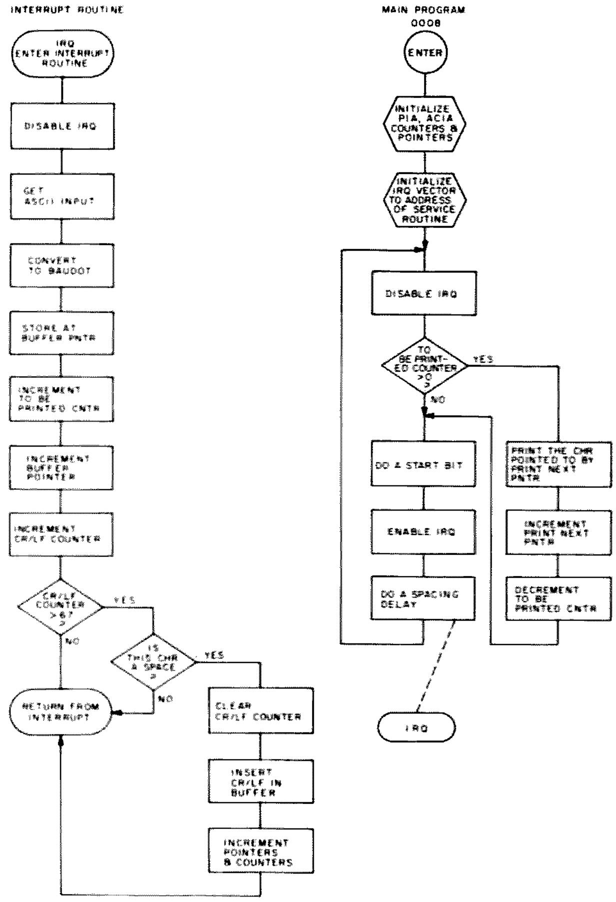


Fig. 2. Flowchart.

If you can't find a small 12-volt relay that will stand interrupting 150 V dc at 60 mils, try one with a higher coil voltage. In most cases, 12 or 13 volts will operate a 24-volt relay. If you have a 6-volt relay with sufficient contact rating, all you need change in this circuit is the power transformer. Change to a 6.3-V ac secondary, and you will have approximately 9 volts dc unregulated. Use a heat sink on the voltage regulator. The transistor pair is a circuit that I have used quite a bit; I feed them with supply voltages that have ranged from +5 to +15 volts. They are quite inexpensive, 5/$1.00 at James Electronics.

Paralleling the two normally-closed sections of K-1 has the apparent effect of reducing contact bounce, in addition to increasing current capacity.

I do not recommend connecting either of the RTTY loop lines to interface board common, the goal being to keep that 150 volts out of my computer!

My interface is assembled on perfboard and housed in a small Radio Shack cabinet. Don't forget a fuse in the transformer primary. I always use sockets for all ICs, even on perfboard.

Machine Code

The M6800 CPU, like other CPU chips, has what is called an instruction set. This is simply a list of commands that the chip will recognize and execute. For most microprocessors, these are one-byte (8-bit) numbers. These commands are sometimes called op codes, and the instruction

```
                         PROGRAM LISTING, RTTY OUT.

                         Program entry point: 0008
aDDR.  OP-CODE  DATA   MNEMONIC         REMARKS
0000            00     RMB      Buffer atorage poiater.
0001            00     RMB      To be printed counter.
0002            00              Not used.
0003            00     RMB      CR/LF counter.
••••   ••       •• ••  •••          ••••••••
0008   86       FF     LDA-A    Initialize PIA for output
000A   B7       80 00  STA-A    to model 19.
000D   86       04     LDA-A
000F   B7       80 01  STA-A
0012   86       95     LDA-A    Initialize ACIA to
0014   B7       80 04  STA-A    generate IRQ.
0017   CE       03 00  LDX      Set up IRQ vector to
001A   FF       A0 00  STX      aervice routine.
001D   7F       00 36  CLR      Print next pointer.
0020   7F       00 01  CLR      To be printed counter.
0023   01       01 01  NOP      No operation, not used.
0026   7F       00 03  CLR      CR/LF counter.
0029   7F       00 00  CLR      Buffer atorage pointer.
                       •••••••••••••••

                       START PRINT
002C   0F              SEI      Disable IRQ.
002D   B6       00 01  LDA-A    Get to be printed counter.
0030   27       05     BEQ      If zero, branch to 0037.
0032   CE       02 00  LDX      Set index reg. to atart of buffer.
0035   A6       00     LDA-A    Get chr. at index plus prnt. nxt pntr.
0037   36              PSH-A    Save A reg.
0038   7E       03 20  JMP      Do a atart bit.
003B   36              PSH-A    Save A again.
003C   7E       00 6D  JMP      To bit timer.
003F   7C       00 63  INC      Increment bit counter.
0042   44              LSR-A    Shift lsb out of A reg.
0043   24       07     BCC      If lsb=0, BRA to out a apace.
0045   C6       01     LDA-B    Else out a mark.
0047   F7       80 00  STA-B
004A   20       05     BRA      To bit count check.
004C   C6       00     LDA-B    Out a apace.
004E   F7       80 00  STA-B
0051   F6       00 63  LDA-B    With bit counter.
0054   C1       06     CMP-B    To hex 06.
0056   26       E3     BNE      Back to 003B if not zaro.
0058   7F       00 63  CLR      Finished, clr bit counter.
005B   B6       00 01  LDA-A    More chrs. to print?
005E   27       25     BNE
0060   7E       00 7F  JMP      To atop bit timer and apacer.
0063   00              RMB      Bit counter.
                    ••••••••••••••••
                       BIT TIMER
ADDR.  OP-CODE  DATA   MNEMONIC         REMARKS
0064   01       01     NOP
0066   01       01 01  NOP
0069   01       01     NOP
006B   3C                       Timer coastants.
006C   35
006D   B6       00 6B  LDA-A    Timer
0070   F6       00 6C  LDA-B
0073   5A              DEC-B
0074   26       FD     BNE
0076   4A              DEC-A
0077   26       F7     BNE
0079   32              PUL-A
007A   7E       00 3F  JMP      Go finish this chr.
                    ••••••••••••••••
              STOP BIT TIMER AND SPACER
007D   01              NOP
007E   01              NOP
007F   7A       00 01  DEC      Dec. to be printed counter.
```

Program listing.

set for an M6800 chip will not produce the same results when input to an 8080 chip. However, a chip called the Z-80 will properly execute all of the 8080 instruction set, plus several more instructions that the 8080 cannot execute.

When writing machine code for my SWTPC 6800, I make frequent use of two reference listings, the *Motorola M6800 Microprocessor Programming Manual*, pages A-1 through A-69, and an article from *73* by T. H. Hunter called "Backward Branch the Easy Way" (Holiday, 1976, page 90).

Machine code, when deposited by hand, commonly utilizes one of two methods, depending on the configuration of the computer. Computers similar to the older model Imsai 8080 having a complete front panel permit data entry in binary format by manipulation of a row of toggle switches located on the front panel. By means of these switches you can examine (display contents of) any memory address, change the contents thereof, start program execution from the displayed address, examine the next sequential address, etc.

Computers similar to the SWTPC 6800 have no switches for data entry. Their front panels usually contain only a power on-off switch and a system reset button. This type of computer has what is called a "system monitor" program stored in permanent memory (ROM). When the power is turned on or the reset button depressed, the CPU's program counter is automatically initialized to the beginning of this program and the program begins running. This means that in addition to the computer, you must also have a terminal unit consisting of a keyboard that produces ASCII characters and a display. If you have a video display, you must also have a display refresh memory consisting of a memory byte (usually less than 8 bits) for each position on the screen that is to be printed into, plus logic circuitry to generate the necessary timing, decoding, and synchronizing signals. This display refresh could be accomplished inside the computer, but it would use up a good bit of the computer's time and memory.

The system monitor program establishes communi-

```
          ASCII "A" = 0100 0001  (41 in hex)
                      0100 0001  (ASCII "A")
Plus  0000 0001 0000 0000        (hex 0100, start of decode table)
-----------------------------------------------------------------
Equals 0000 0001 0100 0001       (hex 0141)
```

Fig. 3.

```
0082   7C   00 36   INC     Inc. print next pointer.
0085   C6   01      LDA-B   Out a stop bit.
0087   F7   80 00   STA-B
008A   0E           CLI     Enable interrupt request.
008B   86   AF      LDA-A   Timer constants
008D   C6   FF      LDA-B
008F   5A           DEC-B   Timer
0090   26   FD      BNE     To 008F if not zero.
0092   4A           DEC-A
0093   26   F8      BNE     Count B down again if not zero.
0095   7E   00 2C   JMP     Finished, print another one.
                    ***************
0100   XX   XX XX   XXX     Insert DECODING TABLE beginning here.
                    *************
0200   XX   XX XX   XXX     Reserved for operating buffer,
02FF   XX   XX XX   XXX     no initial data necessary.
                    ***************
                         SERVICE IRQ
                    LOAD, DECODE, AND STORE
0300   B6   80 05   LDA-A   Get data from ACIA
0303   B7   03 0A   STA-A   In decode table index.
0306   CE   01 00   LDX     With decode table start.
0309   A6   00      LDA-A   Indexed by contents of 030A.
030B   CE   02 00   LDX     Buffer start.
030E   D6   00      LDA-B   From loc.0000 (Storage pointer)
0310   F7   03 14   STA-B   In buffer index.
0313   A7   00      STA-A   Indexed by contents of 0314.
0315   7C   00 00   INC     Increment storage pointer.
0318   7C   00 01   INC     Increment to be printed counter.
031B   7E   03 3C   JMP     To CR/LF routine.
                    ***************
                      DO A START BIT
0320   C6   00      LDA-B   Out a start bit.
0322   F7   80 00   STA-B
0325   20   02      BRA     Around constants.
0327   3C                   Timer constants.
0328   35
0329   B6   03 27   LDA-A   Timer.
032C   F6   03 28   LDA-B
032F   5A           DEC-B
0330   26   FD      BNE
0332   4A           DEC-A
0333   26   F7      BNE
0335   32           PUL-A
0336   7E   00 3F   JMP     Go finish this chr.
                    ***************

                    CR/LF ROUTINE
0339   01   01 01   NOP
033C   7C   00 03   INC     Increment CR/LF counter.
033F   C6   43      LDA-B   With decimal 67.
0341   F1   00 03   CMP-B   To CR/LF counter.
0344   22   2B      BHI     To 0371 if CR/LF less than 67.
0346   C6   04      LDA-B   Load B with Baudot space.
0348   11           CBA     Compare B to A; is space?
0349   01   01      NOP
034B   26   24      BNE     To 0371 if not space.
034D   CE   02 00   LDX     With buffer start.
0350   D6   00      LDA-B   With contents of buffer sto. pntr.
0352   F7   03 58   STA-B   In temporary.
0355   C6   08      LDA-B   With Baudot CR
0357   E7   00      STA-B   Indexed by temporary.
0359   7C   00 00   INC     Increment buffer sto. pntr.
035C   7C   00 01   INC     Increment to be printed counter.
035F   D6   00      LDA-B   With buffer storage pointer.
0361   F7   03 67   STA-B   In another temporary.
0364   C6   02      LDA-B   With Baudot LF.
0366   E7   00      STA-B   Indexed by temporary.
0368   7C   00 00   INC     Increment buffer sto. pntr.
036B   7C   00 01   INC     Increment to be printed counter.
036E   7F   00 03   CLR     Clear CR/LF counter.
0371   3B           RTI     Return from interrupt.
                    END
```

cation between you and your computer via the keyboard and display. Input is in hexadecimal notation, which is a condensed cousin of binary. Two hex digits can express any number that you can write with eight binary digits.

A system monitor program contains several small programs (routines) that the designer thinks will be useful, such as:

- Examine (display) a specified memory location.
- Change the contents of the displayed location, then display the next sequential location.
- Jump to a specified location and start execution.
- Display contents of the stack.
- Load cassette data through the control port.
- Record data on cassette from specified memory, etc.

Several companies now offer system monitor boards for S-100 systems, which greatly simplifies the task of establishing communication with a computer of the front panel type.

The RTTY Program

Looking at the program listing, you will see that the first few memory locations contain zeros. These locations are used by other parts of the program as temporary data storage locations. Out in the main program at their point of use, you will also see several NO-OPS which, if executed, cause only the program counter to be incremented. These were put there to replace unnecessary code and could be used as jump-points to other routines if you want to expand the program. We start the program by typing J 0008 (with SWTBUG system monitor; all numbers in hex unless otherwise stated). Remember that I spoke of an instruction set or op code? At 0008, the op code 86 means load accumulator A with the next byte. The program counter is incremented as each byte is processed, thereby keeping track of what location comes next.

How does the computer know the difference between op codes and data? It doesn't! So, to avoid a spectacular program wipe-out, the first byte in your program had better be a valid op code followed by the number of bytes of data that that particular op code requires. All subsequent lines of code must follow the same general pattern—op code followed by enough data to satisfy the op code you have used. The first few lines of code are used as the flowchart says, to clear all pointers and counters, to set the PIA for output, and to set the ACIA to generate an interrupt request when new data comes in

ADDR.	DATA	ADDR.	DATA	ADDR.	DATA
0100	00	0132	13	014C	12
****	**	0133	01	014D	1C
0107	05	0134	0A	014E	0C
****	**	0135	10	014F	18
010A	02	0136	15	0150	16
****	**	0137	07	0151	17
010D	08	0138	06	0152	0A
****	**	0139	18	0153	05
0120	04	013A	0E	0154	10
0121	0D	013B	1E	0155	07
0122	11	013C	1F	0156	1E
0123	14	013D	00	0157	13
0124	09	013E	1B	0158	1D
0125	00	013F	19	0159	15
0126	1A	0140	00	015A	11
0127	0B	0141	03	015B	00
0128	0F	0142	19	015C	1F
0129	12	0143	0E	015D	00
012A	00	0144	09	015E	1B
012B	00	0145	01		
012C	0C	0146	0D		
012D	03	0147	1A		
012E	1C	0148	14		
012F	1D	0149	06		
0130	16	014A	0B		
0131	17	014B	0F		

```
****************************
* Subtract 0100 from any   *
* of these addresses, and  *
* you get an ASCII chr.    *
* The data there is the    *
* Baudot equivalent.       *
****************************
```

Decoding table.

from the keyboard. We also store the address of the interrupt service routine at location A000-A001 (0300). At 0300, the service routine reads the incoming character, converts it to Baudot, and stores it in the buffer. It increments the proper pointers and counters, then checks to see if you have stored enough characters to need a CR/LR. If so, it adds them to the buffer after the next space and avoids hacked or hyphenated words this way.

The Baudot conversion works in the following manner: The binary value of the ASCII character, plus the binary value of the start of the decoding table, produces addresses where we have stored Baudot translations. See example in Fig. 3.

Hex 0141 is the address at which this program contains the Baudot equivalent of the letter "A", 000 0011. And so it goes for the entire Baudot-printable sequence, with the numerical value of each ASCII character serving as a pointer to a memory location where we have stored the Baudot equivalent. This method is much faster than trying to do a character-by-character comparison through alphanumeric tables.

The ltrs/figs shift is set up to decode a less than (<) as figs and a greater than (>) as ltrs. This seems a trifle unhandy, since to get these characters one must also depress the shift bar. My date entry keyboard has Λ and \ as the two topmost right-hand keys, so these are also decoded as figs/ltrs, respectively. My keyboard prints these without shifting.

At this point, I won't bore you further with a line-by-line explanation of the program. You should get into machine-language programming; it's great fun and unlimited in its applications. If I can be of any help in your implementation of this program, drop me a line (with an SASE, please) and I'll do what I can to help. ■

Tim Ahrens WA5VQK
7405 Ladybug St
Austin TX 78744

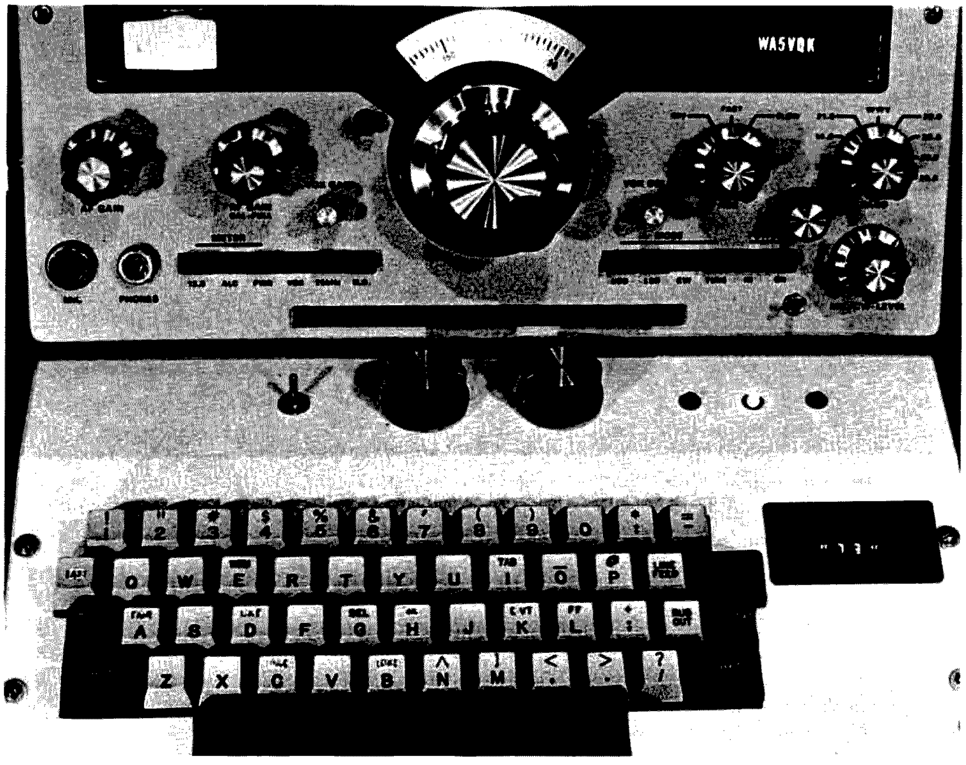
The Perfect Morse Machine

—send and receive CW with a dedicated micro

Author's note: I will supply a photocopy of the PC board artwork for $4.00. I will also program reader-supplied 2708s for $6.00. Both are payable by money order or certified check. I also wish to thank Mike Hadley WA7NLM for his audio filter design.

Have you seen all of the ads coming out for "automatic" Morse keyboards and readers with one big alphanumeric "eye" that gives you a readout as someone is sending code? Then there are the "complete" stations which will do both on a TV screen for only $600. The item I am about to describe can do all of this and more, with many possible options, for less than $100.

About three years ago at the Dayton Hamvention, I picked up a program for a computer-controlled Morse code station. This program was written with the MC6800 computer in mind and was fathered by Don Jackson W7GKU and Jim Bainter WA7VKZ. The computer and the program in our story have changed significantly, but still are based on their algorithms. The original program was designed for use with the old Mikbug® evaluation module, and used the onboard ACIA (Asynchronous Communications Interface Adapter) serial port for communications with a TTY or CRT terminal.



Well, after I finally got to the point where I had a little knowledge of the 6800, I decided to try to make this thing work. Keep in mind that a little knowledge is dangerous! I had to do some work, but after a while, a wire-wrapped version appeared on a card within my computer. I didn't believe it, but it really worked. The only problem I had with it was the way it copied code. It was so perfect that all of those with sorry fists would really mess it up. With all of the means available to generate decent code, whether keyer or keyboard, there is really no excuse for a poor fist.

Well, enough of my soapbox. With this gizmo, everybody can have perfect CW capabilities. After the original version, wire-

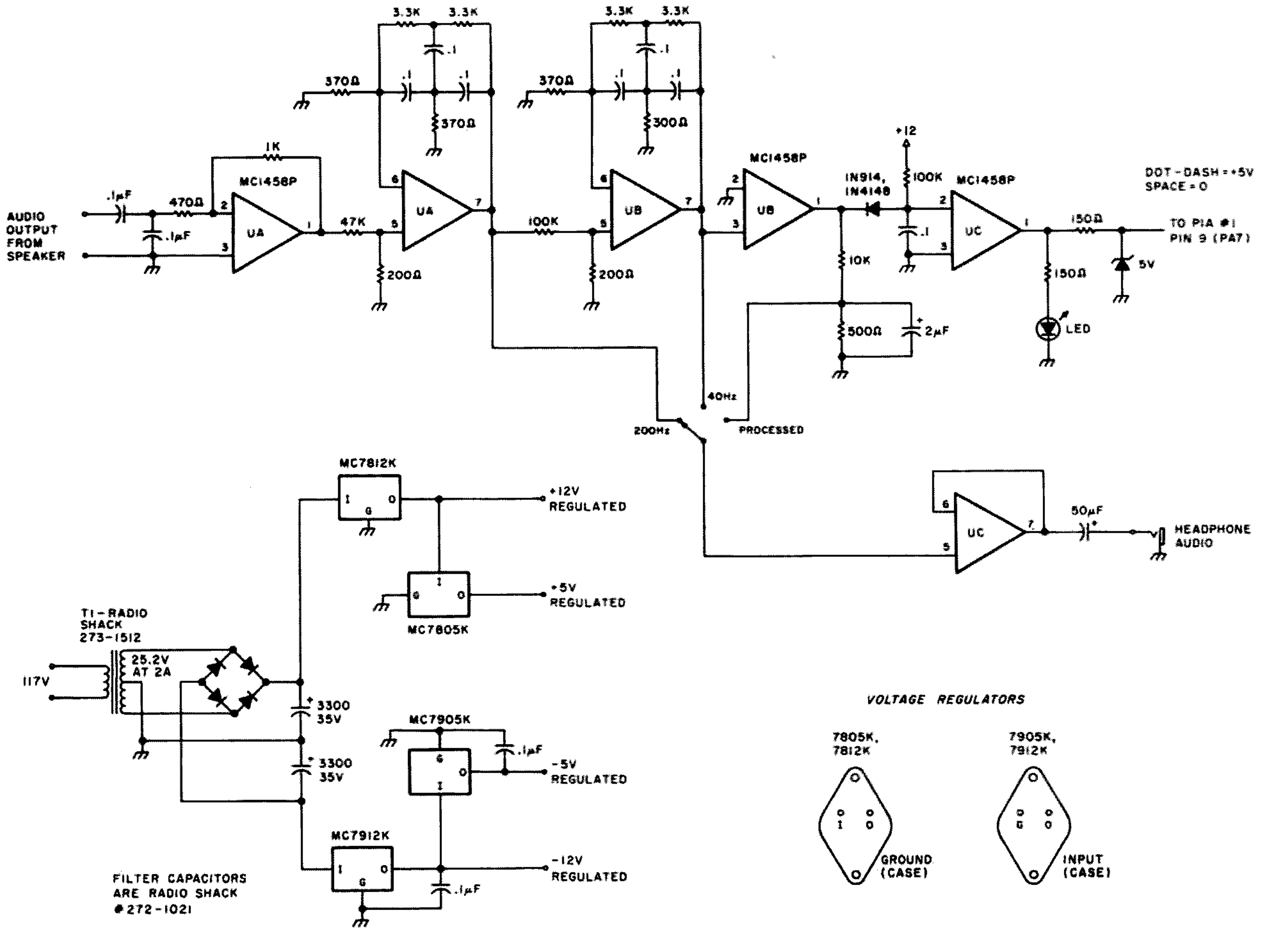


Fig. 1. This is the audio filter and recommended power supply. The input audio is filtered by the op amps and turned into dc to be fed into the PIA. Vcc = pin 8 (+12); Vee = pin 4 (−12).

wrapped deep within the bowels of my mainframe, worked, the next thought was to make it a fully self-contained system with a dedicated CPU to work with. The most logical choice was to use the MC6802—son of 6800. With clock and RAM all on silicon, at least three packages could be saved over the original 6800 design. The age of the small dedicated system has arrived.

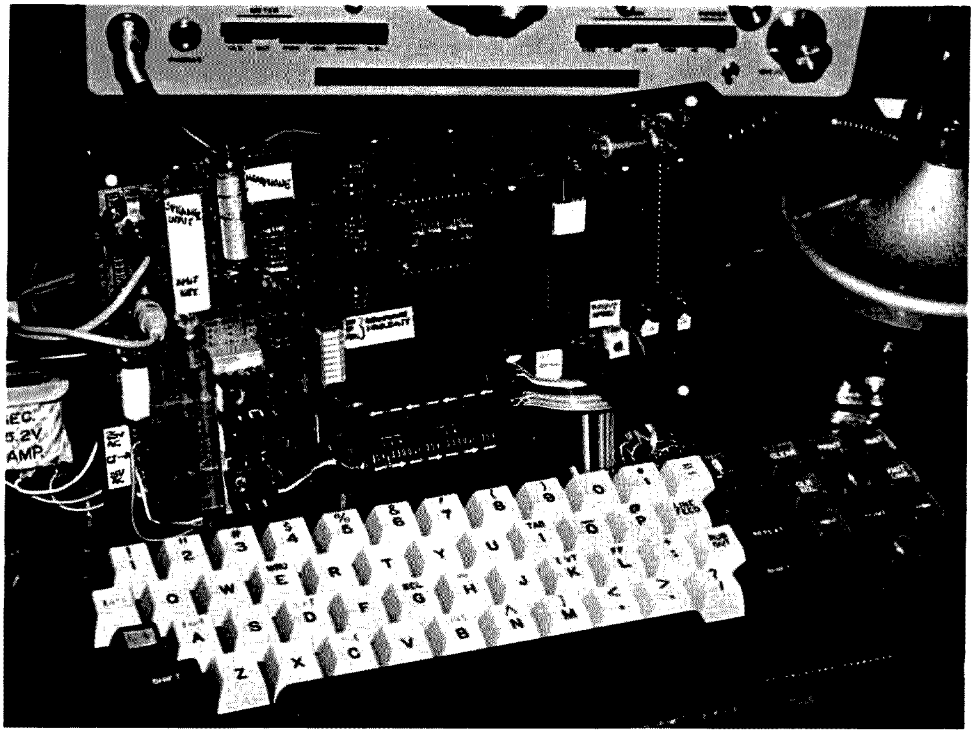
The following evening was spent on wire-wrapping a small board with the system. The program was, of course, stored in an EPROM for automatic "boot" and for more additions later. The two biggest drawbacks that I could find were that it still required a terminal which was both large and expensive, and it had a switch to go from receive to transmit, and so forth. The last time I saw one of those things was as a Novice with my Globe Scout and S100!

So, these little things had to be fixed. OK, the switch could be replaced with a different polling routine within the software. No sweat, but what about the terminal? Well, plugging in a keyboard would be no trouble, but something to peer at was also required. What to do? Well, Burroughs makes some fine display panels which can display about 30 characters on a line, but you might have to float a loan to buy one—and having to use 250 volts didn't appeal to me, anyway.

Enter the DL-1416. Litronix has done it again. The 1416 is a four-digit, 16-segment, alphanumeric intelligent display, which, when fed parallel ASCII, will display the most-used 64 characters of the ASCII set. It is a five-volt-only device, and by placing it directly on the CPU bus, will appear as "write-only RAM." Unfortunately, the slow setup times and the need to have data valid before Read/Write comes out present a few problems. The first version had the LEDs just hanging on the data bus and worked with some degree of reliability. But when Rs started coming out as Ps, I knew that the timing specifications were being violated.

After much manipulation of the clock and stretching of the E pulse, I determined that too much glue (peripheral hardware) would be required to just leave it on the bus. Then I remembered that only half of PIA 2 was being used, so the most logical choice was to put the 1416 on the peripheral data bus. By setting the control register within the PIA first to a \$34 and then to a \$3C, the CB2 line would go low and come high again, all done while the data was latched onto the output lines. Great—use this for the $\overline{W}$ (write) line, and tie it to $\overline{CE}$ (chip enable), too! The timing of the 1416 specifies that the falling edge of $\overline{CE}$ must be at least 500 ns before the rising edge of $\overline{W}$. So having them both come in at the same time is permissible. See the timing diagrams.

According to Appnote 9A from Litronix, systems which use only a 6-bit



ASCII code can still utilize the 1416 by inverting D5 and feeding it into D6. By doing it this way, two "spare" data lines on the PIA are saved. These two lines are used for addressing either of the four digits to be written to. All of the work writing to the LEDs is now being accomplished in software.

The clock within the 6802 is really a strange beast. It can accept any parallel-resonant crystal from 1 to 4 MHz. Of course, the crystal is divided by four, so remember this when selecting your crystal. In this program, the CPU will work fine even when running at its minimum frequency (100-kHz bus speed, 400-kHz crystal frequency).

A funny thing happened

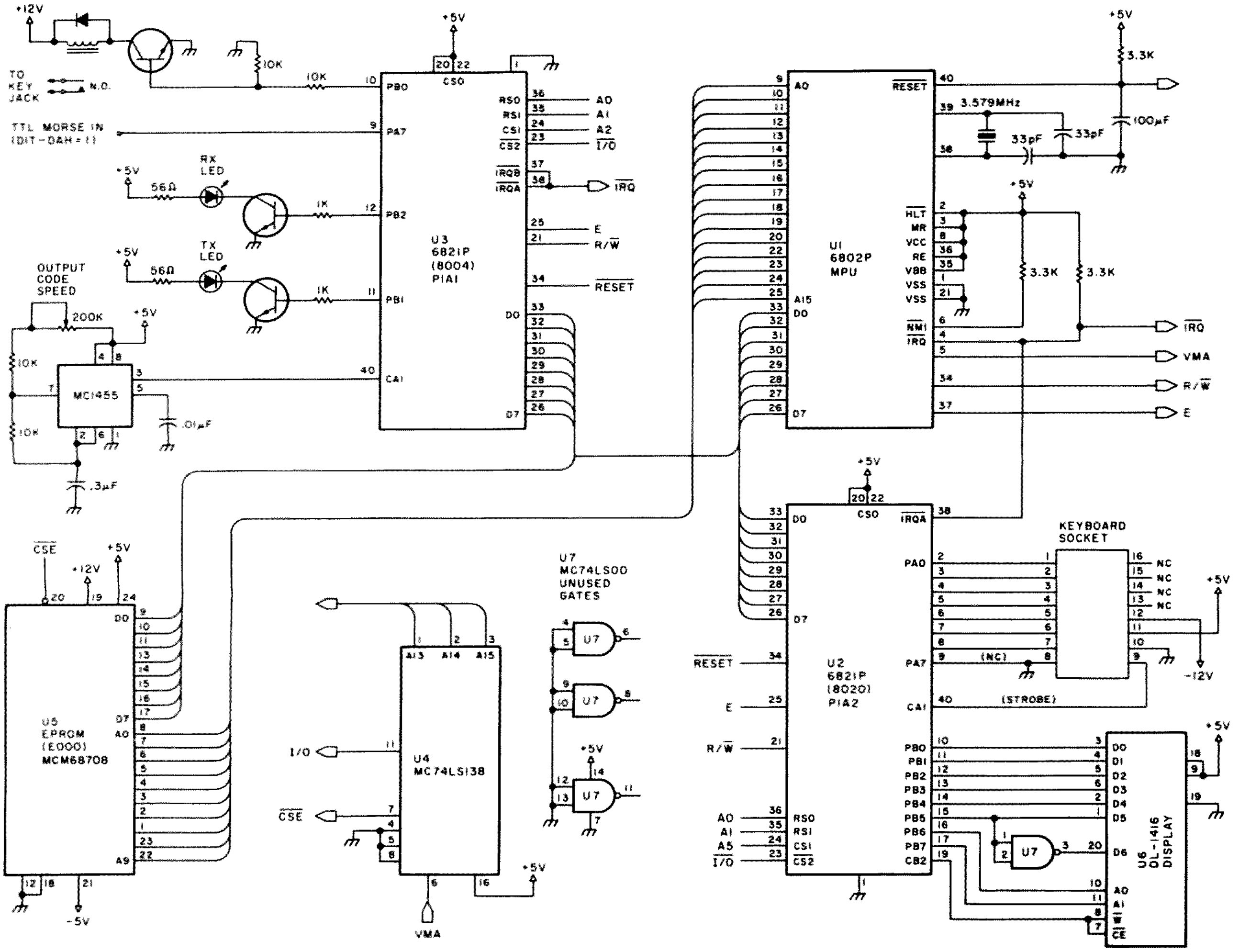


Fig. 2. The main processor, composed of the MC6802 MPU, two PIAs, and an EPROM.

while experimenting with different crystal types; the thing oscillated even without a crystal! The frequency was really slow and quite unstable, but it worked. Even after power down and up, it continued to oscillate. Since the 6802 is not specified for use without a crystal, Motorola won't guarantee it to work without one, but, just for fun, why not try it out on yours when you build it?

You might think that having only four digits a little bigger than a calculator display would be a real hassle to use. Not so! The program takes the incoming data or keyboard data and puts it in the right-hand display. As the next character comes in, it is shifted left one digit. Instant "Times Square" display. I was a bit hesitant to use on-

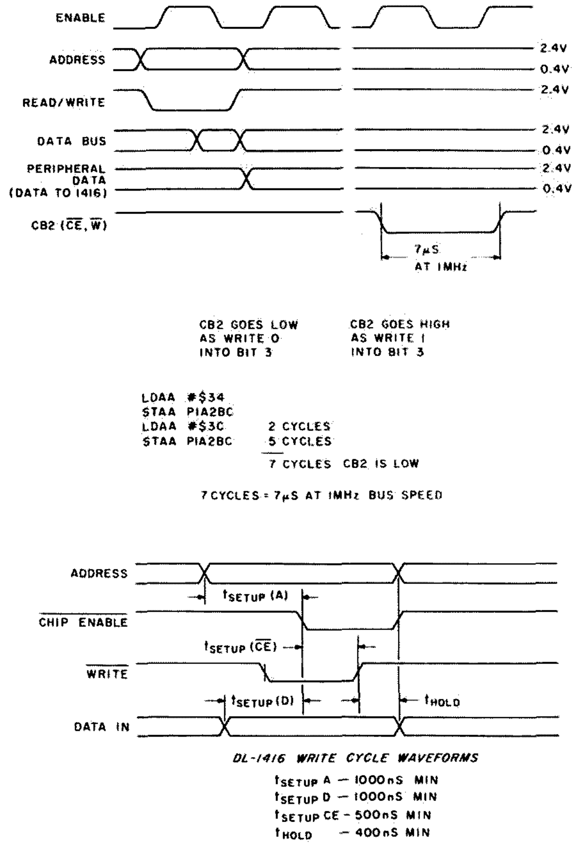


Fig. 3. PIA write-timing to displays, and Litronix-recommended write-cycles for the DL-1416.

POWER SUPPLY NOTES

The total current requirements for the reader/talker are given below. These figures are the absolute maximums for the individual components, so don't expect them to be that high, but, just in case, go ahead and plan for it.

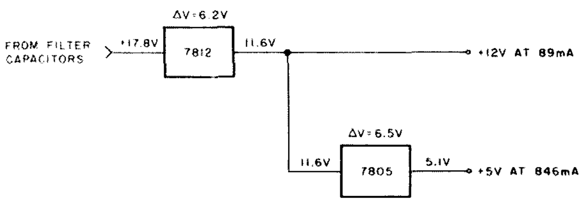
Current requirements for the reader/talker. All values are in milliamps and are absolute maximums.

	+5 V	+12 V	−12 V	−5 V
MC6802	240	—	—	—
MC6821	110	—	—	—
MC6821	110	—	—	—
MCM68708	10	65	—	65
MC74LS138	6.4	—	—	—
MC74LS00	15	—	—	—
DL1416	100	—	—	—
MC1458	—	8	8	—
MC1458	—	8	8	—
MC1458	—	8	8	—
3 LEDs	30	—	—	—
Average Keyboard	225	—	45	—
Maximum Totals	846.4	89	69	45

As can be seen in the totals, all currents can be handled with the three-terminal-style regulators. The following calculations are to determine what the power dissipation for each device is. For the three-terminal regulators, the power dissipation can be expressed by the following equation:

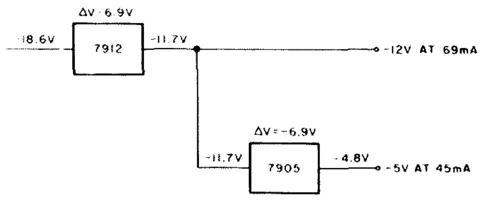
$P_D = (\Delta E_{IN})\, I_{OUT} + E_{IN}\,(I_Q)$, where: P_D = Power dissipation. E_{IN} = In-Out voltage, I_{OUT} = output current, and I_Q = current through ground lug.

For the positive voltage regulators, the following schematic is used, and the voltages are labeled. These were typical, using the values of transformers and capacitors specified in Fig. 1.



$$7812\ P_D = (6.2\ V)\,(.935\ A) + 17.8\,(.008) = 5.94\ W$$
(Note: .935 A = .846 A + .089 A)
$$7805 P_D = (6.5\ V)\,(.846\ A) + 11.6\,(.008) = 5.34\ W$$

In the same light, the minus voltage regulators can be also calculated:



$$7912\ P_D = (6.9\ V)\,(.114\ A) + (18.6)\,(.008) = .935\ W$$
$$7905\ P_D = (6.9\ V)\,(.045\ A) + 11.7\,(.008) = .404\ W$$

By taking the input of the 7805 from the output of the 7812, the power dissipation of the 7812 was raised from about ½ Watt to almost 6 Watts. But by taking the 7805 input directly at the capacitor output, its P_D would have been 10.75 Watts! This would be very difficult to heat sink, so by doing it as shown, the total power dissipation is about the same, only divided between two parts.

According to the *Motorola Linear IC Data Book*, to dissipate the required power (5.9 and 5.3 W), a heat sink which can dissipate 15°C/Watt will be required. The minus voltage regulators are not as critical, as they have a lesser current demand on them. I recommend the use of the -K suffix regulators (TO-3 case), because their thermal resistance (junction-to-case vs. junction-to-air in the plastic package) is so much better. Heat sink them with an appropriate sink, preferably to a metal case, and no problems should be encountered. The negative regulators' requirements can be satisfied by simply bolting them to the chassis. (Be sure to insulate their cases!)

The voltage regulators shown in the pictures are of the plastic style and get quite hot even with the heat sinking shown. When the project is put into an enclosure, TO-3-style regulators will replace them.

ly four digits, but after using it, I find that 4 is really not too few, and the faster the code is sent, the easier it is to read. The new design now automatically transfers from receive to transmit and back again after all characters have been sent. The algorithm used in the code conversion is set up so that it automatically senses speed changes and adjusts itself for the correct speed. This can be anywhere between about one-half wpm to 300 wpm. Changing speed requires only about 2 characters to be lost, so it is quite efficient. Neat, eh?

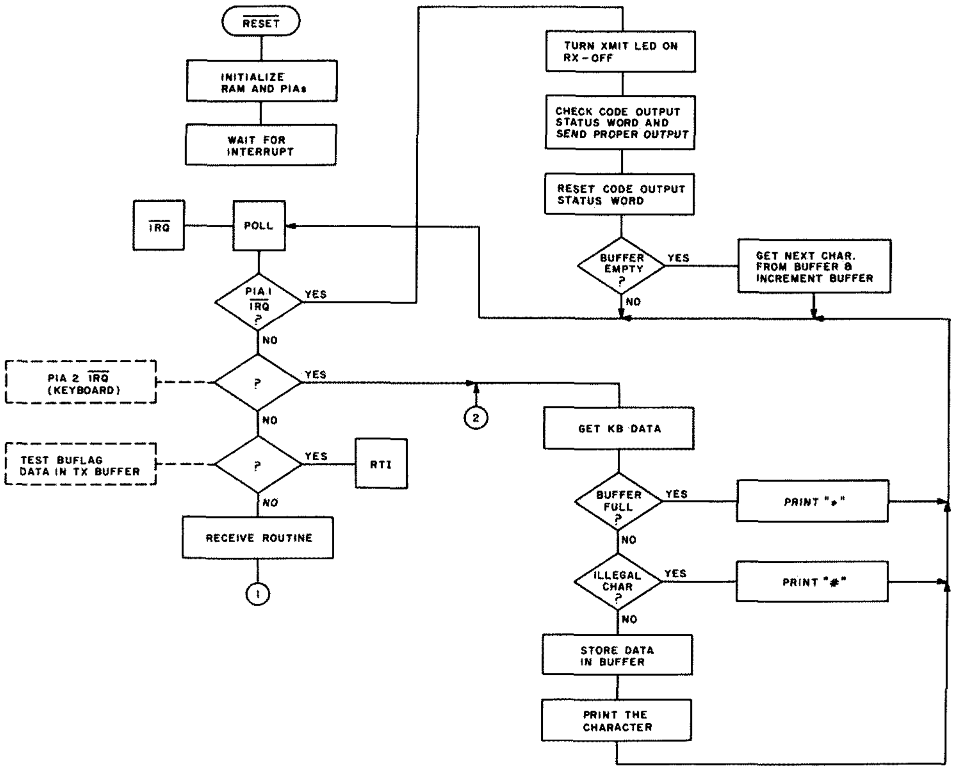


Fig. 4. Flowchart, part 1.

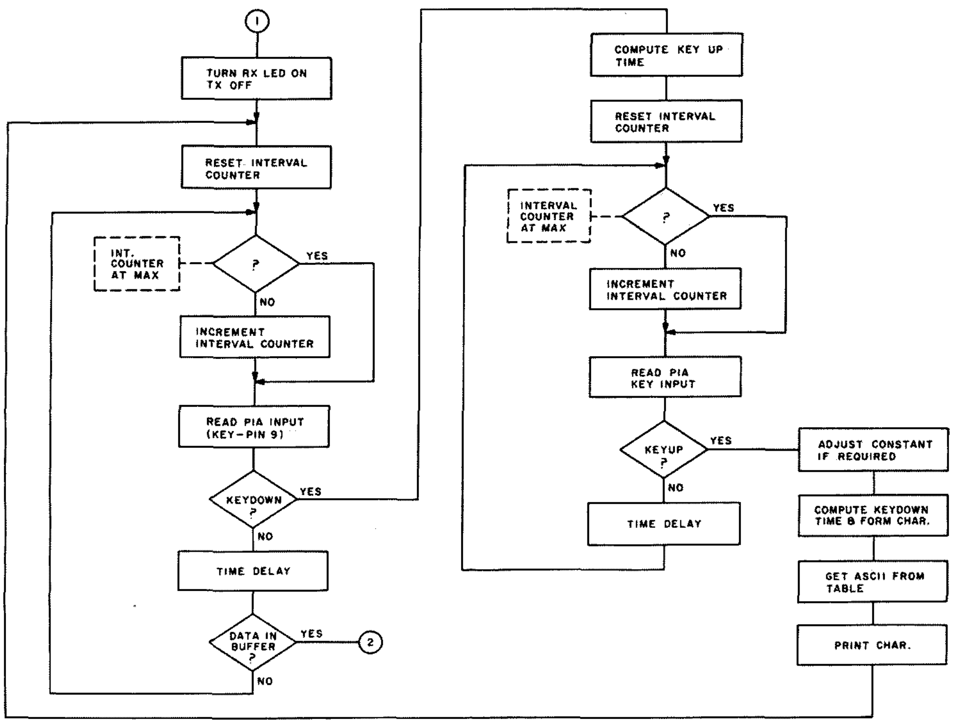


Fig. 5. Flowchart, part 2.

Back before I built the keyboard/reader, I thought that it would be "cheating" to use one; it had been done manually for such a long time, who was I to change any preconceived ideas? Anyway, I have found just the opposite to be true! Number 1, the computer is not foolproof. It can be messed up by zero-beat QRM, sloppy fists, or high noise levels. So, when you start your QSO, try not to get carried away and go too fast, because if one of these should happen, you might be stranded by sending faster than you can receive. Another thing is that you are seeing a character appear on the display at the same time you are hearing it. No better way for associative learning than to get the code into your eyes and ears simultaneously. I've found my speed to be dramatically increasing following the use of it for a couple of weeks. Also, you have a tendency to follow the conversation along in your head—the only way to do it for above 15 or 20 wpm. The final plus is that you hear perfect code being sent by your keyboard, and it makes you wish that everyone had one of these things! So, it's not really cheating, but only another progressive learning device provided by the computer.

As this design recognizes a single input to determine a character and a single output for code, why couldn't it also be used for Baudot or ASCII teletype™? This is just a bug in your ear—look for some further programs in later articles. Wouldn't it be nice to have a truly portable TTY "machine"?

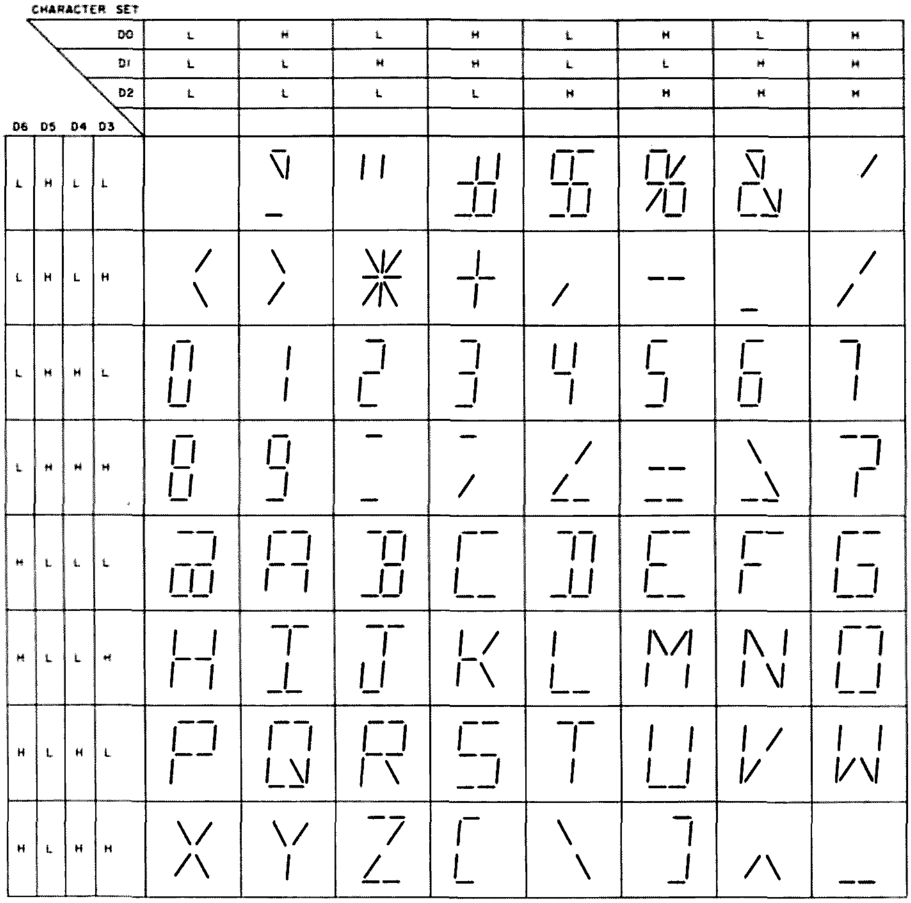
Construction

As you can see in Fig. 1,

the audio from a headphone jack or speaker tie-in goes into a filter-processor where it is converted from audio tones to TTL-compatible levels. This audio input is fed into an op amp preamplifier, so not a whole lot of audio is required. You might want to pad it if your receiver overdrives the device. You also can plug your headphones into the jack on the board and use it for a filter. The first switch position provides selectivity down to about 200 Hz, the second to 40 Hz, and the third to processed audio—this is a really fun feature. After it is tuned in correctly, all you hear is a tone. No QRM, no static, no garbage, only a pure representation of the sent character. This is a really weird feeling, especially if you have never used it before. If you don't want to build the computer, at least build the filter—it works great for CW by itself.

After this processed audio is converted to a voltage level, it is fed into a single bit of a PIA (Peripheral Interface Adapter) parallel port. Two of these PIAs are used on the board, one for Morse in and out, transmit speed timing, and indicator LEDs. The second PIA is for the keyboard and LED display unit. The 555 circuit is set for the desired speed at which you wish to transmit. In this design, a relay is provided for Morse code output. Although my HW-104 uses positive voltage keying and worked great with just a single keying transistor, a reed relay provides a more versatile interface for use with any type of keying, from grid-block to cathode.

The EPROM in the circuit is used to hold the pro-



LOADING DATA

$\overline{CE}$	$\overline{CU}$	$\overline{W}$	ADDRESS A_1	A_0	DATA INPUT D6	D5	D4	D3	D2	D1	D0	DIGIT 3	DIGIT 2	DIGIT 1	DIGIT 0
H	X	X	X	X	X	X	X	X	X	X	X	N/C	N/C	N/C	N/C
L	H	L	L	L	H	L	L	L	L	L	H	N/C	N/C	N/C	A
L	H	L	L	H	H	L	L	L	L	H	L	N/C	N/C	B	A
L	H	L	H	L	H	L	L	L	L	H	H	N/C	C	B	A
L	H	L	H	H	H	L	L	L	H	L	L	D	C	B	A
L	H	L	L	L	H	L	L	L	H	L	H	D	C	B	E
L	H	L	H	L	H	L	L	H	L	H	H	D	K	R	E
L	H	L	—	—	—	—	—	—	—	—	—	SEE CHARACTER SET			

LOADING CURSOR

$\overline{CE}$	$\overline{CU}$	$\overline{W}$	ADDRESS A_1	A_0	DATA INPUT D6	D5	D4	D3	D2	D1	D0	DIGIT 3	DIGIT 2	DIGIT 1	DIGIT 0
H	X	X	X	X	X	X	X	X	X	X	X	D	K	B	E
L	L	L	X	X	X	X	X	L	L	L	H	D	K	B	.
L	L	L	X	X	X	X	X	L	L	L	L	D	K	B	E
L	L	L	X	X	X	X	X	L	L	H	L	D	K	.	E
L	L	L	X	X	X	X	X	L	H	L	L	D	.	B	E
L	L	L	X	X	X	X	X	H	L	L	L	.	K	B	E
L	L	L	X	X	X	X	X	H	H	H	H	.	.	.	.
L	L	L	X	X	X	X	X	L	L	L	L	D	K	B	E

Fig. 6. Litronix DL-1416 character set and truth table. X = don't care; N/C = no change.

Program listing. Software for reader in 6800 assembler source code.

```
00001                          NAM    MORSEMAX (LED VERSION)
00002A 0000                    ORG    $0000
00003                   ***********************************************
00004                   * MORSE CODE/ASCII SEND/RECEIVE PROGRAM
00005                   * FOR THE MOTOROLA 6802 MICROPROCESSOR
00006                   * FROM AUSTIN, TEXAS
00007                   * MICROPROCESSOR CAPITOL OF THE WORLD!
00008                   ***********************************************
00009                   * I/O HARDWARE CONFIGURATION:
00010                   *    PIA1 ADDRESS - $8004
00011                   *       CA1 - INTERRUPT TIMING FOR XMIT CODE,
00012                   *             2-50 HZ.
00013                   *       PA7 - RECEIVE CODE INPUT
00014                   *       PB0 - CODE OUT
00015                   *       PB1 - TRANSMIT LED
00016                   *       PB2 - RECEIVE LED
00017                   *    PIA2 ADDRESS (KBD) - $8020
00018                   *    LITRONIX DISPLAY DL-1416 4 DIGIT LED - $C000
00019                   *    MCM2708L EPROM - $E000
00020                   ***********************************************
00021                   * ALL COMMONLY USED MORSE CHARACTERS
00022                   * ARE AVAILABLE:
00023                   *
00024                   *     SPACE - SPACE
00025                   *     ESC   - AS
00026                   *     =     - BT
00027                   *   CNTRL A - KN
00028                   *         B - BK
00029                   *         C - AR
00030                   *         D - SK
00031                   *         F - SN
00032                   *         H - ERROR ( 8 DOTS )
00033                   *
00034                   ***********************************************
00035                   *
00036                   *** TEMPORARY STORAGE FOR VARIABLES AND HUFFER **
00037                   *
00038A 0000     0002  A CVCX   RMB    2         INDEX REG CONVERT STORE
00039A 0002     0002  A SAVEX  RMB    2         X-REG TEMP STORAGE
00040A 0004     0001  A COUNT  RMB    1
00041A 0005     0001  A RESMSK RMB    1         COSTA RESET MASK
00042A 0006     0001  A BUFLAG RMB    1         B7=1  DATA IN BUFFER
00043A 0007     0003  A TMPSVE RMB    3         TEMP SAVE AREA FOR LED DIS
00044A 000A     0001  A COSTA  RMB    1         CODE OUTPUT STATUS
00045                   *B7 DIT FLAG,B6 DAH FLAG,B5 ELEMENT SPACE FLAG
00046                   *B4 WORD SPACE FLAG,B3 CHAR. SPACE FLAG
00047A 000B     0001  A LETYPE RMB    1         LAST ELEM TYPE DOT=0 DASH"
00048A 000C     0001  A HLETIM RMB    1         HALF LAST ELEM TINE
00049A 000D     0001  A TLETIM RMB    1         TWICE LAST ELEM TIME
00050A 000E     0001  A SPEEDK RMB    1         SPEED CONSTANT
00051A 000F     0001  A RCHAR  RMB    1         CHAR BEING RECEIVED
00052A 0010     0001  A LDATIM RMB    1         LAST DASH TIME
00053A 0011     0001  A TQLDAT RMB    1         3/4 LAST DASH TIME
00054A 0012     0001  A TLDAT  RMB    1         TWICE LAST DASH TIME
00055A 0013     0001  A KDTIM  RMB    1         KEYDOWN INTERVAL TIME
00056A 0014     0001  A KUTIN  RMB    1         KEYUP INTERVAL TIME
00057A 0015     0001  A CHCTR  RMB    1         REC. CHARACTER COUNTER
00058A 0016     0002  A RECX   RMB    2         REC. INDEX REG. TO ACCA.
00059A 0018     0055  A BUFBOT RMB    85        XMIT BUFFER BOTTOM
00060A 006D     0001  A BUFTOP RMB    1         XMIT BUFFER TOP

00062                   * PIA USED FOR I/O OF CW AND LED STATUS
00063A 8004                    ORG    $8004
00064A 8004     0001  A PIA1AD RMB    1
00065A 8005     0001  A PIA1AC RMB    1
00066A 8006     0001  A PIA1BD RMB    1
00067A 8007     0001  A PIA1BC RMB    1

00069                   * PIA USED FOR KEYBOARD INPUT AND LED DISPLAY OUT
00070A 8020                    ORG    $8020
00071A 8020     0001  A PIA2AD RMB    1         *KEYBOARD
00072A 8021     0001  A PIA2AC RMB    1
00073A 8022     0001  A PIA2BD RMB    1         *DISPLAY
00074A 8023     0001  A PIA2BC RMB    1

00076           007F  A STACK  EQU    $007F
00077           FFF8  A IRQVEC EQU    $FFF8
00078                   *
00079A E000                    ORG    $E000
00080                   *                KN  BK  AR  SK   ACK
00081A E000     00    A CODE   FCB    0,$B4,$88,$54,$16,0,$14,0
00082                   *              ERR       SP
00083A E008     01    A        FCB    1,0,0,0,0,$21,0,0
00084A E010     00    A        FCB    0,0,0,0,0,0,0,0
00085                   *                    AS
00086A E018     00    A        FCB    0,0,0,$44,0,0,0,0
00087                   *               SP    *
00088A E020     21    A RTAB   FCB    $21,0,$4A,0,0,0,0,$7A
00089                   *               (    )       ,  -  .  /
00090A E028     B6    A        FCB    $B6,$B2,0,0,$CE,$86,$56,$94
00091                   *               0   1   2   3   4   5   6   7
00092A E030     FC    A        FCB    $FC,$7C,$3C,$1C,$0C,4,$84,$C4
00093                   *               8   9   :   ;       BT(=)  ?
00094A E038     E4    A        FCB    $E4,$F4,$E2,$AA,0,$8C,0,$32
00095                   *                 A   B   C   D   E   F   G
00096A 8040     00    A        FCB    0,$60,$88,$A8,$90,$40,$28,$D0
00097                   *               H   I   J   K   L   M   N   O
00098A E048     08    A        FCB    $08,$20,$78,$B0,$48,$E0,$A0,$F0
00099                   *               P   Q   R   S   T   U   V   W
00100A E050     68    A        FCB    $68,$D8,$50,$10,$C0,$30,$18,$70
00101                   *               X   Y   Z
00102A E058     98    A        FCB    $98,$B8,$C8

00104                   ***RESTART ROUTINE***
00105A E05B CE 007F   A RESRT  LDX    #$7F      CLR RAM 0-7F
00106A B05K 6F 00     A L1     CLR    0,X
00107A E060 09                 DEX
00108A E061 26 PB E05E         BNE    L1
00109A E063 CB 2020   A        LDX    #$2020
00110A E066 DF 07     A        STX    TMPSVE    'CLEARS TMPSVE'
00111A E068 DF 08     A        STX    TMPSVE+1
00112A B06A CB 0P01   A        LDX    #$0F01
00113A E06D DP 0E     A        STX    SPEEDK    INZ SPEED CONS & RCHAR
00114A E06F 86 80     A        LDAA   #$80
00115A E071 97 6D     A        STAA   BUFTOP    INZ BUFTOP
00116A E073 09                 DEX
00117A E074 CE E000   A        LDX    #CODE
00118A E077 DP 00     A        STX    CVCX      INZ CVCX
00119A E079 CE 006D   A        LDX    #BUFTOP
00120A E07C DF 02     A        STX    SAVEX
00121A E07E CE E0B4   A        LDX    #POLL     INZ IRQ VECTOR
00122A E081 FF FFF8   A        STX    IRQVEC
00123A E084 CE 8004   A        LDX    #PIA1AD
00124A E087 6F 01     A        CLR    1,X       CLR PIA1AC
00125A E089 6F 03     A        CLR    3,X       CLR PIAIBC
00126A E08B 8E 0007   A        LDS    #$0007    CA1=+ & ALLOWED
00127A E08E AF 00     A        STS    0,X       (PIA1AD & PIA1AC)
00128A E090 8E FF34   A        LDS    #$FP34
00129A E093 AF 02     A        STS    2,X       (PIA1BD & PIA1BC)
00130A E095 A6 00     A        LDAA   0,X       CLR IRQA FLAGS
00131A E097 A6 02     A        LDAA   2,X       CLR IRQB FLAGS
00132A E099 86 00     A        LDAA   #$00
00133A E09B B7 8020   A        STAA   PIA2AD
00134A E09E 86 07     A        LDAA   #$07      CA1 NEG INPUT
00135A E0A0 B7 8021   A        STAA   PIA2AC
00136A E0A3 86 FF     A        LDAA   #$FP
00137A E0A5 B7 8022   A        STAA   PIA2BD    SETS P1A2B FOR OUTPUTS
00138A E0A8 86 04     A        LDAA   #$04
00139A E0AA B7 8023   A        STAA   PIA2BC    SETS DDR
00140A E0AD 8E 007F   A        LDS    #STACK    INZ STACK POINTER
00141A E0B0 0E                 CLI              CLEAR INTERRUPT FLAG
00142A E0B1 3E          EXEC   WAI
00143A E0B2 20 FD E0B1         BRA    EXEC
00144                   *
00145                   ***JUMP FROM IRQ VECTOR***
00146A E0B4 7D 8005   A POLL   TST    PIA1AC
00147A E0B7 2B 0E E0C7         BMI    POLL2     (MC1455 IRQ)
00148A E0B9 7D 8021   A        TST    PIA2AC
00149A E0BC 2B 6A E128         BMI    COMMR1    (KEYBOARD IRQ)
00150A E0BE 7D 0006   A        TST    BUFLAG
00151A E0C1 2B 03 E0C6         BMI    NOTRCV    (DATA IN BUFFER)
00152A E0C3 7E E1E9   A        JMP    REC
00153A E0C6 3B          NOTRCV RTI

00155                   ***TRANSMIT ROUTINE***
00156A E0C7 F6 8004   A POLL2  LDAB   PIA1AD
00157A E0CA F6 8006   A        LDAB   PIA1BD
00158A E0CD CA 02     A        ORAB   #2        XMIT LED ON
00159A E0CF C4 FB     A        ANDB   #$FB      REC LED OFF
00160A E0D1 F7 8006   A        STAB   PIA1BD
00161A E0D4 96 0A     A        LDAA   COSTA     GET CODE OUTPUT STATUS
00162A E0D6 2A 07 E0DF         BPL    CFDAH     CHECK FOR DAH
00163A E0D8 C6 7F     A        LDAB   #$7F
00164A E0DA D7 05     A        STAB   RESMSK    DIT RESET
00165A E0DC 5F          CES1   CLRB             DIT BEING SENT
00166A E0DD 20 29 E108         BRA    CKCNT     TEST COUNT
00167A E0DF 48          CFDAH  ASLA             TEST FOR DAB
00168A E0E0 2A 08 E0EA         BPL    CFES      CHECK FOR ELEMENT SPACE
00169A E0E2 C6 BF     A        LDAB   #$BF
00170A E0E4 D7 05     A        STAB   RESMSK    DAB RESET
00171A E0E6 C6 04     A        LDAB   #4        DAH BEING SENT
00172A E0E8 20 1E E108         BRA    CKCNT

00174A E0EA 48          CFES   ASLA             TEST FOR ELEMENT SPACE
00175A E0EB 2A 0A E0F7         BPL    CFWS      CHECK FOR WORD SPACE
00176A E0ED C6 DF     A        LDAB   #$DF
00177A E0EF D7 05     A        STAB   RESNSK    ELEMENT SPACE RESET
00178A E0F1 8D 2C E11F         BSR    SOZERO
00179A E0F3 C6 01     A        LDAB   #1
00180A E0F5 20 11 E108         BRA    CKCNT
```

gram permanently until it is desired to erase it. For a one-time shot, specify the plastic version. Much less expensive, but good only once. On the ceramic types, be sure to keep the adhesive paper over the quartz lid, as it might start to forget if exposed to ultraviolet light. The MC6802 processor contains an on-board clock generation circuit and 128 bytes of RAM. This RAM is used by the processor for temporary storage and for the 85-character keyboard buffer. You can type in up to 85 characters, sit back, and drink your coffee while the code dribbles out. Additional memory could be added—up to 65 thousand characters, and that's what I call a big buffer. With only a little more memory, canned messages could be inserted and held for a later call-up (before power is turned off)—CQs, tests, QTHs, for example. As the program is right now, only what is typed will be sent out.

Almost any crystal between 1 and 4 MHz can be used, so the old junk box can be used for some of the components. Look in an old color TV set—the 3.58-MHz crystal works well, too. Reset is provided by the resistor-capacitor combination automatically upon power-up conditions. If for any reason the computer does something strange or just quits, turn the power off and back on again. This will reset everything and start over. A note about the keyboard: The program is set up to recognize any keyboard that provides the ASCII code

```
E0F7 48          CFWS   ASLA
E0F8 2A 08 E102         BPL    CFCS      CHECK FOR SPACE
E0FA C6 EF     A        LDAB   #$EF
E0FC D7 05     A        STAB   RESMSK    WORD SPACE RESET
E0FE C6 08     A        LDAB   #8        WORD SPACE BEING SENT
E100 20 06 E108         BRA    CKCNT

E102 C6 F7     A CFCS   LDAB   #$F7
E104 D7 05     A        STAB   RESMSK
E106 C6 04     A        LDAB   #4
E108 D1 04     A CKCNT  CMPB   COUNT
E10A 27 06 E112         BEQ    CK1
E10C 7C 0004   A        INC    COUNT
E10F 7E E0B4   A RETRN  JMP    POLL

E112 7F 0004   A CK1    CLR    COUNT
E115 96 0A     A        LDAA   COSTA
E117 94 05     A        ANDA   RESMSK
E119 97 0A     A        STAA   COSTA
E11B 26 F2 E10F         BNE    RETRN
E11D 20 14 E133         BRA    GNEL

                 ***SEND OUT A ZERO***
E11F B6 8006   A SOZERO LDAA   PIA1BD
E122 84 FE     A        ANDA   #$FE
E124 B7 8006   A        STAA   PIA1BD
E127 39                 RTS
E128 20 64 E18E COMMR1  BRA    COMMR

                 ***SEND OUT A ONE***
E12A B6 8006   A SOONE  LDAA   PIA1BD
E12D 8A 01     A        ORAA   #1        SET BIT ZERO
E12F B7 8006   A        STAA   PIA1BD
E132 39                 RTS

                 ***GET NEW ELEMENT FOR OUTPUT***
E133 96 6D     A GNEL   LDAA   BUFTOP
E135 81 80     A        CMPA   #$80      TEST FOR CHAR END
E137 26 26 E15F         BNE    GNEL1
E139 86 08     A        LDAA   #$08      SEND OUT CHAR. SPACE
E13B 97 0A     A        STAA   COSTA
E13D 8D E0 E11F         BSR    SOZERO
E13F DE 02     A        LDX    SAVEX
E141 8C 006D   A        CPX    #BUFTOP
E144 26 09 E14F         BNE    GNELR
E146 96 06     A        LDAA   BUFLAG    BUFFER EMPTY
E148 84 7F     A        ANDA   #$7F
E14A 97 06     A        STAA   BUFLAG    RESET FLAG
E14C 7E E0B4   A        JMP    POLL
                 *
E14F 8D 2D E17E GNELR   BSR    MOVUP
E151 96 6D     A        LDAA   BUFTOP
E153 81 21     A        CMPA   #$21      LOOK FOR SPACE
E155 27 1A E171         BEQ    SWS
E157 7D 000A   A        TST    COSTA
E15A 27 03 E15F         BEQ    GNEL1
E15C 7E E0B4   A        JMP    POLL
                 *
E15F 78 006D   A GNEL1  ASL    BUFTOP
E162 25 04 E168         BCS    SODAH     SEND OUT DAH
E164 86 A0     A        LDAA   #$A0      SEND OUT DIT & ELEMENT SPA
E166 20 02 E16A         BRA    SOEL
                 *
E168 86 60     A SODAH  LDAA   #$60      SEND OUT DAH &ELEMENT SPAC
E16A 97 0A     A SOEL   STAA   COSTA     SET STATUS
E16C 8D BC E12A         BSR    SOONE
E16E 7E E0B4   A        JMP    POLL
                 *
E171 86 80     A SWS    LDAA   #$80
E173 97 6D     A        STAA   BUFTOP
E175 86 10     A        LDAA   #$10
E177 97 0A     A        STAA   COSTA     SEND OUT WORD SPACE
E179 8D A4 E11F         BSR    SOZERO
E17B 7E E0B4   A        JMP    POLL
                 *
E17E CE 0055   A MOVUP  LDX    #BUFTOP-BUFBOT
E181 A6 17     A MOV1   LDAA   BUFBOT-1,X
E183 A7 18     A        STAA   BUFBOT,X
E185 09                 DEX
E186 26 F9 E181         BNE    MOV1
E188 DE 02     A        LDX    SAVEX     UPDATE INPUT POINTER
E18A 08                 INX
E18B DF 02     A        STX    SAVEX
E18D 39          MOVRT  RTS

                 ***COMM REC INTERRUPT ROUTINE***
E18E DE 02     A COMMR  LDX    SAVEX
E190 B6 8020   A        LDAA   PIA2AD    GET KB DATA
E193 8C 0018   A        CPX    #BUFBOT
E196 27 49 E1E1         BEQ    BUFFUL    MEMORY BUFFER FULL
E198 81 5A     A        CMPA   #$5A
E19A 22 49 E1E5         BHI    BADCH     ILLEGAL CHAR
E19C 97 01     A STM    STAA   CVCX+1
E19E DE 00     A        LDX    CVCX
E1A0 E6 00     A        LDAB   0,X       DATA CONVERTED TO MORSE CO
E1A2 27 41 E1E5         BEQ    BADCH     KICK OUT BAD CHAR'S
E1A4 DE 02     A        LDX    SAVEX
E1A6 09                 DEX
E1A7 E7 00     A        STAB   0,X       STORE DATA IN BUFFER
E1A9 DF 02     A        STX    SAVEX     MOVE POINTER DOWN
E1AB D6 06     A        LDAB   BUFLAG
E1AD CA 80     A        ORAB   #$80      SET FLAG BIT 7
E1AF D7 06     A        STAB   BUFLAG
E1B1 8D 03 E1B6 PRNT    BSR    OUTCH     PRINT CHARACTER
E1B3 7E E0B4   A        JMP    POLL
                 ***PRINT CHARACTER ROUTINE***
E1B6 36          OUTCH  PSHA             SAVE LSB CHARACTER
E1B7 C6 C0     A        LDAB   #$C0
E1B9 CE 0009   A        LDX    #TMPSVE+2
E1BC A6 00     A        LDAA   0,X
E1BE 8D 10 E1D0 OUTCH1  BSR    STROBE
E1C0 09                 DEX
E1C1 A6 00     A        LDAA   0,X
E1C3 A7 01     A        STAA   1,X
E1C5 C0 40     A        SUBB   #$40
E1C7 26 F5 E1BE         BNE    OUTCH1
E1C9 32                 PULA
E1CA 84 3F     A        ANDA   #$3F      STRIPS BIT 6 AND 7
E1CC 97 07     A        STAA   TMPSVE
E1CE 20 00 E1D0         BRA    STROBE
E1D0 1B          STROBE ABA
E1D1 B7 8022   A        STAA   PIA2BD    WRITE INTO APPROPRIATE DIG
E1D4 86 34     A        LDAA   #$34      BIT 3 = 0
E1D6 B7 8023   A        STAA   PIA2BC    PULSES CB2 LOW
E1D9 86 3C     A        LDAA   #$3C      BIT 3 = 1
E1DB B7 8023   A        STAA   PIA2BC    AND BACK AGAIN FOR
E1DE 39                 RTS              WRITE PULSE
E1DF 20 AD E18E COMMR2  BRA    COMMR
                 *
E1E1 86 2A     A BUFFUL LDAA   #'*       PRINT '*' FOR BUFFER FULL
E1E3 20 CC E1B1         BRA    PRNT
                 *
                 *
E1E5 86 23     A BADCH  LDAA   #$23      PRINT '#' FOR BAD CHAR
E1E7 20 C8 E1B1         BRA    PRNT

                 ***START OF RECEIVE ROUTINE***
E1E9 B6 8006   A REC    LDAA   PIA1BD
E1EC 8A 04     A        ORAA   #4        REC LED ON
E1EE 84 FD     A        ANDA   #$FD      XMIT LED OFF
E1F0 B7 8006   A        STAA   PIA1BD
E1F3 86 FF     A KEYUP  LDAA   #$FF      RESET INTERVAL COUNTER
E1F5 81 FE     A KULOOP CMPA   #$FE      INTERVAL COUNTER AT MAX?
E1F7 27 03 E1FC         BEQ    NOINC     DO NOT INCR IF MAX
E1F9 4C                 INCA             INCREMENT INTERVAL COUNTER
E1FA 20 0A E206         BRA    KUCONT

E1FC 97 14     A NOINC  STAA   KUTIM     SAVE KU INTERVAL TIME
E1FE D6 0F     A        LDAB   RCHAR     GET RCVD CHAR
E200 C1 01     A        CMPB   #1        ANYTHING THERE?
E202 27 02 E206         BEQ    KUCONT
E204 8D 4C E252         BSR    COMPKU
E206 F6 8004   A KUCONT LDAB   PIA1AD    CHECK INPUT
E209 2B 09 E214         BMI    KD        BRANCH IF KEYDOWN
E20B 8D 36 E243         BSR    TIMER     TIME DELAY

E20D 7D 8021   A        TST    PIA2AC    TESTS BIT 7 TO SEE IF DATA
E210 2B CD E1DF         BMI    COMMR2    IF DATA THN XMIT
E212 20 E1 E1F5         BRA    KULOOP
E214 97 14     A KD     STAA   KUTIM     SAVE KU INTERVAL TIME
E216 8D 3A E252         BSR    COMPKU
E218 86 FF     A KEYDWM LDAA   #$FF      RESET INTERVAL TIMER
E21A 81 FE     A KDLOOP CMPA   #$FE      INTERVAL COUNTER AT MAX?
E21C 27 01 E21F         BEQ    MAXKD     DO NOT INCR IF MAX
E21E 4C                 INCA             INCREMENT INTERVAL COUNTER
E21F F6 8004   A MAXKD  LDAB   PIA1AD    CHECK INPUT
E222 2A 04 E228         BPL    KU        BRANCH IF KEYUP
E224 8D 1D E243         BSR    TIMER
E226 20 F2 E21A         BRA    KDLOOP

E228 97 13     A KU     STAA   KDTIM     SAVE KD INTERVAL TIME
E22A 81 04     A        CMPA   #$4       KD INTERVAL TIME TOO LOW?
E22C 24 05 E233         BCC    CKHI      BRANCH IF NOT TOO LOW
E22E 96 0E     A        LDAA   SPEEDK
E230 44                 LSRA             DIVIDE SPEED CONSTANT BY 2
E231 20 07 E23A         BRA    UNZERO

E233 81 7F     A CKHI   CMPA   #$7F      KD INTERVAL TIME TOO HIGH?
E235 25 07 E23E         BCS    CMPTKD    BRANCH IF OK
E237 96 0E     A        LDAA   SPEEDK
E239 48                 ASLA             MULTIPLY SPEED CONSTANT BY
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Continued

set and a negative-going strobe. There are many available from wholesale houses for $20.00 and up.

Key Characters Available

The computer will generate all of the Morse characters plus some special function keys which can be generated by the use of the CNTRL key. A list of them follows:

Control A	KN
B	BK
C	AR
D	SK
F	SN
H	ERROR (8 dots)
=	BT
ESC	AS
SPACE	SPACE

A "space" will insert a space in the buffer to be transmitted along with the code, thereby making perfect Morse every time. While typing, if you should reach the top of the buffer, the character you try to enter will be displayed as an *, meaning that it did not get entered and you should reenter it after one character has been sent.

Any illegal character typed will appear as a # and will not get sent. Any received character which the computer cannot figure out—like run-together characters—will be displayed as an __, and an error (8 dots) will be an @.

Parts Procurement

All parts (with the exception of the DL-1416) can be obtained from your local Motorola distributor, and the 1416 comes from a Litronix distributor. All of the parts should tally to

```
00363A E23A 8A 01     A UNZERO ORAA    #1        ASCERTAIN SPEED CONSTANT I
00364A E23C 97 0E     A        STAA    SPEEDK    NOT SET TO ZERO
00365A E23E 8D 31 E271 CMPTKD  BSR     COMPKD
00366A E240 7E E1F3   A        JMP     KEYUP

00368                   ***SUBROUTINE TO CREATE TIME DELAY***
00369A E243 37          TIMER  PSHB              SAVE B
00370A E244 36                 PSHA              SAVE A
00371A E245 D6 0E     A        LDAB    SPEEDK
00372A E247 86 40     A DELOP2 LDAA    #$40
00373A E249 4A          DELOOP DECA
00374A E24A 26 FD E249         BNE     DELOOP
00375A E24C 5A                 DECB
00376A E24D 26 F8 E247         BNE     DELOP2
00377A E24F 32                 PULA              RESTORE A
00378A E250 33                 PULB              RESTORE B
00379A E251 39                 RTS

00381                   ***SUBROUTINE TO COMPUTE KU***
00382A E252 91 11     A COMPKU CMPA    TQLDAT
00383A E254 25 1A E270         BCS     MOREL     BRANCH IF KUTIM ^ TQLDAT
00384A E256 96 0F     A        LDAA    RCHAR     GET CHAR BEING RECEIVED
00385A E258 81 01     A        CMPA    #1
00386A E25A 27 09 E265         BEQ     CKFSP
00387A E25C 8D 4A E2A8         BSR     GAFT      GET ASCII FROM TABLE
00388A E25E BD E1B6   A        JSR     OUTCH     PRINT CHARACTER IN ACCA
00389A E261 86 01     A        LDAA    #1
00390A E263 97 0F     A        STAA    RCHAR     READY FOR NEW CHAR
00391A E265 96 12     A CKFSP  LDAA    TLDAT     GET TWICE LAST DASH TIME
00392A E267 91 14     A        CMPA    KUTIM     COMPARE WITH KU INTERVAL
00393A E269 24 05 E270         BCC     MOREL     BRANCH IF TLDAT "= KU INTE
00394A E26B 86 20     A        LDAA    #$20      ASCII SPACE
00395A E26D BD E1B6   A        JSR     OUTCH     PRINT SPACE
00396A E270 39          MOREL  RTS

00398                   ***SUBROUTINE TO COMPUTE KD***
00399A E271 96 0D     A COMPKD LDAA    TLETIM    GET TWICE LAST ELEM TIME
00400A E273 91 13     A        CMPA    KDTIM     COMPARE WITH KD INTERVAL
00401A E275 25 10 E287         BCS     DASHEL    BRANCH IP TLETIM ^ KD INTE
00402A E277 96 0C     A        LDAA    HLETIM    GET HALF LAST ELEM TIME
00403A E279 91 13     A        CMPA    KDTIM     COMPARE WITH KD INTERVAL
00404A E27B 24 04 E281         BCC     DOTEL     BRANCH IF HLETIM "= KD INT
00405A E27D 96 0B     A        LDAA    LETYPE    CHECK LAST ELEMENT TYPE
00406A E27F 26 06 E287         BNE     DASHEL    BRANCH IF LAST ELEM WAS DA
00407A E281 7F 000B   A DOTEL  CLR     LETYPE    MAKE LAST ELEM TYPE=00=DOT
00408A E284 0C                 CLC
00409A E285 20 14 E29B         BRA     ADDEL
00410A E287 7C 000B   A DASHEL INC     LETYPE    MAKE LAST ELEM TYPE=DASH
00411A E28A 96 13     A        LDAA    KDTIM     GET KD INTERVAL
00412A E28C 97 10     A        STAA    LDATIM    STORE IN LAST DASH TIME
00413A E28E 16                 TAB               SAVE IN ACCUM B
00414A E28F 44                 LSRA              DIVIDE KD INTERVAL BY 2
00415A E290 97 11     A        STAA    TQLDAT    SAVE 1/2 KD
00416A E292 44                 LSRA              DIVIDE 1/2 KD BY 2
00417A E293 9B 11     A        ADDA    TQLDAT    ADD 1/2 TO 1/4 KD INTERVAL
00418A E295 97 11     A        STAA    TQLDAT    STORE RESULT
00419A E297 58                 ASLB              MULTIPLY KD INTERVAL BY 2
00420A E298 D7 12     A        STAB    TLDAT     STORE RESULT
00421A E29A 0D                 SEC
00422A E29B 79 000F   A ADDEL  ROL     RCHAR     ADD NEW ELEM TO CHARACTER
00423A E29E 96 13     A        LDAA    KDTIM     GET KD INTERVAL
00424A E2A0 16                 TAB               SAVE IN ACCUM B
00425A E2A1 44                 LSRA              DIVIDE KD BY 2
00426A E2A2 97 0C     A        STAA    HLETIM    STORE 1/2 KD INTERVAL
00427A E2A4 58                 ASLB              MULTIPLY KD BY 2
00428A E2A5 D7 0D     A        STAB    TLETIM    STORE TWICE KD INTERVAL
00429A E2A7 39                 RTS

00431                   ***SUBR. TO GET ASCII CHAR FROM CODE TABLE***
00432A E2A8 0D          GAFT   SEC               CHANGE FORMAT OF RCHAR.
00433A E2A9 49                 ROLA
00434A E2AA 48          GAFT1  ASLA
00435A E2AB 24 FD E2AA         BCC     GAFT1
00436A E2AD CE E05A   A        LDX     #RESRT-1
00437A E2B0 A1 00     A STAB1  CMPA    0,X
00438A E2B2 27 09 E2BD         BEQ     TABM      FOUND MATCH
00439A E2B4 09                 DEX
00440A E2B5 8C E021   A        CPX     #RTAB+1   END OF TABLE?
00441A E2B8 26 F6 E2B0         BNE     STAB1     NO!
00442A E2BA 86 5F     A        LDAA    #'_       RETURN "_" FOR NO MATCH
00443A E2BC 39                 RTS
00444                   *
00445A E2BD DF 16     A TABM   STX     RECX
00446A E2BF 96 17     A        LDAA    RECX+1    X(LOW) TO ACCA.
00447A E2C1 39                 RTS

00449                   ***INITIALIZATION AND RESTART VECTORS***

00451A E3F8                    ORG     CODE+$3F8
00452A E3F8    E0B4   A        FDB     POLL      IRQ
00453A E3FA    E05B   A        FDB     RESRT     SWI
00454A E3FC    E05B   A        FDB     RESRT     NMI
00455A E3FE    E05B   A        FDB     RESRT     RESET
00456                          END
TOTAL ERRORS 00000
```

```
E29B ADDEL  00409 00422*
E1E5 BADCH  00273 00277 00315*
0018 BUFBOT 00059*00257 00258 00259 00270
E1E1 BUFFUL 00271 00311*
0006 BUFLAG 00042*00150 00227 00229 00282 00284
006D BUFTOP 00060*00115 00119 00218 00225 00233 00240 00251 00257
E0DC CES1   00165*
E102 CFCS   00183 00189*
E0DF CFDAH  00162 00167*
E0EA CFES   00168 00174*
E0F7 CFWS   00175 00182*
0015 CHCTR  00057*
E112 CK1    00193 00197*
E108 CKCNT  00166 00172 00180 00187 00192*
E265 CKFSP  00386 00391*
E233 CKHI   00354 00359*
E23E CMPTKD 00360 00365*
E000 CODE   00081*00117 00451
E18E COMMR  00209 00268*00309
E128 COMMR1 00149 00209*
E1DF COMMR2 00309*00339
E271 COMPKD 00365 00399*
E252 COMPKU 00333 00342 00382*
000A COSTA  00044*00161 00198 00200 00222 00236 00246 00253
0004 COUNT  00040*00192 00194 00197
0000 CVCX   00038*00118 00274 00275
E287 DASHEL 00401 00406 00410*
E249 DELOOP 00373*00374
E247 DELOP2 00372*00376
E281 DOTEL  00404 00407*
E0B1 EXEC   00142*00143
E2A8 GAFT   00387 00432*
E2AA GAFT1  00434*00435
E133 GNEL   00202 00218*
E15F GNEL1  00220 00237 00240*
E14F GNELR  00226 00232*
000C HLETIM 00048*00402 00426
FFF8 IRQVEC 00077*00122
E214 KD     00335 00341*
E21A KDLOOP 00344*00350
0013 KDTIM  00055*00352 00400 00403 00411 00423
E218 KEYDWN 00343*
E1F3 KEYUP  00323*00366
E228 KU     00348 00352*
E206 KUCONT 00327 00332 00334*
E1F5 KULOOP 00324*00340
0014 KUTIM  00056*00329 00341 00392
E05E L1     00106*00108
0010 LDATIM 00052*00412
000B LETYPE 00047*00405 00407 00410
E21F MAXKD  00345 00347*
E270 MOREL  00383 00393 00396*
E181 MOV1   00258*00261
E18D MOVRT  00265*
E17E MOVUP  00232 00257*
E1FC NOINC  00325 00329*
E0C6 NOTRCV 00151 00153*
E1B6 OUTCH  00285 00288*00388 00395
E1BE OUTCH1 00292*00297
8005 PIA1AC 00065*00146
8004 PIA1AD 00064*00123 00156 00334 00347
8007 PIA1BC 00067*
8006 PIA1BD 00066*00157 00160 00205 00207 00212 00214 00319 00322
8021 PIA2AC 00072*00135 00148 00338
8020 PIA2AD 00071*00133 00269
8023 PIA2BC 00074*00139 00305 00307
8022 PIA2BD 00073*00137 00303
E0B4 POLL   00121 00146*00195 00230 00238 00248 00255 00286 00452
E0C7 POLL2  00147 00156*
E1B1 PRNT   00285*00312 00316
000F RCHAR  00051*00330 00384 00390 00422
E1E9 REC    00152 00319*
0016 RECX   00058*00445 00446
0005 RESMSK 00041*00164 00170 00177 00185 00190 00199
E05B RESRT  00105*00436 00453 00454 00455
E10F RETRN  00195*00201
E020 RTAB   00088*00440
0002 SAVEX  00039*00120 00224 00262 00264 00268 00278 00281
E168 SODAH  00241 00245*
E16A SOEL   00243 00246*
E12A SOONE  00212*00247
E11F SOZERO 00178 00205*00223 00254
000E SPEEDK 00050*00113 00355 00361 00364 00371
E2B0 STAB1  00437*00441
007F STACK  00076*00140
E19C STM    00274*
E1D0 STROBE 00292 00301 00302*
E171 SWS    00235 00250*
E2BD TABM   00438 00445*
E243 TIMER  00336 00349 00369*
0012 TLDAT  00054*00391 00420
000D TLETIM 00049*00399 00428
0007 TMPSVE 00043*00110 00111 00290 00300
0011 TQLDAT 00053*00382 00415 00417 00418
E23A UNZERO 00357 00363*
```

less than $80-$90, including the display, which is $30 in quantities of one.

Operation

Operation of the reader-talker is quite simple. Hook up the required power supplies, the cords to the speaker and key jacks, and go to town. The easiest way to tune in a signal is to use the on-board headphone jack and set the selectivity to 40 Hz. When you hear the signal, watch the LED, and when it starts to blink at the incoming CW rate, switch the filter to the processed mode and tune for the cleanest signal. An RIT control is almost a must as the input tuning is quite sharp, and if you tune the other guy for the best signal each time he gives it back to you, you could walk right up or down the band!

The only drawback I have found is that when copying at fast speeds, the display will run words together, since most operators do not leave enough space between them. I understand that most of the keyboard keyers do not have a space key on them, and this will explain some of the problems. The others are self-explanatory. As I said earlier, the lack of more digits on the board is not a hindrance, and after you use it a while, you'll agree. Whether you use a PC board or wire-wrap this project, it will be a great addition to any ham shack and do a lot for cleaning up the airways.■

Microcomputers and Your Satellite Station

—part 1: calculating orbital crossing data

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In case you haven't noticed, microcomputers have really begun to come of age. Units such as the Radio Shack TRS-80 are available with built-in BASIC language (in ROM) and a reasonable amount of RAM workspace. The availability of such machines, with capability for later expansion, has shifted the emphasis from small computers as an engaging hobby to their real utility as data processing terminals in science, business, and a number of other areas of application. I purchased a TRS-80 computer to handle a number of important jobs in my research lab, with an eye toward its possibilities in my weather satellite operation as well. I have been completely happy with the computer and have been working up innumerable programs, some of which involve the satellite operation.

There is little doubt that one of the most tedious tasks facing satellite station operators is keeping track of equatorial crossing data for polar orbiting spacecraft. Such information is absolutely essential in generating tracking data for the OSCAR communications satellites and the various polar orbiting weather satellites. There are several ways to keep track of this information. The most direct procedure is to monitor the W1AW bulletins on a daily basis to get reference orbit data for the next day. This is time-consuming and still requires that you calculate crossing dates for passes not covered with the reference orbit data. You can get similar reference orbit data from the various magazines, AMSAT bulletins, and other sources, but again you often are faced with calculating crossings for additional passes, since most of these sources list only one or two reference crossings for a given day.

My usual situation is that I will decide on short notice that I want to copy a few weather satellite passes. I then will root around looking for some old crossing data, usually finding something up to several weeks old written on the back of a matchbook cover or something equally pretentious! I then sit down and quickly project the data with the pocket calculator (something that usually is anything but quick), only to discover that I have just missed the best pass or that I have made an error and none of the carefully-generated numbers means anything for that particular day.

One of my first programming tasks when I had the TRS-80 on line, was to develop a program to provide orbital crossing data, given information on any single reference crossing. This program is shown in Fig. 1. The program is written in Radio Shack Level I BASIC and incorporates the various abbreviations that are possible with that dialect—P for PRINT, for example. With minimal work, the program could be modified to run in almost any of the small BASIC dialects. As written, the program occupies 2062 bytes of memory and fits comfortably within the 4K capacity of the most inexpensive member of the TRS-80 family. Even with modifications to run on another system, it is safe to say that the program easily could be accommodated in 4K of memory and thus be usable on virtually all small systems.

Let's look at the use of

the program, and then we can consider some highlights of the program structure for those of you who can't resist making modifications.

Using the Program

You can load the program at the keyboard using Fig. 1 and then save it on cassette for later use after debugging the inevitable typos! Once the program is loaded, simply enter RUN (R), and the display should show the program ID header (ah, vanity!) and request the name of the spacecraft. Here, you simply enter the name of the bird you are tracking. Let's take a fictitious example and enter NOAA 6. It then will request the orbital period in minutes. You should use the most accurate figure you can obtain for the period as this and the number of significant figures the machine can handle are the primary limitations in the accuracy of long-term predictions. For the sake of example, let's enter a period of 115.16 minutes.

The computer then will print:

ENTER MONTH, DAY, YEAR OF REFERENCE CROSSING:
?

Each part of this data must be entered separately. For example, if the date of the reference crossing is 1/23/78, you would perform the following input operations:

1 ENTER
23 ENTER
78 ENTER

The machine will ask for the reference orbit number. This tells us the number of orbits since initial insertion and is handy for making long-distance OSCAR schedules (both stations can be assured that they are using the satellite during the proper pass) and for cataloging satellite pictures in the case of the weather birds. If you don't care about orbit numbers, simply enter 0. If you use them, then simply enter the number of your reference orbit. Let's say, for the sake of our example, that the reference orbit number is 7248—we would enter that number when requested.

The computer now will request the hours, minutes, and seconds of the reference crossing. Like the date, these items are entered separately and in sequence. If the crossing is at 20:15:48, we would enter 20, enter 15, and enter 48. A note here: If the reference data are GMT times and dates, the printout will be so referenced. If you want printout in local times and date, make the appropriate conversions in the reference data prior to entry.

The computer now will ask for the crossing point in degrees W. If your reference data has a crossing in degrees E longitude, convert this to degrees W using the formula:

```
1   CLS
10  P."ORBITAL CROSSING PROGRAM"
15  P."BY DR. RALPH E. TAGGART"
20  P.
25  IN."WHAT IS THE NAME OF THE SPACECRAFT";A$
30  CLS:IN."ENTER THE ORBITAL PERIOD (IN MINUTES)";P:CLS
35  P."ENTER MONTH, DAY, AND YEAR OF REFERENCE CROSSING"
40  IN.L:IN.J:IN.K:GOSUB 900:D=W:Z=W:CLS
45 IN."REFERENCE ORBIT NUMBER";N:X=N:CLS
50  P."ENTER HR., MIN., SEC. OF REFERENCE CROSSING"
55  IN.H:IN.M:IN.S:A=(60*H)+M+(S/60):G=A:CLS
60  IN."REFERENCE CROSSING POINT (DEG W)";C:Y=C:CLS
65  P."ENTER MONTH, DAY, YEAR FOR DISPLAY"
70  IN.L:IN.J:IN.Q:GOSUB 900:T=W:CLS
75  IF (Q<K)+(T<D) THEN GOSUB 930:GOTO 65
80  IF Q=K+1 THEN T=365+T
85  IF T>D+5 THEN 500
90  GOSUB 940
100 A=A+P:N=N+1
110 IF A>1440 THEN A=A-1440
120 C=((P/1440)*360)+C
130 IF C>360 THEN C=C-360
140 IF D=T THEN 200
150 IF D>T THEN 300
160 GOTO 100
200 H=INT(A/60)
210 M=INT(A-(H*60))
220 S=A-((H*60)+M):S=INT(S*60)
230 E=C+.05:E=INT(E*10)/10
240 P.N,H;":";M;":";S,E
250 GOTO 100
300 IN."DO YOU WANT ANOTHER DAY'S DATA (Y=1 N=0)";R
310 IF R=0 THEN 400
320 P."ENTER MONTH, DAY, YEAR FOR DISPLAY"
330 IN.L:IN.J:IN.Q:GOSUB 900:T=W:CLS
340 IF (Q<K)+(T<Z) THEN GOSUB 930:GOTO 300
350 IF Q=K+1 THEN T=356+T
360 IF T=D-1 THEN GOSUB 950:GOTO 300
370 IF T=D THEN GOSUB 940:GOTO 200
380 IF T>D+5 THEN 500
385 IF D>T THEN D=Z:A=G:C=Y:N=X:GOTO 75
390 GOSUB 940:GOTO 100
400 CLS:IN."ANOTHER SPACECRAFT";R
410 IF R=1 THEN CLS:GOTO 25
420 END
500 D=Z:A=G:C=Y:N=X
505 B=(T-1)-D:I=1440*B:B=INT(I/P)+1
510 A=(B*P)-I
520 V=B*((P/1440)*360):U=INT(V/360):C=V-(U*360)
530 D=T-1:N=N+B
540 GOSUB 940:GOTO 100
899 END
900 W=0
901 IF L=1 THEN W=J:RET.
902 IF L=2 THEN W=31+J:RET.
903 IF L=3 THEN W=59+J:RET.
904 IF L=4 THEN W=90+J:RET.
905 IF L=5 THEN W=120+J:RET.
906 IF L=6 THEN W=151+J:RET.
907 IF L=7 THEN W=181+J:RET.
908 IF L=8 THEN W=212+J:RET.
909 IF L=9 THEN W=243+J:RET.
910 IF L=10 THEN W=273+J:RET.
911 IF L=11 THEN W=304+J:RET.
912 IF L=12 THEN W=334+J:RET.
930 P."SORRY - PROGRAM DOES NOT COMPUTE DATA"
931 P."PRIOR TO REFERENCE CROSSING":RET.
940 CLS:P."DATE ";L:"/";J;"/";Q;"  ";A$
941 P."ORBIT","TIME","DEGREES W":RET.
950 CLS:P."YOU JUST PRINTED DATA FOR ";L;"/";J;"/";Q
951 RET.
999 END
```

Fig. 1. TRS-80 program for computation of satellite equatorial crossings. Given a single reference crossing, the program permits the computer to display crossings for any subsequent day for a period of up to two years from the date of the reference crossing.

```
DATE:  1/24/78     NOAA 6
ORBIT            TIME           DEGREES W
 725Ø             Ø:6:7           157.8
 7251             2:1:16          186.6
 7252             3:56:26         215.4
 7253             5:51:35         244.2
 7254             7:46:45         273
 7255             9:41:55         3Ø1.8
 7256             11:37:4         33Ø.5
 7257             13:32:14        359.3
 7258             15:27:23        28.1
 7259             17:22:33        56.9
 726Ø             19:17:43        85.7
 7261             21:12:52        114.5
 7262             23:8:2          143.3
DO YOU WANT ANOTHER DAYS DATA (Y=1 N=Ø)?
```

Fig. 2. Sample printout for 1/24/78, given a reference crossing for NOAA 6 on 1/23/78 at 20:15:48, crossing the equator at 100.23° W (assuming a period of 115.16 minutes).

Numeric Variables

A	The current crossing time in minutes.
B	Scratchpad variable in the 500 block routines.
C	The current crossing point (degrees W).
D	The current numerical day.
E	Rounded value for the crossing point used for display.
F	Not used.
G	Not used.
H	Hours—used for input and display.
I	Scratchpad variable in the 500 block routines.
J	Day of the month (used for input).
K	Year of the reference crossing date.
L	Month of the year (used for input).
M	Minutes—used for input and display.
N	Current orbit number.
O	Not used.
P	The orbital period.
Q	The year of the display date.
R	Interactive question replies.
S	Seconds—used for input and display.
T	Display day number.
U	Scratchpad variable in the 500 block routines.
V	Scratchpad variable in the 500 block routines.
W	Output value from the date conversion subroutine.
X	Orbit number for the reference crossing.
Y	Reference orbit crossing point (degrees W).
Z	Day number of the reference crossing.

String Variables

A$	The name of the spacecraft.
B$	Not used.

Fig. 3. Variable assignments in the orbital crossing program.

Longitude (°W) = 360 − (Longitude °E).

Let us assume a crossing point of 100.23° W and enter it. The computer will ask for the month, day, and year for display. This is entered in three parts, as before. Let's take the next day—1/24/78—and enter 1, then 24, and then 78. Quick as a wink the computer will print out the display shown in Fig. 2, showing *all* of the passes for 1/24/78.

It certainly beats messing with the calculator, doesn't it? Note that you are not necessarily finished, for at the bottom of the listing you are asked if you want another day's printout. If you do, simply enter 1 and the computer will request the new date. Just for the fun of it, enter 12/31/78—a projection of almost a year! Notice that for all intents and purposes you get the readout right away, regardless of the length of the projection. The program will handle dates up to one full year beyond the year of the reference crossing, to handle the cross-year transition. You can demonstrate this by requesting a printout for any date in 1979. Remember, however, that although the machine will crunch the numbers for you, the period must be known with some precision for long-term projections!

The program also permits you to back up in time. Try entering a date of 1/23/78 for example. The computer will print out the single orbit (number 7249) that will start on the day of the reference crossing. For the sake of your own edification, you might type in a date prior to the reference crossing. The computer will politely inform you that it won't respond to that and will give you a chance to request another date!

OK—enough with imaginary data. Enter 0 when you are asked if you want another day's data (NO = 0). The computer will ask if you want another spacecraft. Enter 1 (YES) and plug in some actual crossing information as requested, and you will be off and running with real data.

Program Notes

The following is not an exhaustive analysis of the program structure, but does provide sufficient information for you to dive into the program—in company with your Level I BASIC user's manual—if you are interested in how it works.

With a few exceptions, lines 1-65 are devoted to interactive data input. A few mathematical operations are included here to convert data from a convenient-form-for-user input to a convenient-form-for-machine processing. One example is line 50, where you input data on the hour (H), minute (M), and seconds (S) for the reference crossing. It is most convenient in terms of orbital calculations to keep track of the current crossing time in total minutes (A). The mathematical routines in the remainder of line 50 simply convert the time to total minutes.

A similar situation is encountered in line 35, where you input the month (L), day (J), and year (K) of the reference crossing. The month and day are converted to the day of the year using the subroutine that runs from line 900 to 912. A numerical day of the year is far more convenient than attempting to keep track of days of a certain month. A similar situation exists in line 70, where the identical conversion is made for the desired day for printout.

Line 75 checks to ensure that the requested date is actually on or after the date of the reference crossing, while line 80 updates the desired display day number (T) if the year of the display date (Q) is the year following the year for the reference crossing date (K).

Line 85 requires some additional explanation. The basic approach to computing orbital data is iterative, in that the orbital period is simply added to the time of the last orbit to determine the time of the next crossing, with a similar approach taken for the crossing point. If we are projecting forward in time beyond a few days, this requires an increasingly greater interval for the computer to repeat these calculations again and again until it arrives at the day for printout. If the desired day for printout is more than 5 days beyond the reference cross-

ing day, line 85 bypasses the iterative mode (which begins with line 100) and jumps to a moderately-complicated mathematical routine in lines 500 through 540 that will quickly derive data for an arbitrary single orbit on the day prior to the day requested. Once this has been done, the machine jumps back to line 100 to begin the iterative calculations leading up to the first orbit of the desired day.

You could leave out 85 and the routines in the 500 block, but if you did, you would require lots of time for long-term projections. With the program as written, for example, a one-month projection requires just two seconds to start cranking out data. This two-second delay is all that is required for any projection beyond reference day +5. If we eliminate 85 so that we don't use the routines in the 500 block, a one-month projection would require about 30 seconds to initiate printout, and a one-year projection would require six *minutes* to initiate printout. The iterative approach is the surest way to avoid missing an orbit, but does take time over a long haul.

The iterative sequence is fairly straightforward. Line 100 adds the period to the previous time to get the new time and also updates the orbit number by 1. Line 110 checks the new time against 1440—the total minutes in a day—and, if required, corrects the time to the new day and updates the current day number (D). Line 120 computes the increment of longitude for a single orbit and adds this to the last crossing point to derive the crossing point for the new orbit.

Line 130 compares this value with 360 degrees and corrects it if required. Lines 100 through 130 thus generate the data for a new orbit; lines 140 through 160 simply compare the current orbit day (D) with the day for display (T). If D is smaller than T, we haven't arrived yet, and the computer shuffles back to 100 to compute data for the next orbit. If D is larger than T, we have gone through all the orbits of interest and we are shuffled off to 300 for additional display options. If, however, D=T, we want to display the data and thus move along to the display routines in the 200 block.

Lines 200 through 220 convert the orbital crossing time in minutes back to hours (H), minutes (M), and seconds (S) for display. Line 230 rounds out the crossing point to one decimal place (to make a more pleasing display), and then 240 prints out the data. Line 250 then sends the computer back to the iterative routine to compute the next orbit. These display routines will be repeated as long as the orbits fall on the target day, after which it quits and goes to the 300 block to give you the option of another day. If you take the option, the date for the new day is processed and checked, just as it was at the beginning.

There are a few new wrinkles, however. Line 370 is a special routing designed to avoid missing the first orbit when the new day is the one immediately following the day for which you have displayed data. Line 360 takes care of the situation in which you inadvertently ask for a new day which is identical with the day for which you have just received data, and 385 catches situations where we must backtrack. If D is larger than the new day you request (T), it means that we must backtrack in our calculations—a clumsy process. The easiest approach is simply to reassign the reference crossing values to the orbit number (N), time (A), crossing point (C), and day (D), and start over again—something accomplished in 385.

```
21    IN. "REFERENCE ORBIT DATA ON FILE (Y=1 N=0)"; R
22    CLS: IF R=1 THEN 600
600   A$=... insert name of spacecraft
610   P=... insert orbital period in minutes
620   L=... insert reference month
621   J=... insert reference day
622   K=... insert reference year
623   GOSUB 900: D=W: Z=W:
630   N=... insert reference orbit number
640   H=... insert reference orbit hour
641   M=... insert reference orbit minute
642   S=... insert reference orbit seconds
643   A=(60*H)+M+(S/60) : G=A
650   C=... insert reference crossing point (degrees W)
651   Y=C
660   GOTO 65
```

Fig. 4. Program modifications for repeated use of data for a single reference crossing. Depending upon the accuracy of the period (P), the data in lines 620-622, 630-642, and 650 should be updated every few weeks or months with new crossing data to maintain accuracy. If you update for a new satellite, you should then change the data in lines 600 and 610 as well. Be sure to save the modified program on cassette so that you don't lose the reference data.

The 900 block is devoted to subroutines, including conversions of dates to numerical days of the year and various printing routines. As a guide to understanding the program or making creative modifications, Fig. 3 is provided to summarize the variable assignments used in the program.

Program Modifications

Aside from inspirations that may come to you, there are two major modifications that you may find desirable to make at one time or another. The program as written does not accommodate leap years (29 days in February as opposed to the normal 28). For use during a leap year, each number in lines 903 through 912 should be increased by 1. Thus, for example, line 906 would read:

906 IF L=6 THEN W=152+J: RET.

Another modification is useful if you will be working primarily with just a single satellite. If you know the period with some precision, you may want to work with a single reference crossing over a period of weeks or months and avoid the hassle of inputting reference data at the start of a run. Fig. 4 shows the additions required to accomplish this. Be sure, however, to dump the modified version back on to cassette so that you don't lose the reference data.

Summary

Over a period of years, I have tended to concentrate on the geostationary weather satellites primarily, to avoid the orbit-computation hassle associated with polar orbiters. This program was developed to minimize the strain of dealing with the new TIROS N satellite that became operational in 1978. The program is so useful that I could probably justify the purchase of the TRS-80 for that alone. The beauty of a computer, of course, is that it is a general-purpose problem-solving machine, and need not be limited to any one task.

Part II of this mini-series will demonstrate how to use the TRS-80 to calculate antenna bearings for geostationary spacecraft. Why not try a microcomputer? Even if you hate computers, you soon will wonder how you ever got along without one! ■

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A Brasspounder Improves Heath's HR-1680

—add a crystal CW filter, bfo, noise blanker, and more

The Heathkit® HR-1680 is a distinct rarity: a ham-bands-only receiver in kit form for a tad more than $200. It is a fine piece of equipment and is almost the answer for a low-budget station. Why almost? Low budget usually means CW using a home-brew or swap-meet-special transmitter and low power at that. The SSB capabilities of the HR-1680 are good, but CW is sort of tacked on. What the HR-1680 needs is a narrow CW filter, and a bfo placed correctly for CW operation, and maybe even a noise blanker. It so happens that Heath makes these items for other products in their line, and for a reasonable price.

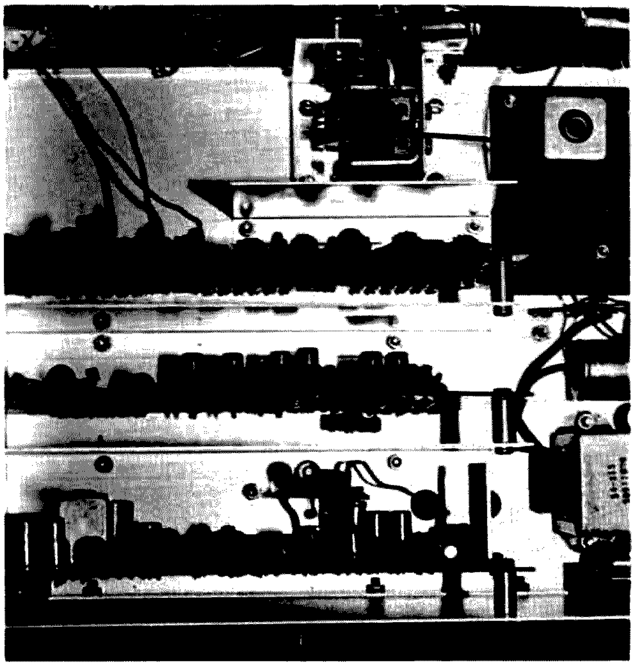

Photo A. Top interior view of the HR-1680 shows the new bfo board (near middle of bottom board) and new connecting wire to pilot lamps (upper right).

I hate modifications that wreck the appearance of a piece of gear and reduce its resale value to zero. Many modifications not only prove to be far less useful than the author promises, but unfortunately, irreversible. This article describes how to add a crystal CW filter, bfo, noise blanker, and a couple of other worthwhile modifications to your HR-1680 without having to attack the set with drills, saws, and other sharp instruments. All modifications are reversible, require a minimum of rewiring, and the drilling of one little hole on one circuit board. Purists can attach the bfo board to the AUD/REG board with silastic rubber.

Modifications

The modifications will be presented in the following order:
1) changing the dial lamps to reduce voltage regulator heating; and to a type more readily available.
2) modification of the spinner knob for 1-kHz resolution;
3) addition of an SBA-301-2, 400-Hz crystal filter;
4) addition of a separate bfo for CW; and
5) addition of an SB-104-1, noise blanker.

The crystal filter and noise blanker are housed in a small utility cabinet (Radio Shack 270-253 is an ideal size), or they could be fitted into the HR-1681 speaker cabinet if desired. The bfo board is attached to the HR-1680's AUD/REG PCB. Total cost of all mods should be about $75.

Pilot Lamps

At this writing, I have been using my HR-1680 for over two years without any component failures, and this mod may be due in part to something that annoyed me no end when I discovered it. The pilot lamps in the HR-1680 operate from the regulated supply. This represents two Watts of unnecessary power for the regulator series pass transistor (Q201) to handle, and causes its heat sink to reach to over 100°C after only a few minutes of operation. Besides, nobody seems to stock type 1813 bulbs.

The solution is simple: Disconnect the red wire supplying 13.8 volts to the

pilot lamps. Run a new wire across the top of the chassis and connect it to the junction of D1, D2, and C2 at one end and the lamp sockets at the other. Arch the wire up and over and avoid getting it too close to the vfo (see Photo A). Remove the two type 1813 bulbs and replace them with type 1819 bulbs (28 volts, 40 mA). The new lamps will provide just about the same amount of light, you will save 120 mA of total current, and the regulator will now operate at a reasonable temperature even when we borrow 50 mA to operate the crystal filter amplifier and the noise blanker.

A small drawback exists with this modification: The lamps won't light when external power is used. If you use external power very often, you might want to install some sort of switching arrangement. My feeling is that if you are really on emergency power, can you afford those wasted Watts? Buy a flashlight.

Spinner Dial

Another thing that bothered me about the HR-1680 was the dial calibration. When the vfo is properly adjusted, the HR-1680's dial is reasonably linear, but there are calibration marks only at every five kHz. It seemed that the spinner knob could be inscribed to give at least one-kHz markers. I spent about a week of fooling around and gluing pieces of cardboard to the spinner. To spare you the cussin', I found that each revolution of the spinner was equivalent to 15.625 kHz or 23.04 degrees of arc per kHz. It does not take a mathematician to see that there is no way to calibrate the spinner in a whole number of one-kHz increments. After spending all that time, I was not about to give up. I removed the skirt from the spinner and glued a thin flat plate (a 3½-inch diameter dial plate from an old stereo receiver) to the back side of the spinner knob. I then scribed lines on the plate to make pies of 23.04 degrees, and when I ran out of plate, I stopped. I then filled the scribed lines with black ink and coated the plate with clear nail polish (acrylic spray made the ink run). Now the spinner is calibrated in one kHz increments with one .625-kHz increment left over. The construction sounds terrible, but it works fine. See Photo B.

Photo B. Front view of modified HR-1680 (with completed filter-blanker on top) shows details of modified spinner knob.

Crystal Filter and Amplifier

Anyone who has ever operated CW must surely have desired "single-signal reception." The audio filter of the HR-1680 does not have anything like the needed selectivity. I feel sure that the people at Heath know this, but they had to keep the price down. Heath makes two 400-Hz filters, the SBA-301-2 and the newer SBA-401-1. As far as I can determine, the filters are

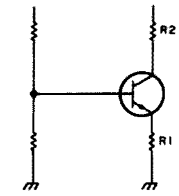

Fig. 2. In a common-emitter bipolar amplifier, the voltage gain of a stage with an un-bypassed emitter resistor is approximately the ratio of the collector resistor to the emitter resistor: Gain ≈ R2/R1. This relationship holds over one or two decades (sometimes more) assuming that the gain of the transistor is adequate for the bandwidth of interest. As an example, consider a phase-splitter circuit where R1 = R2 and the gain is unity. In the amplifier used in this article, R1 = 470 Ohms and R2 = 2200 Ohms. R2/R1 = 2200/470 = 4.68 or 4.68 x 20 log 10 = .670 x 20 = 13.4 dB. Naturally, when 10% components are used the approximation suffers.

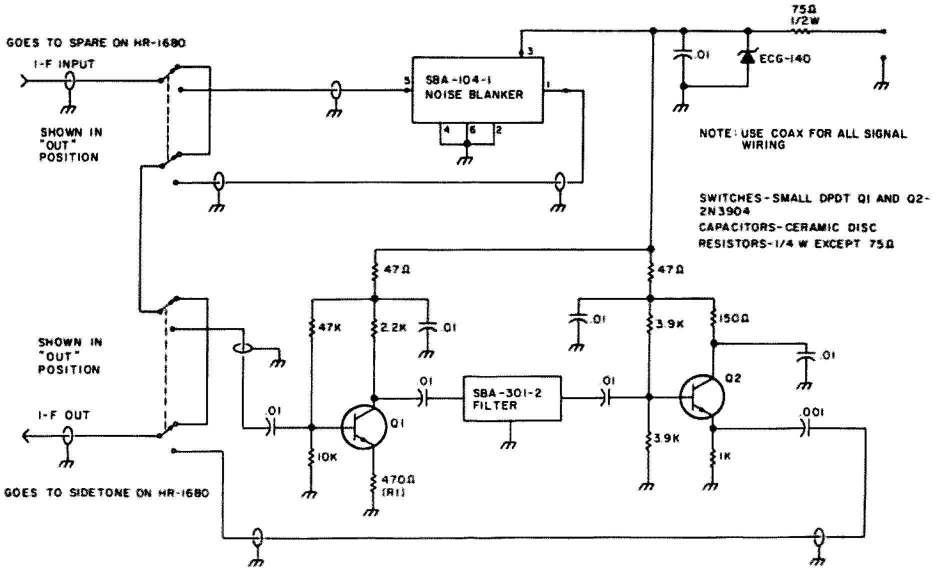

Fig. 1. Filter-blanker interface schematic diagram.

the same, and the different part numbers reflect the additional coils, diodes, etc., included in the SBA-401-1 for use in the SBA-104A transceiver. I am sure that either one would work. Buy the cheaper SBA-301-2.

The crystal filter has some insertion loss which must be made up, and it must be presented with the correct (2k Ohms) input and output impedance in order to perform correctly. I used a circuit that I found in *Amateur Radio Techniques* by the RSGB for the filter amplifier. The amplifier has a gain stage for input to the filter and an emitter-follower output (see Fig. 1). It does not use any inductive components, but it allows for a proper match into and out of the filter. The gain of the input stage is set by selecting the value of emitter resistor R1. Details on gain calculation are shown in Fig. 2. With the values indicated, the first stage gain is approximately 13.4 dB (voltage) and this results in unity gain through the filter-amplifier combination. The nice thing about this circuit is that there is nothing to tune. The filter and its amplifier are mounted on a piece of copperclad board using the board fabrication method outlined in the bfo section.

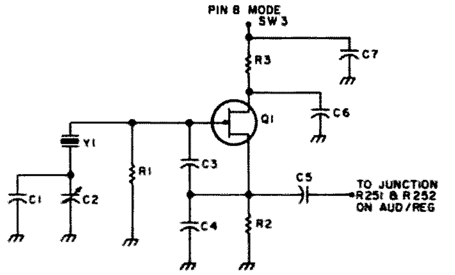

Fig. 3. Bfo schematic diagram.

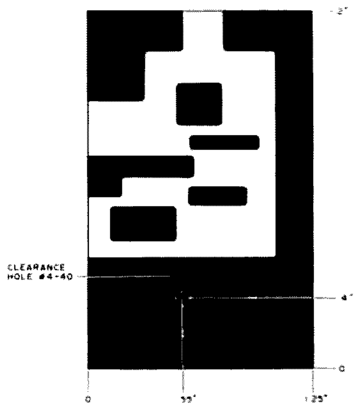

Fig. 4. PCB layout.

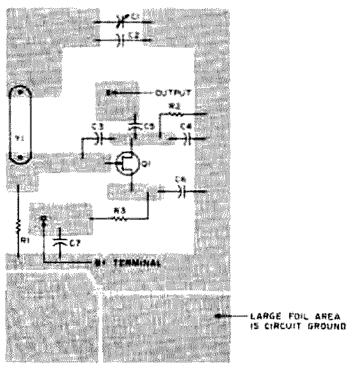

Fig. 5. Component location. Note: crystal and FET are mounted on the component side. All remaining components are mounted on the foil side.

Bfo

To obtain maximum benefit from the crystal filter, the bfo needs to provide a beat note of about 750 Hz to be within the bandpass of the HR-1680's audio filter. The frequency of the bfo should be 3395.4 kHz (filter center frequency), plus or minus 750 Hz. Several solutions suggested themselves, but I wanted to retain full SSB capabilities; so, fooling with one of the existing bfos was out. I built a new bfo using a 3395.7-kHz crystal (Heath part number 404-549, about $5.70) in a slightly modified copy of the HR-1680 bfo circuit (See Fig. 3). The trimmer (C2) allows the crystal to be pulled upwards in frequency by as much as 700 Hz, so you can place the bfo signal for the most pleasing tone or to fit the peak of the audio filter. The injection level is the same as the original bfo's and the new bfo works as well as the original. If you don't care about SSB, you can just pad the USB-CW bfo down to the correct frequency.

The new bfo is built on a piece of single-sided copperclad board. The foil pattern shown (Fig. 4) should be followed rather closely so the finished board will fit properly onto the AUD/REG board. For small one-of-a-kind PC boards, I find that it is faster and easier to grind off the unwanted foil with a Dremel Moto-Tool® or to score the foil with an X-acto® knife and peel off the unwanted foil, rather than to do all the things involved with etching. I used a Moto-Tool on the board that I built and it took less than an hour to produce a completed bfo.

The crystal and the FET are on the component side of the board (Fig. 5) and holes are drilled for their leads. All other components are on the foil side and no holes are required. Use a leftover PCB pin (Heath part 432-121) for the 13.8-volt connection.

The completed bfo board is mounted to the AUD/REG board using 4-40 hardware and one ¼-inch standoff. A small clearance hole must be drilled in the AUD/REG board just to the right of the connector sockets (viewing component side) that are below the existing bfo crystals (see Photo C). The exact location of the hole depends on your board, but the main idea is to have the new crystal snug against Y205 (and upsidedown) so as to create a compact piggyback fit.

Solder a small piece of bare wire from the new crystal to Y205 in the same fashion as was done for

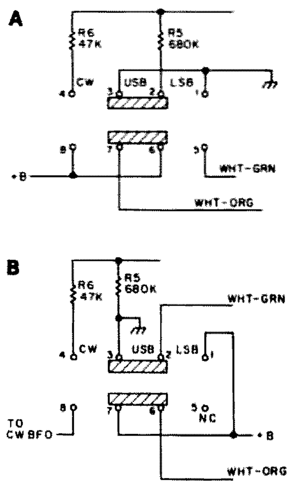

Fig. 6. MODE switch arrangement. (a) Original wiring. (b) After modifications.

Y203 and Y204 during the original assembly of the HR-1680. Connect an insulated wire between the ground foil on the new board to connector socket pin 13 of the AUD/REG board. Make sure that you do not get solder in the spring clips. Solder an insulated wire to the junction of R251 and R252 and solder the other end to the output land of C5 of the bfo board.

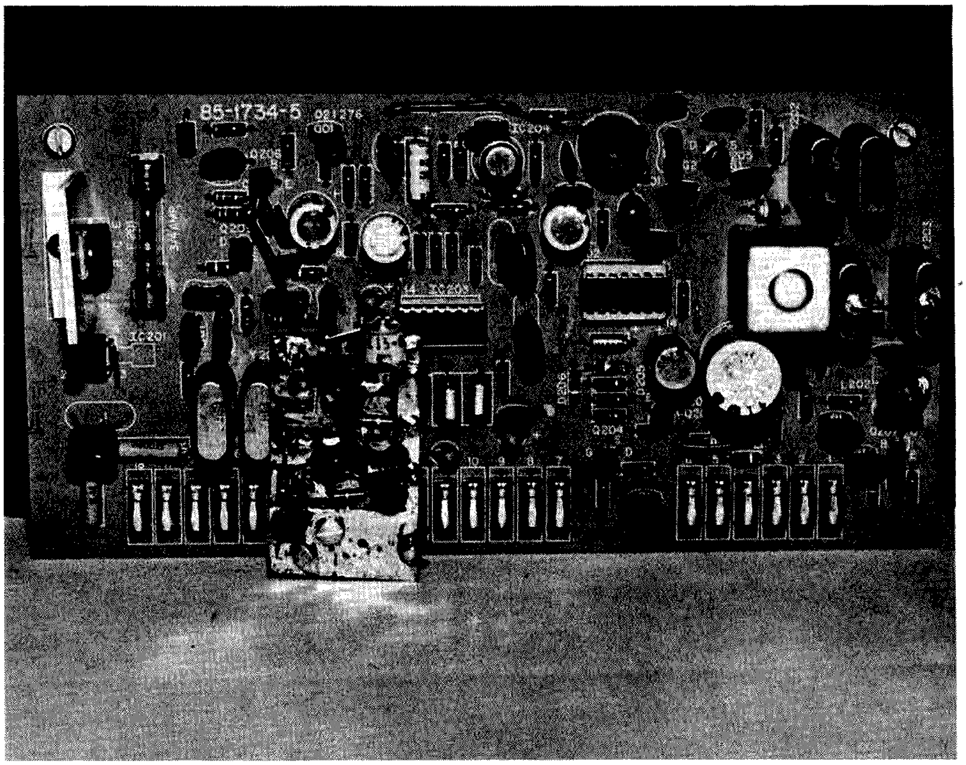

Photo C. Component-side view of AUD/REG board with new CW bfo board attached.

Mode Switch Wiring Changes

The MODE switch must be rewired so that the new bfo will be energized when the switch is placed into the CW position. Fig. 6 shows the original and modified connections.

Remove all connections to the MODE switch except for R6 (pin 4). Solder the end of R5 which was connected to pin 2 to the adjacent ground lug. Solder the red wire (originally connected to pins 6 and 8) to pin 7 and connect a short insulated jumper from pin 7 to pin 1. Solder the white-orange wire to pin 6. Solder the white-green wire to pin 2.

Secure a piece of #20 or #22 stranded insulated wire about two feet long. Solder one end of the wire to pin 8 of the MODE switch and dress the wire along the harness branch which contains the white-orange and the white-green wires to the AUD/REG board. Pull the free end of the wire through the ventilation hole which is almost directly under Q201. This wire is the 13.8-volt source for the CW bfo. Cut the free end to leave about three inches above the chassis, and install a leftover PCB connector (Heath part 432-120) or a pin removed from an old miniature tube socket at the free end of the wire.

Breaking the I-f Signal Path

The normal i-f signal path in the receiver must be broken in order to insert the crystal filter and the noise blanker. The best and most convenient place to break the path is between the output of the FRONT END board and the AUD/REG board's input.

Disconnect the shielded cable with violet color coding from pins D1 and D2 of the AUD/REG board chassis socket. Dress the cable to the SPARE phono-type connector at the rear of the receiver. Solder the inner conductor to the inside terminal of the phono connector and the shield to the ground terminal.

Disconnect the 10k resistor from the SIDETONE phono connector and either remove it altogether or secure it so that it does not short to anything. Cut a piece of the shielded cable supplied with the blanker kit (or RG-174/U) long enough to reach from D1 and D2 of the AUD/REG board to the SIDETONE jack. Solder the inner conductor to the inside terminal and the shield to the ground terminal of the SIDETONE jack.

The SPARE jack is now i-f out and the SIDETONE jack is i-f input. This change disables the sidetone feature of the receiver. If you want to retain the sidetone capability, you will have to install another connector somewhere. My sidetone comes from my keyer and the loss did not bother me. I assure you that the filter is worth a little trouble.

Noise Blanker

The SBA-104-1 noise blanker is very effective for some types of noise, notably automotive ignition noise and other types of short duration impulse noise. It does not do much good with long-term "grinding" noise like summer static and some types of power line noise. Since the HR-1680 does not have any noise limiter at all, the SBA-104-1 is a worthwhile improvement.

Build the noise blanker according to Heath's instructions, except change the value of R3 from 33

Parts List

C1—47-pF silver mica
C2—15—60-pF ceramic trimmer (Erie 528 type)
C3—33-pF silver mica
C4—330-pF silver mica
C5—10-pF silver mica or ceramic
C6,7—.01 ceramic disc, 100 volts
R1—47k, ¼ Watt
R2—330 Ohms, ¼ Watt
R3—1.5k, ¼ Watt
Q1—2N3819 or similar junction FET
Y1—3395.7-kHz Heath part 404-549

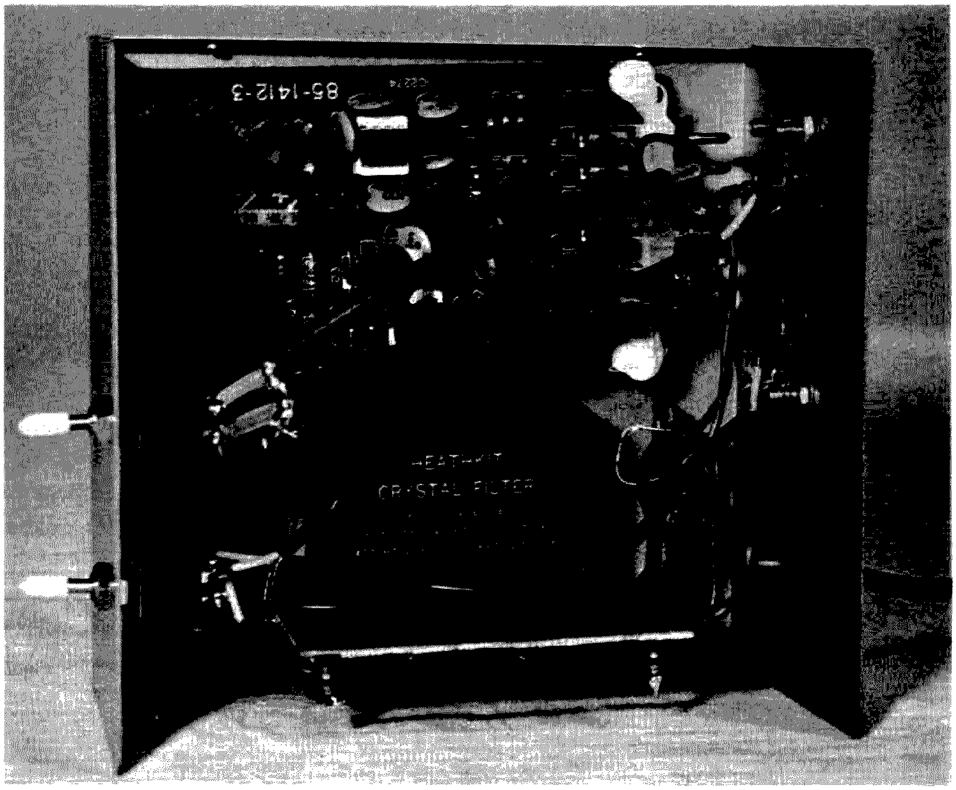

Photo D. Interior view of filter-blanker cabinet. Note globs of silastic rubber used to secure connector to PCB.

Ohms to 390 Ohms. The 390-Ohm resistor is included in the kit for use in the SB-104A and is not needed in the HR-1680. I could not see that the 560-Ohm resistor and the 2.2-uH coil were needed in the HR-1680, so I left them out.

The Heath manual discusses the increase in the IMD (intermodulation distortion) when the blanker is installed, and I noticed that a whole flock of "birdies" fly across the dial when the blanker is in the signal path. When you really need the blanker, all this does not matter, but it is not to be lived with when there is no noise. The best solution is to switch the blanker completely out of the circuit when it is not being used. The circuit diagram reflects this switching.

Filter-Blanker Power

13.8 volts is available at the external power connector at the rear of the set. This connector goes directly to series pass transistor Q201, and care should be exercised when using it because the fuse is ahead of the regulator. The blanker is normally connected to 11 volts, so I used one of several ECG-140s (10-volt) zeners that I had as a simple shunt regulator. The blanker and crystal filter work well with a 10-volt supply.

Checkout

Connect the filter-blanker combination to the HR-1680 using RG-58 coax with phono-type connectors at each end. The length of the cables is not critical, but they should not be too long. My cables are about 20 inches each and I could not measure any loss through the cables and switching arrangement.

Use Heath's instructions for checking and adjusting the blanker, except just switch the blanker out for "initial" readings.

To check out the crystal filter, switch out the blanker, switch the MODE switch to USB, and switch the FUNCTION switch to CAL. Find one of the 100-kHz calibration signals (any band) and switch to CW to see if the new bfo is operating. The beat note will change pitch when the new bfo is switched in. Switch in the crystal filter and verify that it is working. Switch to WIDE and USB and find a strong CW signal or use the spot function on your transmitter. Switch to NAR and peak the signal on the audio filter of the HR-1680. Switch in the crystal filter and switch to CW and adjust the bfo trimmer for a beat note which is peaked at the audio filter center frequency. You should now be able to switch the filter and blanker in and out without changing the S-meter reading.

With the crystal filter switched out and the receiver in the WIDE position, an S-9 signal can be heard over three or four kHz. With the crystal filter switched in, the same signal can be heard over less than one kHz and the signal falls off sharply outside the passband of the filter. The audio filter is helpful in eliminating some of the higher frequency noise that the crystal filter passes.

The normal SSB filter is always in the signal path and this helps improve the overall shape of the passband of the receiver. With the circuit shown, the crystal filter is properly terminated and does not have the "ringing" often associated with sharp filters. In fact, at first I did not think that it was working correctly because the audio was so natural sounding. I purposely mismatched the filter and the typical "ringing" was there. With the new bfo and using only the wider SSB filter, you can now actually zero-beat a signal. This is extremely handy at times.

Conclusion

With the modifications that I have outlined, the HR-1680 becomes a superb CW receiver which outclasses almost every secondhand set and is equal to many new and much more expensive sets. ■

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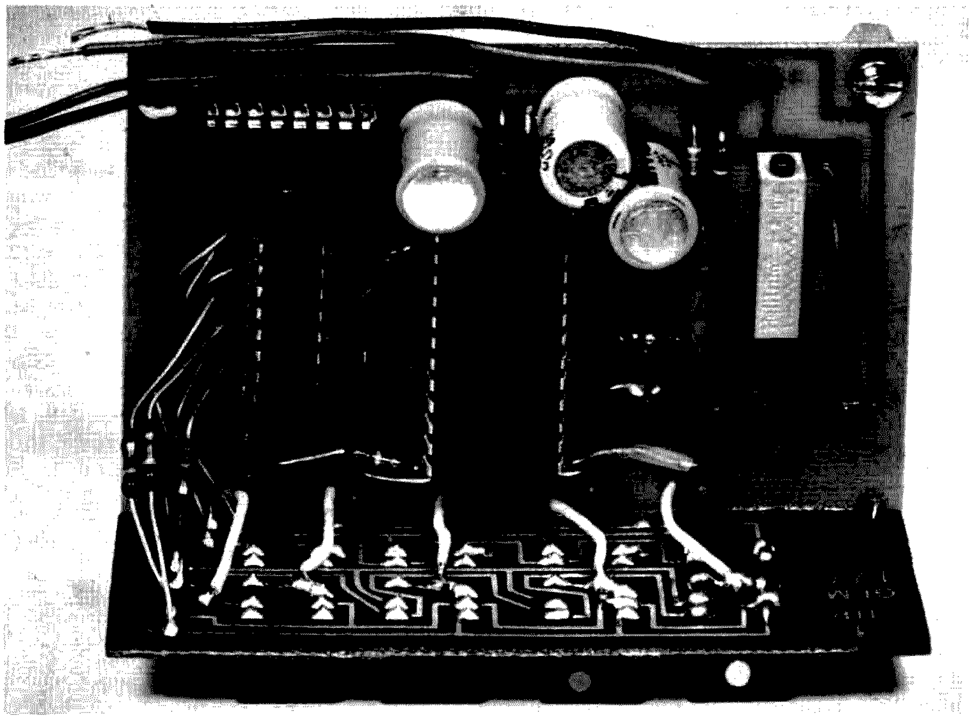
The Dollar-Saver DVM

—3½-digit unit features autopolarity, auto-zero, and a $30 price tag

Thanks to a new integrated circuit, there has been a dramatic drop in the cost of the digital voltmeter. If you have held off buying or building a simple digital voltmeter because the parts cost too much, you are in for a pleasant surprise with this one! The parts will cost about $30.00 or less, and a kit is available to save you the effort of rounding up all of the components. Needless to say, the price is right! The voltmeter is easy to build, too. The bulk of the components are on a 24-pin IC from Motorola. All you have to add to this chip is a display circuit, a voltage reference, and power supplies. The circuit is, as a result, quite simple. And PC board layouts are included to make this project as easy to build as a simple kit!



The completed DVM.

So how about the features? This voltmeter has at least all the features of digital panel meters on the market, and, in fact, more features than several meters that sell for at least twice the price! You get features such as auto-zero (no more zero-adjust—Hooray!), auto-polarity with minus sign display, and overrange indication. You have your choice of a 0 to 199.9 mV range or 0 to 1.999 V range by simply changing one resistor. As you just might have guessed, this meter has a 3½-digit display of 0.33" LEDs, and backing the display up is a voltmeter chip with ± 0.05% accuracy. Of course, the accuracy you get depends upon how well you calibrate your instrument, but it can be darn good! Input impedance is greater than 1000 megohms, minimizing circuit loading and making the design of input at-

tenuators much easier. In short, this voltmeter is built around a terrific IC chip, and one that represents a major breakthrough in features and price.

This article will show you how to build a simple, super low-cost voltmeter. It's so cheap you can permanently install one in such equipment as power supplies, etc. Perhaps in a future article, we can show you how to add ac volts, Ohms, and current ranges to your existing instrument. None of these additions are especially expensive, but they will dramatically increase the versatility of your voltmeter.

How It Works

The heart of this digital voltmeter project is a single CMOS IC made by Motorola. It contains all the critical circuitry necessary for a simple digital voltmeter. Fig. 1 shows a block diagram of the basics. All you have to add to it is a dc-to-dc inverter, which converts the positive 5-volt power to minus 5 volts, a 2-volt reference supply, a display driver, and a display. This sounds like a lot of parts, but in reality there aren't that many. And they are cheap, anyhow. Note that this voltmeter will measure dc volts only. Other functions require a few more parts which must be added to this basic voltmeter, and that must wait for another article.

The Motorola IC is what is known as a dual-ramp A/D converter. This is a technique of converting analog signals to digital logic and is probably the most widely used method of A/D conversion. Dual-ramp (or dual-slope, if you prefer) voltmeters feature high accuracy (0.1% to 0.05% is common) and high resistance to noise which might be on the voltage you are trying to measure. Noise read on inferior meters causes jitter in the readings. The dual-ramp technique has been taken one step further by Motorola in that there is an auto-zero step before each measurement, eliminating the zero-adjust control forever!

Let's look at some of the circuitry inside the DVM IC. Fig. 2 shows a simplified version of the A/D converter. There are three CMOS op amps, as you can see, and they function as follows: Dc signals are applied to the input of the first op amp, which serves as a buffer, isolating the influences of the outside world from the sensitive A/D converter. It has a gain of one. The second op amp serves as a ramp generator. It generates linear sweeps upon command. The signal applied at the noninverting input (+ input) and the position of the switch across the capacitor determine the size of the ramp. This is the part of the circuit that does the actual bulk of the A/D conversion. The third op amp serves as a comparator and it squares up the signal from the second op amp so that the remaining digital circuitry can be driven. The digital section consists of three decades of BCD counters, latches, and the "1" digit/polarity-sign logic. The remaining digital circuitry consists of a clock oscillator, multiplex, and control logic. Quite a few IC chips would be required to build this DVM circuit the hard way!

Now let's turn on the power and trace the voltage to be measured through the IC chip. The complete analog-to-digital conversion is done in six steps. The first step is to zero the A/D converter. This is done by correcting the offset voltages on the first two op amps of Fig. 2, or in other words, by setting their output voltages to zero. The capacitor across op amp number two is also shorted. The second step stores the number of counts equivalent to the input offset voltage (corrected by step 1) for later use in the auto-zero process. Step 3 uses the information to again re-zero the A/D converter. Then in step 4, the switch across the capacitor of the second IC opens, the plus input is grounded, and a positive ramp results. This ramp is for measuring positive voltages. The ramp starts at the voltage being measured, and then goes to its limit. This generates a series of pulses which are squared by the third op amp and go on to drive a 3½-digit counter array, indicating the voltage. In step 5, the reference voltage is substituted at the plus input of the second op amp, resulting in a negative ramp for measuring negative voltages. It works the same as the positive ramp. Finally, in the sixth step, the signals are squared up by the third IC and counted by the digital section. This process takes place about four times a second.

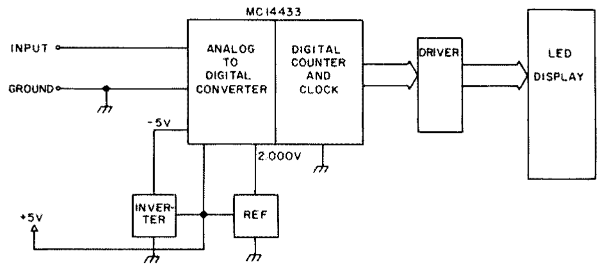


Fig. 1. Block diagram of the DVM.

Let's take a look at the rest of the DVM circuit (Fig. 3), now that the Motorola IC has been discussed. Looking at the input, resistor R1 and diodes D1 and D2 serve as input protection, saving your DVM chip in the event of a gross overload. The hex inverter, IC1, is wired as an oscillator/buffer. It produces a 900 Hz square-wave signal, which is voltage-doubled by D3-D4 and C2-C3, and that provides the minus 5 volts required by the DVM chip. There is a 2.000-volt reference voltage source consisting of C5, D6, Q1, R5, and R6. FET Q1 serves as a constant-current source, making the reference voltage more stable. Capacitor C4 and resistor R4 serve as the integrator components in the A/D section of the IC. Capacitor C6 and resistor R7 set the clock frequency, or the rate at which each A/D conversion is made. The LED display is driven by IC3, a BCD-to-7-segment decoder, with current limiting supplied by R13 through R19. Each digit is switched by Q2 through Q5, and the necessary current limiting is supplied by resistors R8 through R12. And last, but not least, the

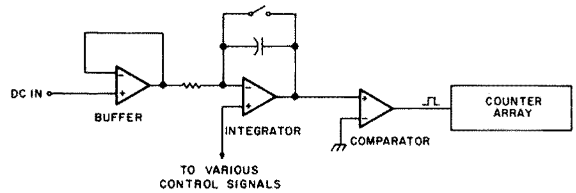


Fig. 2. Simplified schematic of the A/D section of the Motorola chip. The digital counter array is a standard 3½-digit configuration.

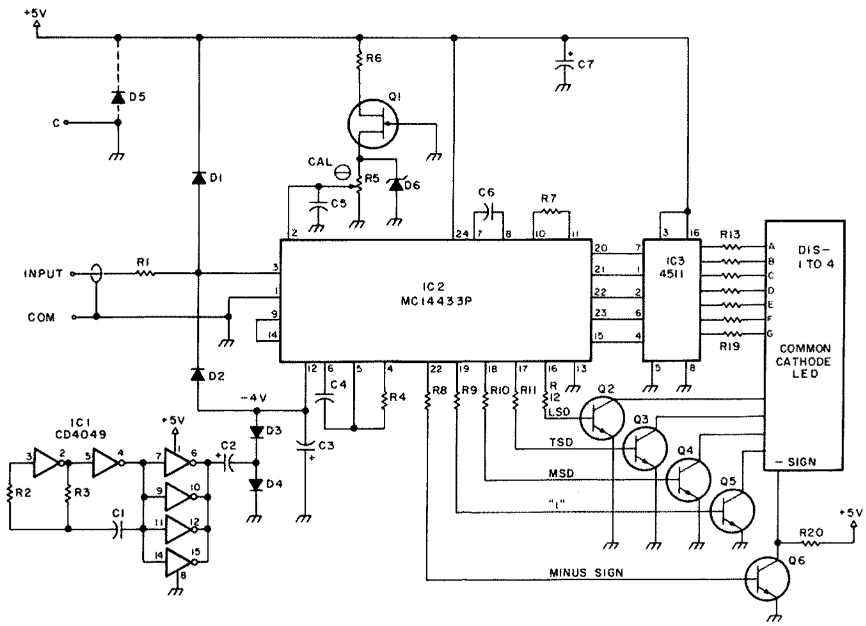


Fig. 3. Schematic diagram of DVM.

minus sign is driven by Q6.

Construction

The actual construction of this DVM project shouldn't take too long and, if you use a PC board set, it can be wired in an evening by a moderately fast constructor. PC boards are recommended for this project because the ground connections are critical in a DVM as sensitive as this one. A poor layout will result in noise pickup and, thus, diminished accuracy. If you are reasonably well-versed in DVM construction, fine! You can design your own layout, and it will work fine as long as you are careful of what you connect to the analog ground (pin 1, IC2). If you are not so knowledgeable in DVM construction, play it safe. Either copy your boards from our illustrations, or buy the kit from the author.

A good place to start is with the display board. Fig. 4 shows the front view of this board, which you can wire directly from this illustration. Just place the board in front of you so that the row of 8 holes along the edge is to your left, then stick in each of the displays, solder, and trim the wires. Next, add the three jumpers below the displays. Check this board for properly soldered connections, solder bridges, etc., and set it aside.

Now you can start on the main board. Cut up Molex Soldercons® into strips of four 8-pin, and two 12-pin. You can use ordinary 16-pin sockets for the two small ICs, but you *must* use Molex for the 24-pin IC because parts run underneath this IC! Insert the strips into the proper holes as shown in Fig. 5. Be sure that the board is oriented properly. The "c", "5V", and "in" markings on the foil side should be closest to you. Solder the pins in place, but do not remove the tab from each row of pins. Next, add the four jumpers. You can use bare wire but be careful to allow a little clearance on the jumper that goes under IC1. You don't want this wire to touch any IC pins. Install trimmer pot R5 on the board. Follow suit with the rest of the resistors, but temporarily leave off R13 through R19. They go on when you add the display board. As you install R12 and R8, you may want to put spaghetti tubing on these resistor leads to prevent them from shorting against the pins of IC2. When you finish with the resistors, install the five diodes. Diode D5 is optional—it provides reverse polarity protection for the DVM. It kills the power supply if the DVM is improperly powered, saving the $15 DVM chip. If you want this feature, mount the diode on the foil

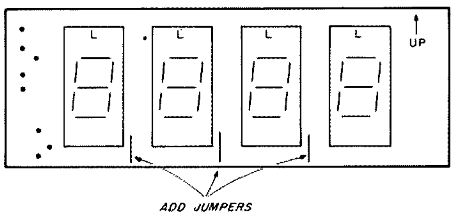


Fig. 4. Front of display board.

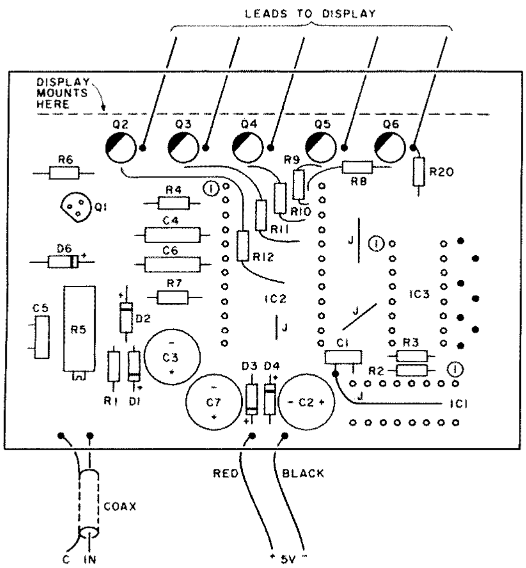


Fig. 5. Top of main board.

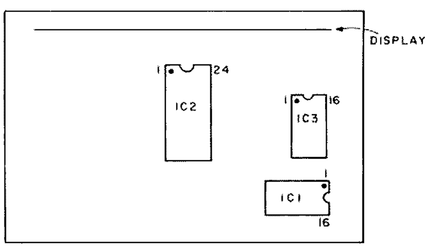


Fig. 6. IC location diagram.

side of the board between the "c" terminal and the "5V" terminal. Do not run the leads through these holes, as wires will later be connected here. Instead, solder directly to the foil. Make sure that the diode polarities are correct and then go on to the capacitors. When you are done, be sure to check the polarity of C2, C3, and C7. Add the FET, Q1. Notice how it is mounted in the illustration. If you have trouble finding a TIS-75, you may get it from S.D. Sales of Dallas, Texas. They call them "FETS" by Texas Instruments" and they have sold at 5 for a $1.00. Add transistors Q2 through Q6, orienting them as shown. Notice that the emitter leads of these transistors are bussed together. Finish up the board by cutting up a piece of hookup wire into five one-inch pieces. Strip and tin each end, then solder one each to the collector pads of Q2 through Q6.

Now it's time to install the display board and clean up a few odds and ends. The display board mounts flush against transistors Q2 through Q6. You can mount it with two homemade "L" brackets, or just epoxy it. We did the latter after wiring up the display. If you want to do the same, start by wiring the drivers first. Simply solder the free end of the wire coming from Q2 to the cathode of the display *directly* above it. Follow with the other transistors. Note that the minus sign driver, Q6, lead goes to the pad marked "–" on the edge of the board. When you are done with the drivers, turn to the segments. Seven 180 Ohm resistors serve as the leads here, so no more wire is necessary. You will notice that there are pads around IC3 marked "a" through "g". These are the segment letters, and they are duplicated on the display board. Install the resistors in this order: c, d, e, a, b, f, and g. Leave extra lead length on each of these resistors so they can be positioned without touching. Add short lengths of hookup wire to the holes marked "c" and "5V". These are the power supply leads. Then add a short length of shielded cable between the "c" and "In" holes. This is the signal lead. Finish up by breaking the tabs off the IC sockets and inserting the ICs. Fig. 6 shows IC placement. Be patient with IC2! It may take several tries to get all the pins in the socket.

Calibration

After you have checked over your wiring, and have corrected any problems, you are all set to test your meter. Connect the supply leads to a source of regulated 5 volts dc. If you don't have a power supply handy, or expect to be needing one with this meter, build the simple one of Fig. 7. Apply power and you should see a flash of light from the display and then it should blank. This is normal with open-circuited input leads. Then short the

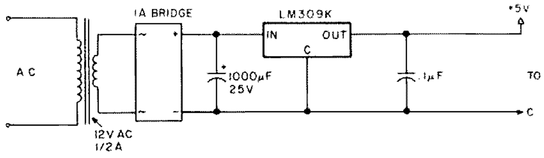


Fig. 7. DVM power supply.

input leads together and the display should light and read "000" with the minus sign flashing slowly. These two tests tell you that your overrange feature (blanked display) and auto-zero feature, as well as the rest of the unit are working properly.

Now you can calibrate your meter. There are several ways to do this and one is shown in Fig. 8. The best way is to use a commercial meter calibrator, such as the Datel, Fluke, and other "low-cost" units. But these are commercial units and the cheapest is about $300.00! If you have access to one of these, fine! Just be sure that the calibrator is at least 5 times more accurate than your meter is, or ± 0.01%. Nearly all commercial calibrators are better than this. However, don't dispair. There are other ways to calibrate your meter. If you can get a hold of a good 3½-digit, or better, voltmeter you can calibrate your meter against it. Of course the accuracy you get from your meter will be reflected by the unit you calibrate against. Do not calibrate against any analog meter, even the best, if you expect accuracy better than 1 to 5%. The last method is to calibrate it against a mercury battery. If you build our kit, you can return it to us and we'll calibrate it for a fee. So one way or another, you can get your meter calibrated!

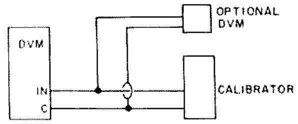
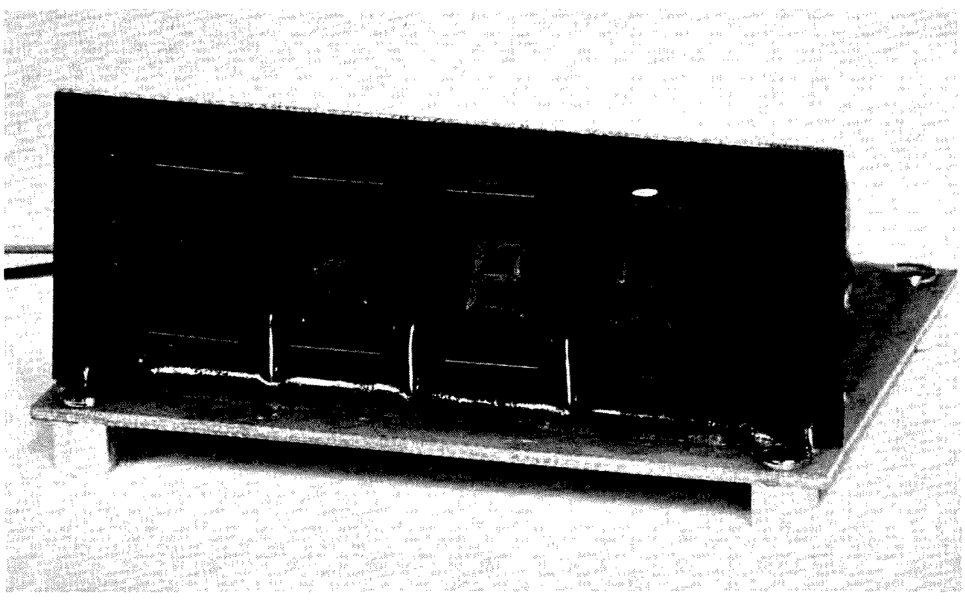


Fig. 8. Calibration setup.

The actual calibration procedure is quite simple. Remember, there is only one adjustment! If you are using a commercial calibrator, set it to 1.99900 volts, and adjust R5 for a reading of 1.999 volts. If you are calibrating against another digital meter, ad-



The display board may be held in place with epoxy.

Parts List

C1, C4, C6—0.1 uF, 50-volt miniature mylar capacitors
C2, C3—50 uF, 16-volt electrolytic capacitors
C5—0.1 uF to 0.2 uF, 10-volt disc capacitor
C7—100 uF, 16-volt electrolytic capacitor
D1, D2—1N4148 switching diodes
D3, D4, D5 (optional)—1N4002 diodes
D6—1N703 zener diode
DIS 1 to DIS 4—Litronix DL-704 LED displays
IC1—CD 4049 hex inverter IC
IC2—Motorola MC-14433P DVM IC
IC3—Motorola MC-14511CP display decoder IC
Q1—TIS-75 FET or equivalent
Q2 to Q6—2N2222 transistors or equivalent
R1—100k, ¼-Watt, carbon-film resistor
R2, R4—470k, ¼-Watt resistors
R3—4.7k, ¼-Watt resistor
R5—10k, multi-turn trimmer potentiometer
R6, R13 to R19—180 Ohm, ¼-Watt resistors
R7—270k, ¼-Watt resistor
R8 to R12—10k, ¼-Watt resistors
R20 270 Ohm, ¼-Watt resistor
Misc.: PC boards, wire, solder, etc.

A kit of all the above parts is available from: Beckman Instruments, 2500 N. Harbor Blvd., Fullerton CA 92638, for $29.95. California residents include $1.80 sales tax. All orders include $2.00 postage and handling. A set of PC boards and construction manual are also available for $4.50, postpaid.

just R5 until the meters read the same. You can use a flashlight battery here for the voltage source and it works fine. And finally, if you are calibrating against a mercury battery, adjust R5 to read 1.340 volts and you will be in the ballpark. After tweaking R5 in any of these methods, reverse your meter's input leads. The minus sign will light and you will get the same reading, plus or minus a millivolt.

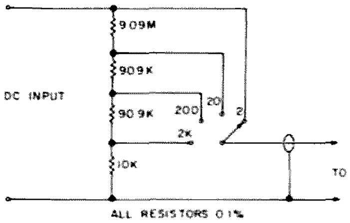


Fig. 9. Voltage divider for additional voltage ranges.

Operation

There are many uses for this meter and it's up to you to find them. Do you have a regulated power supply? Why not add a DVM to it. Fig. 9 shows a simple voltage divider you can use in this or other applications. Of course, you can incorporate it into a nice case and use it as a bench voltmeter. Or, power it with a set of nicad batteries and make your meter portable. The possibilities are endless!

One last thing: You will probably want a decimal point and perhaps a 0 to 199.9 mV range. To get that decimal point, it is recommended that you place a series combination of any small LED lamp and a 2.2k resistor between the appropriate readouts. Attach the leads to the 5-volt power supply. This addition will give superior performance to the built-in decimal points. Need a 200 mV range? Just change R4 to 27k and recalibrate. That's it! ■

Personalize Your Repeater with a Voice ID

— low-cost design uses 8-track decks

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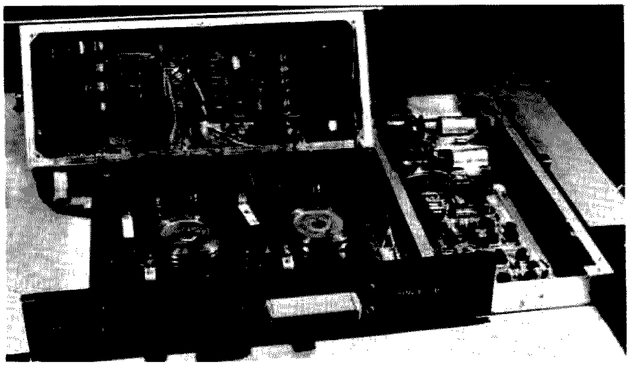
With the great increases of repeater systems on the air today have come all kinds of ideas for hardware to personalize each system and projects offering ideas for clubs to get new members involved with the building and maintaining of these systems.

Here is a voice identification system using easy-to-obtain parts, simple straightforward circuitry, and such easy construction practices that any repeater group can build it with a minimum of problems.

Circuit Description and Planning

The system consists of a 16-digit function decoder feeding an address field of gates which, in turn, drive five relays that simply turn on or off an 8-track tape-player deck.

The function decoder used here is the Data Signal TTD-226, but any function decoder will



This is the M.A.R.C. voice ID system. Two of the four tape decks are shown, mounting into one chassis with access to the tapes from the front. The underneath view of the electronics shows the function decoder board on the right and the address field-motor switching on the left. The audio patch is on the extreme right of the picture.

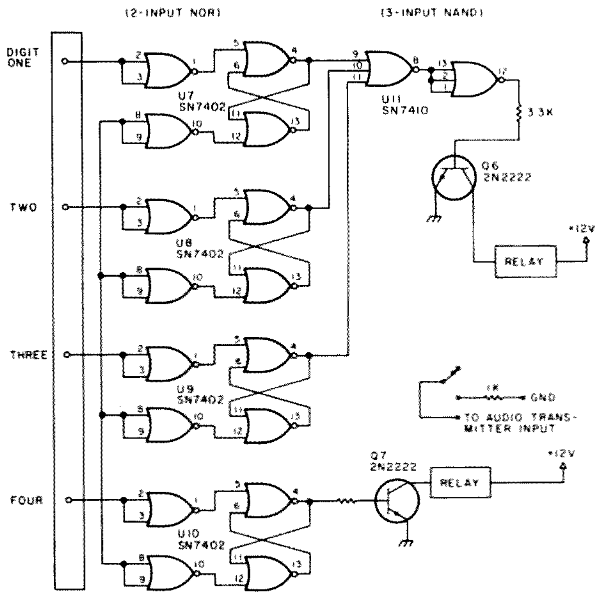


Fig. 1. A multi-digit access board is incorporated, and can be used whenever you desire more than one or two entries. The circuit described here is a 4-digit input, with an audio clamp circuit that will turn off the audio fed to the transmitter. During the digit-accessing, no audio is fed out over the air. When the fourth digit is accessed, the audio clamp circuit is released and the transmitter is again fed audio.

HOW IT WORKS

Audio from the receiver is fed to the function decoder. An agc circuit is used to feed the eight 567 tone decoders. Their outputs feed various gates to give a total output of each digit corresponding to a 16-digit pad. As a digit is sent, a low signal appears at the corresponding pin of S1. This signal is sent to the input of the address field board, which contains five SN7402 QUAD NOR gates wired as flip-flops. Applied low signals to the two inputs will cause the circuit to turn on and drive Q1 into conduction, which then turns the relay on. Proper connection of low signals from the tone decoder to the address field board will give you all kinds of variety with respect to access codes and types of operation.

The relays turn 110 volts on and off to the series of 8-track stereo tape-player decks which feed the repeater audio system. The relays can be used to control any number of functions needed for your particular repeater control.

work. (The repeater handbook has an excellent function decoder described which will work well, also.) The number of digits is up to your group. Great thought has to be put into your input access codes, unless you desire a completely "open" system accessible with one digit.

If your repeater has an autopatch, it will be very important to disable the tape ID decoder system so that dialing phone numbers will not access any tape messages. This can be accomplished very easily by shorting the audio input signal feeding those decoders. At the same time the patch is brought back "down," this audio short is lifted and audio is allowed to feed the decoders once again.

This system uses a three-digit input and a single-digit cancel, or an automatic cancel fed by the tape deck.

Operation

The signal path starts at the repeater receiver speaker. This audio line feeds the repeater transmitter, and we bridge it to feed the function decoder audio input. An agc (automatic gain control) amplifier is used to limit the audio coming into the decoder ICs, so that the audio signals do not distort and overload the circuit. The function decoder then uses 567 PLL chips to decode two-tone audio tones and gives a low or high signal to drive the address field.

The address field board can be thought of as a very simple memory storage board, using 7402 TTL chips. The decision was made to use this method so that one can use inexpensive chips (usually less than 50¢ each) which do not require any special handling or give serious voltage problems.

7402 R-S Flip-Flops

The 7402 is a two-input quad NOR gate. It can be connected as a set-reset flip-flop. A high to pin 5 will cause pin 4, the output, to latch high. Sending a low to pin 3 will reset pin 4 to a low state. We actually have a storage for recall of information at any time. This has to be addressed with another 7402 so that the clocking is uniform.

Alternative IC

As with any electronic circuit, there are many ways to achieve the same function. A 7472, 7407, or 7476 J-K flip-flop latch IC could replace the 7402. Our decision, however, favored simplicity; it allows use of the same chip throughout the entire project, making parts replacement for servicing easier, should any problems arise.

The outputs of the flip-flops drive an NPN transistor, which buffers the 7402 output to control a 12-volt relay. This relay switches the 110 V to the 8-track tape-deck motors. The message tape has silver foil applied at the end of each message. This foil comes in contact with two metal fingers which are connected to the off pin of the flip-flop, thereby latching the 7402 off, which releases the relay and turns the tape-deck motor off. One set of contacts is used to key the PTT line of the transmitter, also.

Time Machine

One feature some of our members really wanted was a voice time machine that could be punched up to give the time of day. Our rural telephone system does not have the usual time-and-temperature public service number. However, in checking out the available time machines, it was found that the lowest-priced unit was over $2,000!

In checking around, a Panasonic "Talking Clock Radio" was found, however. This product was built over five years ago. It uses a series of magnetic discs that change position every minute and hour. A *remote* keying jack and audio output are already installed, so interface was very easy. The biggest problem was the addition of a timer to hold the PTT line on so that the transmitter remained keyed during the six seconds that it takes for the voice tape to announce the time. This was accomplished with a 555

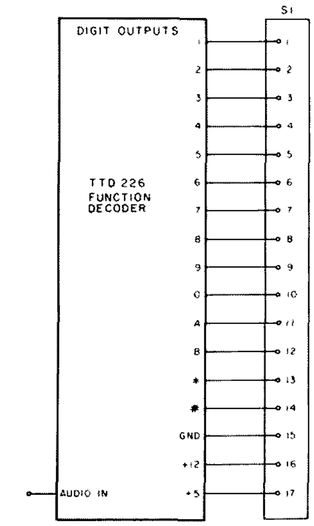


Fig. 2. Interface for the TTD-226. Connect pins of S1-P1 to correspond with the particular access code you desire. Program 1 needs two digits to turn the program on. The tape sensor will turn it off. Select the digits you prefer from S1, to correspond with P1. Example: Connect terminals 3 and 4 of S1 (TTD-226) to terminals 1 and 2 of P1 (address field board). Connect terminal 3 of P1 to the tape-deck sensor switch. When digits 3 and 4 are sent in sequence, U1 turns the program 1 tape deck on. When the message is finished, the aluminum tape sensor on the tape cartridge activates the tape sensor switch, turning off pin 3 of P1, which reverses the U1 flip-flop.

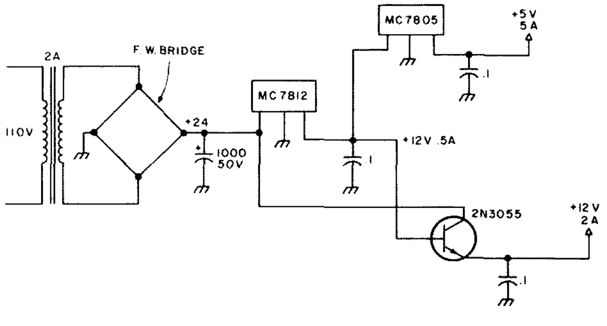


Fig. 3. Power supply.

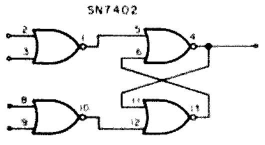


Fig. 4.

timer IC turning on a reed relay to ground the PTT line.

Tape-Player Hardware

As with all repeater groups, our cash was in short supply, so the acquisition of tape decks got to be expensive in the planning stages. We ran across an ad from Poly Paks, however, for 8-track players for $9.00! They worked out great! It was inconceivable to use one of those players, with that head jumping up and down, to select the various programs, so we used two players and removed all of that solenoid nonsense. We mounted the playback head solid and eliminated many problems.

One player is programmed for ID announcements. The other player can be used for club messages, announcements, and so on. We have a third player that comes on every tenth time the CW identifier is called upon. This produces a low level voice ID automatically. The other tapes are accessed by touchtone™ pads only. Each message is about 6 to 8 seconds, average, with a piece of silver foil sensing tape ½" long at the end of each message. Most of our tapes contain 15 different messages on a continuous loop. The sensing foil stops the machine at the end of each. This ensures greater tape life and gives you much more program source.

Chassis Work

The entire unit is built into two aluminum chassis. One, 17" x 6" x 3", houses the electronic keying board, regulated supplies, and relays. The other, 17" x 12" x 3", contains the tape players and associated 110-volt switching. Ninteen-inch standard-rack front panels are mounted on the front of each chassis. The clock radio can be mounted on a shelf inside the repeater cabinet. Proper shielding and single point rf grounding should, of course, be done to prevent any interference. LED indicators are mounted on the front panel to show which program is on the left side of the panel, for the regulated power supply.

PCB

The main address field board, a double-sided board, includes all of the 7402 devices, four tape-player relays, the 6-second timer, and the keying relay for the time machine. A 20-pin edge connector interfaces the board to the output terminal strip mounted on the chassis and connects to the output of the TTD-226 date signal decoder board. A lot of point-to-point wiring is done on the circuit board, so that should you want different access codes at any time, you can simply unsolder the various wire jumpers and re-connect at the desired spots. The relay contacts are hard-wired to the edge connectors so that 18-gauge wire can be used to carry the current. The relays are mounted right on the PC board and use the encased-type relays to keep contacts free of dirt. This point-to-point wiring also makes the circuit very versatile as to how your interface gets connected to the output of the function decoder.

Power Supplies

Two regulated supplies are necessary for the system. A single transformer feeds both of them. Straightforward practice in filtering and grounding has to be observed.

Tape-Deck Modification

The tape decks used were built by RCA and were purchased from Poly Paks. They are of excellent quality and have held up without any problems. They contain an audio preamp that interfaced very well with our audio system, and the on-air quality is remarkable. The track-selection solenoid was removed from the entire unit. Mount the head bar solid to the tape-deck chassis. This ensures almost foolproof operation and cures that terrible "tape-eater" problem that so many 8-track players seem to have. The wiring of

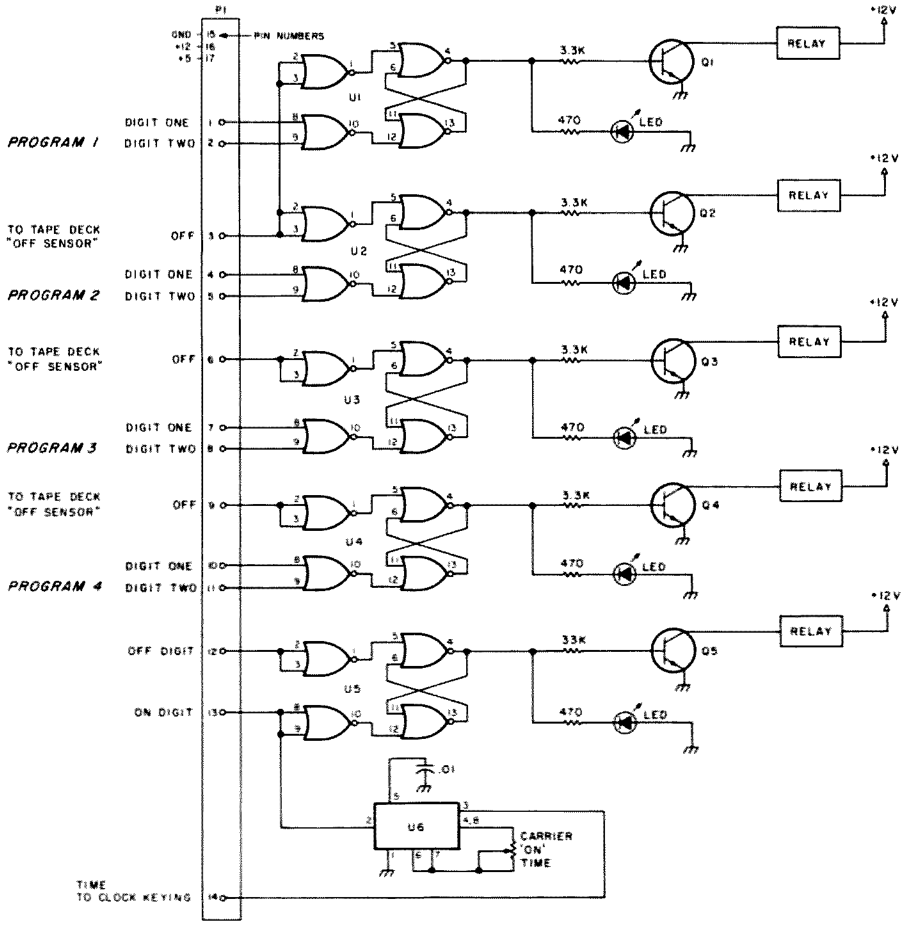
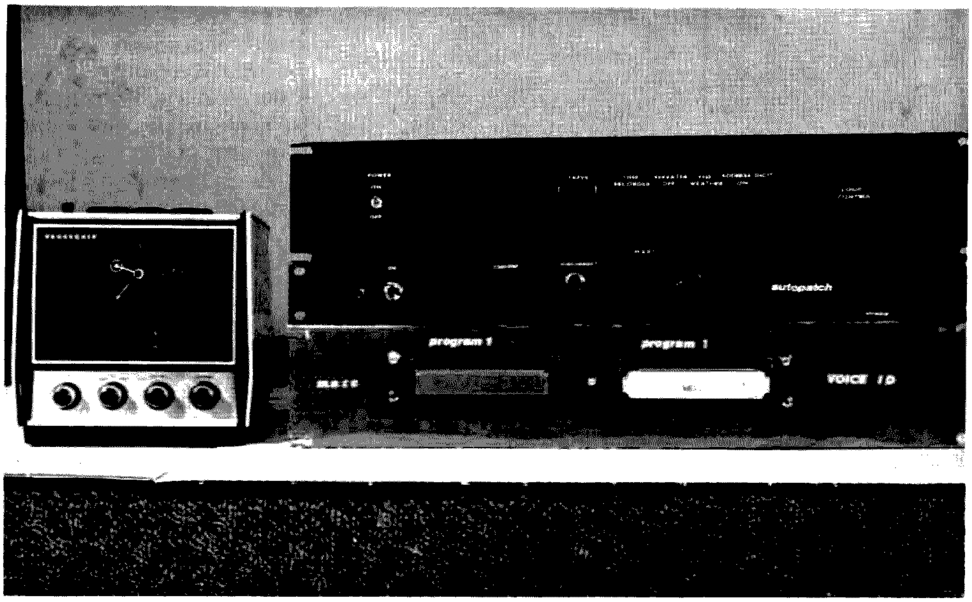


Fig. 5. Address field board.

the tape decks is a very simple process of elimination after all of the unused parts are removed. The motors are 110-volt and are wired with regular 18-gauge lamp cord. Proper bypass capacitors are used to minimize any spikes or hash injected into the power lines. The preamp assemblies remain where they were originally and are wired with +12 volts dc for proper operations. Two holes may be drilled on the chassis bottom to give access to the audio level controls of the preamp cards.



The front view before rack-mounting shows the Panasonic RC 6800 Talking Clock Radio used as the time machine. The stack on the right consists of the logic control, autopatch, and two of the four tape machines.

Message Content

The system described here has been in use since November, 1977, on the Marissa (southwestern Illinois) 147.81/147.21 repeater. Ed Bolton WA3PUN cut most of the voice tapes with some of his best imitations of Amos 'n Andy, John Wayne, Henry Kissinger, and a host of others, giving travel, club affiliation, frequency, and other informative messages. A lovely-voiced lady from a St. Louis radio station did several station ID tapes, also.

Needless to say, the system makes the Marissa Machine (the double M) a very popular system and allows visiting operators to acquire useful information as well as great enjoyment as they use it. ■

The Nearly Perfect WE-800

—add an on-board charger, a TT pad, and . . .

H. R. Worthington K1OTW
17 Fremont St.
Oxford MA 01540

As it comes from the factory, the Wilson WE-800's battery-charging provisions are lacking in that it cannot be used while its nicads are being charged. My solution is an on-board charger with no switching or holes required. A shutoff switch could be added by believers in deeply cycling nicads; there is space at the 9-volt battery connectors at the rear panel. With the current consumption of the synthesizer, full discharge occurs often enough without trying. The Wilson can still be charged as the designer intended, if desired.

Charger: The voltage-doubling circuit shown in Fig. 1 and Photo A is adapted from K5PA's article in the April, 1978, *Ham Radio*, p. 36. It charges at 45 mA anytime the rig is on external power. The 555 is in the standard astable mode and the 7805 is the standard current-limiting circuit as found in the *Motorola Linear I.C. Data Book*. I built it on 1" × 1-3/4" vectorboard. If the transistors and 7805 are stacked as shown, the assembly is 5/8" high and fits neatly into the space next to the diode matrix board as in Photo B. I epoxied the stack together and to the board; all heat sinks are down toward the board so that they provide their own electrical insulation. A blob of silicone rubber prevents rattles.

As indicated in Fig. 2, I tapped 12 V from the EXT PWR jack so that, in the INT position, the nicads don't try to charge themselves. I grounded the charger by soldered it to a nearby shield partition. Charging current is put into an unused terminal of the EXT-INT-CHG switch. This terminal is at the top—viewing the terminals with the chassis upright. When road tested, I found that the original 1400-Hz note was getting into the low-level audio circuits on receive and transmit, so I

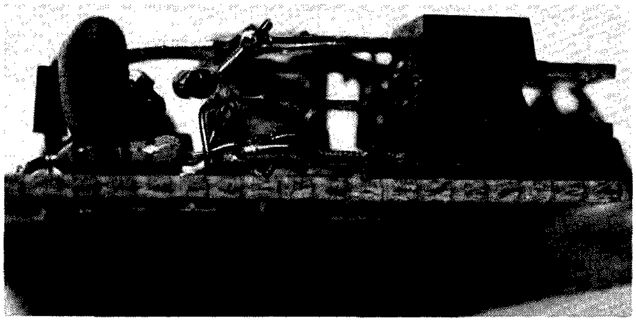


Photo A.

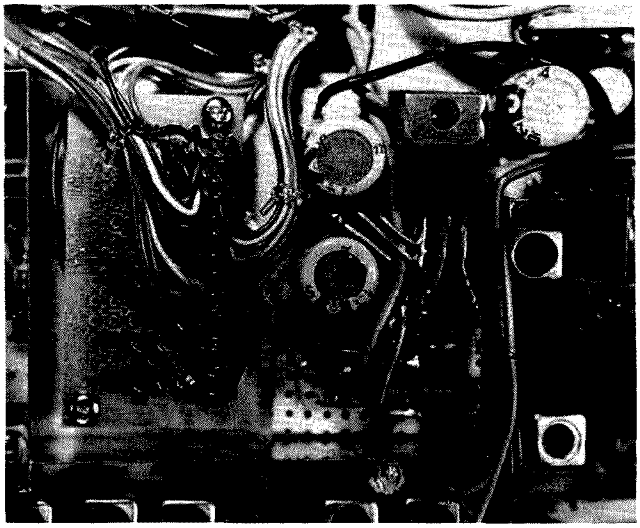


Photo B.

 Jan 1980

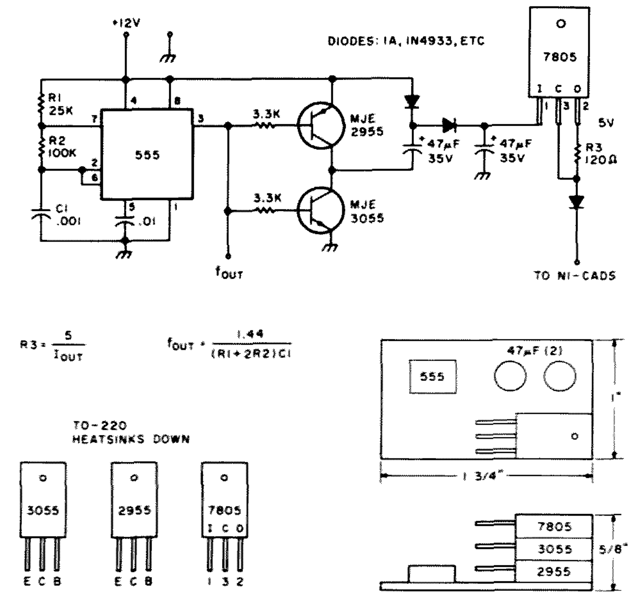


Fig. 1.

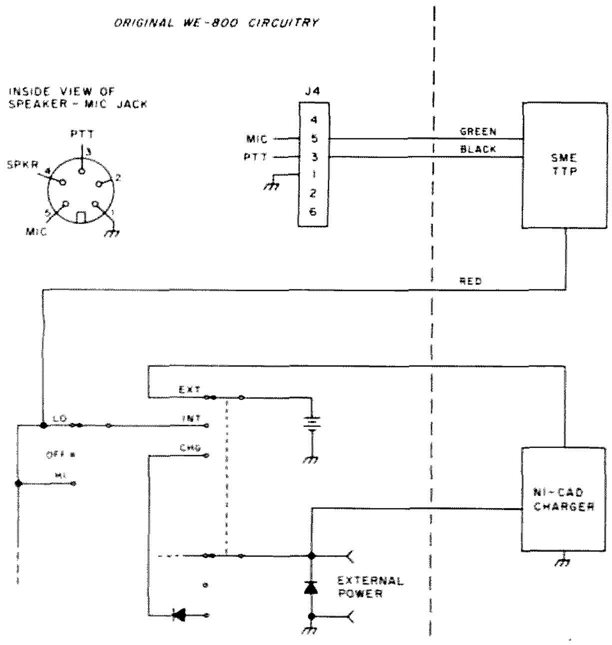


Fig. 2.

changed R1 and R2 to 25k and 100k respectively to increase the 555's frequency to about 6400 Hz. That cured this problem by being above the audio frequency response of the rig (just my theory). R3 of 120 Ohms produced 45-mA charging current. Tolerances of components account for this discrepancy from the formula. The charger draws 130 mA, which produces some heat, but evidently this is not detrimental.

TTP: There is no factory-installed Touchtone™ pad available so I decided upon the Data Signal SME circuitry with the reliable Digitran™ keyboard (type "F" from Data Signal). Since this rig is used sitting on a bench or transmission hump, the keyboard was mounted on top of the case symmetrically with the dummy speaker grille per Photo C. This location is above the battery compartment, so a friendly machinist milled a 1/4" through slot for the 8-pin terminals and a .030" deep × 1/4" slot inside the case to guide the eight leads off the side of the battery compartment. I drilled and countersunk 1/32" on the inside four holes for the plastic mounting pins and melted and filed them flush. I cut the 8-pin terminals flush, soldered the eight leads and secured them into their slot with electricians' tape. I stuck the circuit board onto the side of the case with thin foam tape so that it neatly rests beside the battery enclosure.

I ran the 12-volt, ground, and audio-out leads thru a .062" 3-pin Molex connector so that the case can be removed easily. As shown in Fig. 2, I took 12 V from the HI-OFF-LO switch, soldered the ground lead to pin 3, and soldered the audio lead to pin 5 of the MIC/SPKR jack.

The Data Signal factory-set audio level turned on the local 99/39 autopatch first shot. An unexpected side benefit is that the tones can be monitored in the MIC/SPKR.

As shown in Photo D, I epoxied two automotive distributor cap tower nipples to the bottom surface of the case toward the front to jack it up for a convenient operating angle. They also prevent slippage on a desk. These are for sale at $10 per pair installed, but no clients so far; hi!

Why just "nearly" perfect? The thumbwheel switches should be lighted, but I can't think of anything that doesn't resemble a plumber's nightmare.

Appreciation is due to K1ICU for his photography, WA1VVS for his machining, and WA1WPX for use of her Wilson as the guinea pig.■

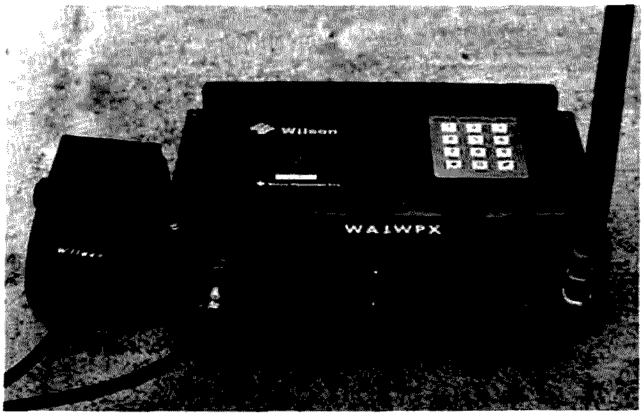


Photo C.

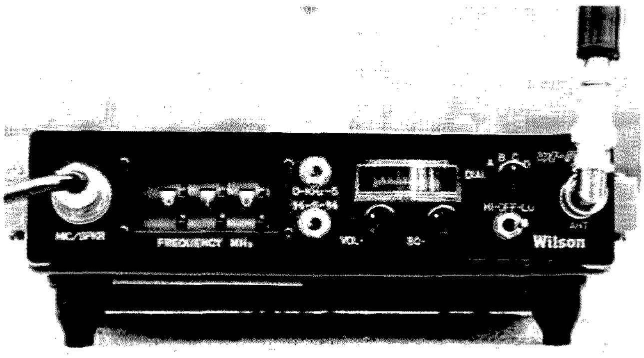


Photo D.

How to Make Your Own Crystal Filters

—requires considerable patience, but very few bucks

73 Magazine *Staff*

Everyone knows that good, high-frequency (3-9 Mhz) crystal filters for use in SSB exciters or accessory CW filters for transceivers are expensive. However, if one has a bit of test equipment and is short on cash but long on patience, it is possible to home-brew very good crystal filters using relatively simple circuitry and without the need for complicated coupling networks.

The crystal filter circuit of Fig. 1 has a number of advantages. First of all, no tuned circuits are involved. The crystals are simply paralleled, and from one to six crystals can be used, depending upon whether one wants to construct a simple CW filter with a very sharp response or an SSB filter with a specific bandwidth. The frequency spacing of the individual crystals used is critical; this will be covered later in detail. The crystals are driven from a low-impedance source by the first-stage emitter-follower. At the series-resonant frequency of the crystals, the signal voltage will be developed across the .001-uF capacitor and drive the output amplifier. At frequencies other than those where the crystals exhibit series resonance, the capacitor serves as a bypassing element and helps sharpen the skirts of the filter response. Some signal leak-through will occur because of stray capacitance across the crystals; this is compensated for by coupling some signal from the collector of the first amplifier around the crystals via the 100-pF variable capacitor. A number of general-purpose transistors can be used in the circuit. With those shown, the circuit will have about 10-dB gain.

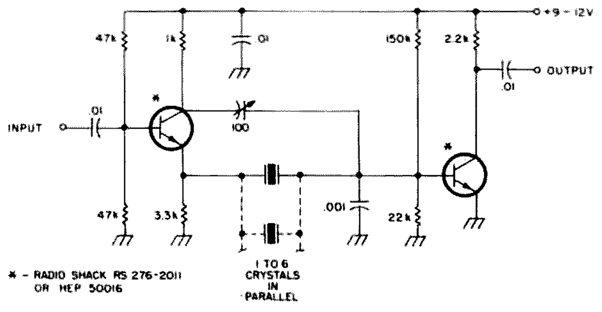


Fig. 1. Simple crystal filter circuit does not require any tuned circuits.

To make the circuit work properly, the series resonance of the crystals used must be carefully controlled. The only exception might be if one decides to use only a single crystal to form a simple CW filter. However, even for CW reception, the bandwidth provided by one crystal is too sharp and provides uncomfortable reception. Therefore, a controlled bandwidth of 200 to 500 Hz should be used. Such a filter can be constructed using at least two crystals spaced in frequency by the desired bandwidth and centered on the i-f frequency desired. For an SSB filter, at least six crystals should be used. This is because the individual crystal series-resonant frequencies should not differ by more than about 300 Hz. Otherwise, the passband of the filter will not be smooth, as it is just a composite of the highly selective passband of each individual crystal.

The type of overall response one might expect from this type of filter is

shown in Fig. 2. The ultimate rejection that one can achieve with the circuit depends on how carefully the circuit is constructed to prevent stray coupling around the crystals, and on how carefully the 100-pF variable is adjusted. Values of 40 dB can be achieved before the skirts of the filter response start to flare out. Admittedly, this is nothing like the 80-dB out-of-passband rejection of an expensive 8-pole commercial crystal filter. It is sufficient, however, for a simple SSB exciter, and more than adequate for an accessory CW filter in a transceiver when the SSB filter is also left in operation to sharpen the skirts of the overall i-f response.

One may ask how there can be anything inexpensive about a circuit which might require up to six crystals. The answer is to use the old-style FT-243 crystals. These crystals are available for $1.00 or less each from various suppliers (JAN Crystals, for instance), and they allow easy disassembly and access to the crystal itself. The latter is important since there is no easy way of specifying the series-resonant frequency for the crystals to be used in the circuit. So, one has to obtain crystals which are marked approximately for the i-f frequencies of interest, disassemble them, and grind them to the exact frequencies needed. This operation, particularly the "grind" part, is not as terrible as it sounds. In fact, the whole operation is relatively simple.

The circuit of Fig. 3 is used to find the series-resonant frequency of a crystal. A signal is applied from a signal generator or vfo. The voltage across the crystal is monitored by any high-impedance instrument which will respond at the frequency being used. Usually an oscilloscope is the most suitable instrument. The "bandwidth" of the oscilloscope may be far below that of the test frequency being used, since only an indication of the voltage change across the crystal is necessary. A "5-MHz oscilloscope," for instance, will easily respond to signals up to 10 MHz or more in frequency (although, of course, it cannot be used to analyze the waveform of 10-MHz signals).

As the test frequency is varied, there will be a sharp drop in the voltage across the crystal when its series-resonant frequency is reached, producing a short circuit. The voltage drop is very sudden, and one must vary the test frequency slowly. The series-resonant frequency should be within a few kHz of the frequency stamped on the crystal holder. The FT-243 crystals are easy to disassemble, and the rest of the job now consists of taking the crystal apart, grinding it slowly to raise its frequency, and then testing it back in its holder until one collects the desired number of crystals with the proper series-resonant frequencies.

Although acids can be used to "grind" crystals, it is usually better to use a very slightly abrasive material such as 3M "Trimite" silicon carbide paper (with a fineness of 400 or greater). This paper is obtainable at large hardware stores and comes in 9" × 11" sheets. The paper is taped to any flat surface, and the crystal held flat with a finger and rubbed on the paper with a circular motion. The grinding should be done "wet." That is, the crystal should be kept moistened with water. After grinding, the crystal is carefully cleaned with rubbing alcohol and, avoiding any finger marks, put back in its holder.

To go back for a moment, it should be mentioned that although the FT-243 holders are easy to disassemble with just a screwdriver, the operation should be done carefully. The contact plates and spring should be kept in the same order for reassembly. Also, the crystal should be marked on one corner so that it is set back in the holder in its original orientation.

The amount of grinding a crystal needs to change its frequency depends on the pressure used while grinding, the number of passes while grinding, and so on. However, it takes very little practice to get some "feel" for the changes which take place in the crystal frequency as one grinds it. For instance, with an 8-MHz crystal, one circular pass on the abrasive paper might change the crystal frequency by 150 Hz. One hundred passes might change it as much as 20 kHz. For lower-frequency crystals, more passes will be required for a given frequency change. A 4-MHz crystal might change 60 Hz in one pass and 7 kHz in 100 passes.

Obviously, as one approaches the desired crystal frequencies, the grinding has to be done slowly and patiently. If one goes slightly too far in the grinding process, the crystal frequency can be lowered slightly with a very soft lead pencil. Lightly rub the surface of the crystal with the pencil and then use a soft cloth and a drop of rubbing alcohol to distribute the coating. With a bit of patience between grinding times and possible corrections, one can easily come "right on" with regard to frequency.

Although the acid approach is not really recommended, those amateurs who have access to the chemicals required and who can be careful in their application may want to try it. If so, one should use an ammonium biflouride solution diluted with two parts of water. The crystal is simply placed in the solution (using a small pair of tweezers) for 30 to 60 seconds at a time, removed and rinsed with water, and dried. The crystal frequency is checked and the process repeated as many times as necessary. The whole process is quite easy, but it must be emphasized that the chemical solution is very corrosive and must be used *and* disposed of carefully. ■

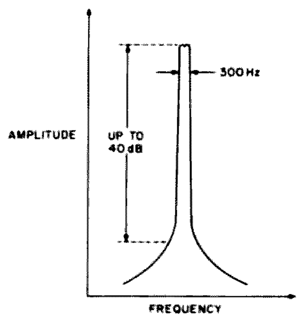


Fig. 2. A typical response one could expect from the crystal filter circuit shown in Fig. 1. In this case, it would be for a two-crystal circuit with the crystals' frequencies (series-resonant frequencies) separated by about 300 Hz.

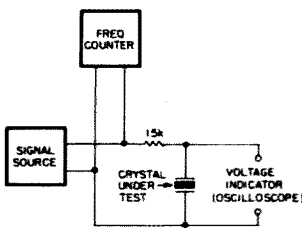


Fig. 3. A test setup for measuring the series-resonant frequency of a crystal. Capacitance effects across the crystal must be avoided, so short leads which go directly to the plates of the oscilloscope must be used. A suitable low-capacitance probe may also be used with the oscilloscope or a suitable VTVM.

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The Procrastinator's Special: A Simple Six-Band Antenna

—this 10-160 endfed vee goes up in a jiffy

There is really nothing new about this type of antenna, but I'm *using* it as an inverted vee. Many years ago it was called a Fuchs antenna (pronounced "Fooks"), but it's easy to see why that name didn't stick. Later on, it was (and is) variously called an endfed Hertz, a directly-fed, self-fed, voltage-fed, straight-wire, or random-length antenna. That last name is applicable only when you really don't know or care what length it is.

Pre-TV, some of the more daring hams would simply clip one end of the antenna to the hot end of the final amplifier tank coil at a point where the final loaded up reasonably well, and they were on the air—never mind the harmonics and parasitics. Using a capacitor at the tank circuit, in series with the aerial, kept anyone who might touch the wire from getting fatally zapped with dc, so the more prudent operators opted for that approach.

Later on, things became more sophisticated and, in the late 1930s, something known as the Universal Antenna Coupler was developed. This enabled link-coupling of an antenna to the amplifier, thus eliminating the dc shock hazard and minimizing spurious radiations.

The ARRL *Antenna Manual*, in its 1949 Fifth Edition, called antennas without feedlines "... the simplest and probably least effective multiband antenna." Untrue. Simple, yes. Ineffective, no.

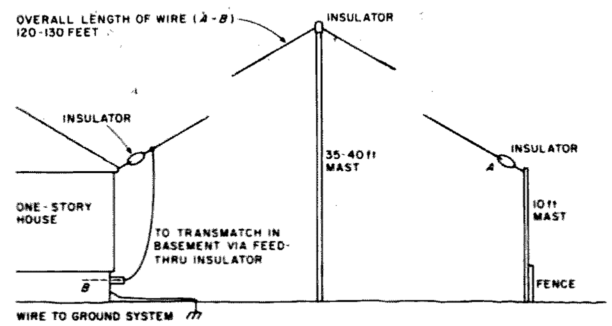

Fig. 1. Directly-fed inverted vee antenna, as installed at W6TKA/Ø. Layout and dimensions can be varied somewhat to suit individual installation requirements.

Those graybeards among you who can remember back to over 20 years ago may recall an article written by me and published in the February, 1956, issue of CQ under the title, "The Drooping Doublet." To the best of my knowledge and research, that was the first article to appear in an amateur publication pertaining to what we call today the inverted vee. That antenna, as was the one I am about to describe, evolved out of necessity.

After many years of using the inverted vee—usually fed, in my operations, with open-wire feeders (or tuned, as many call them)—I found myself in a situation where it just was not too convenient to bring the feedline from a centerfed antenna into the radio room. Having moved from California to Missouri, I now had more land but the shape of my God's Little Half Acre meant that the optimum means of feeding the inverted vee was at one end. What to do? No problem. The ham shack was now in the basement, so I planted my 40-foot telescoping TV pole out in the middle of the backyard, attached an insulator to the top, ran approximately 130 feet of wire through the insulator, hoisted up the mast, and guyed it.

I then extended half of the wire out to a 10-foot pole (which I no longer needed for not-touching-things-with) which was located at the rear fence and attached it with a large insulator. The other end of the wire drooped nicely down to the eaves of the house, where I anchored it with another insulator and then brought it in through an access hole in the wood just above the concrete basement wall. Inside it was attached to a transmatch with, of course, coaxial cable running from there to my transceiver or amplifier.

Having gotten you thoroughly enthused about this miracle of modern science, I must inject a note of caution: A good ground system is most helpful when using

this antenna. Even if you have only a small backyard, the antenna and ground system are still feasible. Among other things, I used a large quantity of #18 copper wire (copperclad steel or aluminum electric-fence wire is cheap and comes in rolls ranging from small to huge) and simply sliced the lawn with—now, don't laugh—a pizza-cutting wheel, poked the wire about an inch into the soil with a large screwdriver, then stomped the grass back in place. No one could tell where I had buried wires.

Somewhat like a ground-plane antenna, the ground system forms a reflecting, conductive plane—the other half of the antenna system, as it were. This is especially important on 160 meters, where the directly-fed inverted vee functions as a quarter-wave or slightly longer radiator.

A good ground helps on all bands to prevent "rf from floating around the shack," as the old expression goes. And it makes quite a difference in the kind of signal others, at distant places, hear from your station. Here in this part of Missouri, soil conductivity is pretty good, according to a soil conductivity map issued by the FCC for use by broadcast stations. To make sure I had the best possible ground, I got a half dozen five-foot ground rods (they really should have been eight feet long), spotted them at various places around the 100- x 100-foot backyard, and wired them together with #12 copper wire. Tied to all of this is the #18 wire I mentioned earlier and the radial system employed for my allband vertical (that antenna is yet another story). From this conglomeration, a couple of stout copper wires run to a chain-link fence which borders the back of my lot (plus several other lots) and is about 600 feet in total length. All ground rod and wire connections were carefully spliced and soldered. (See Fig. 2.)

This antenna was put up in something of a hurry in the fall of 1977, just before the weather turned nasty. My main concern was to have an allband radiator up for the winter; a classy, super-efficient installation was secondary to me at that time. But, to my surprise, the thing seems to radiate as well as any inverted vee I have ever used and is still in use with only minor modifications.

I have three home-built transmatches, so I use one on 160 meters, another on 80/75, and the third on 40 through 10. (See Fig. 3.) One transmatch might work as well if you don't mind retuning it each time you change bands. The transmatches are separated from the radio room by a wall and are located in the unfinished furnace area of the basement. A remote meter on the swr meter and a remote transmitter keying circuit enable me to adjust the transmatches from the furnace room without having to be in two places at once.

Just in case you happen to be curious about the resonant frequency of your directly-fed inverted vee, here's a hint that may help you. Just on a hunch, I connected the *center* conductor of the RG-8/A coax running from my Kenwood TS-820S to the end of the vee and the shield to the ground system. Switching the transceiver to 160 meters and placing it in the "tune" mode (about 10 Watts of output), I carefully tuned the band for a dip in reflected power. Minimum swr occurred at 1.810 MHz. The swr was about 2.0:1, but it was a pronounced dip, so I knew the antenna was quarter-wave resonant at that frequency. Some simple calculations (234/f) told me that the antenna was—electrically, anyway—just over 129 feet long—a quarter wavelength at 1.810 MHz. It is a bit long for 75 meters, representing a half wavelength at 3.610 MHz. It is a full wavelength at 7.220 MHz, two wavelengths at 14.440, three wavelengths at 21.660, and four wavelengths at 28.880 MHz. It provides some gain in those bands over the basic half-wave antenna. Obviously, the antenna presents a variety of input impedances, and hence the need for an antenna tuner (or transmatch) to match the transmitter to the antenna.

I've been very pleased with the results this antenna has provided on all bands, especially 160, 75, and 40 meters. I feel that it is a much more versatile system than a conventional single band, coaxial-fed inverted vee. Advantages include the convenience of allband operation, no cost for feedline, and no worry about where to run the feedline to keep it from getting too close to the antenna or other structures. It seems to work as well as any inverted vee I have used in the past twenty-five years. It is inexpensive, and you can put it up in a few hours. ■

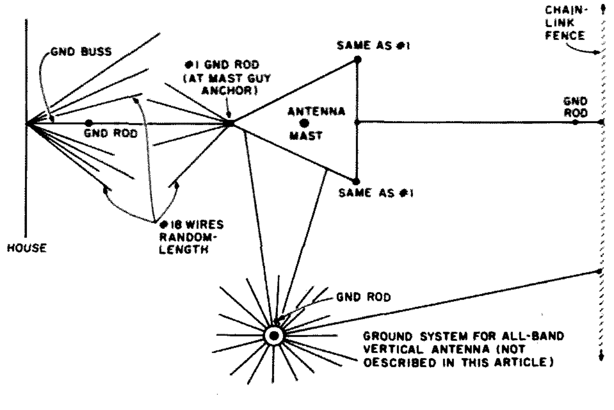

Fig. 2. Ground system in use with directly-fed inverted vee at W6TKA/Ø, shown only as an example of how an efficient ground system can be installed. Many variations are possible and acceptable. (The vertical antenna shown is not described in the article—it is included only to illustrate the total ground system being used.) Both hot and cold water pipes in the basement also are included in the ground system.

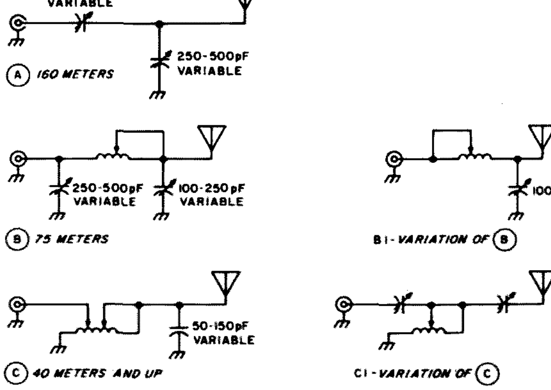

Fig. 3. These transmatch circuits, or other variations of pi, pi L, L, T, et cetera, can be used with the directly-fed inverted vee antenna.

They Don't Make 'Em Like They Used To

—home-brewing a hard-to-find neutralizing cap

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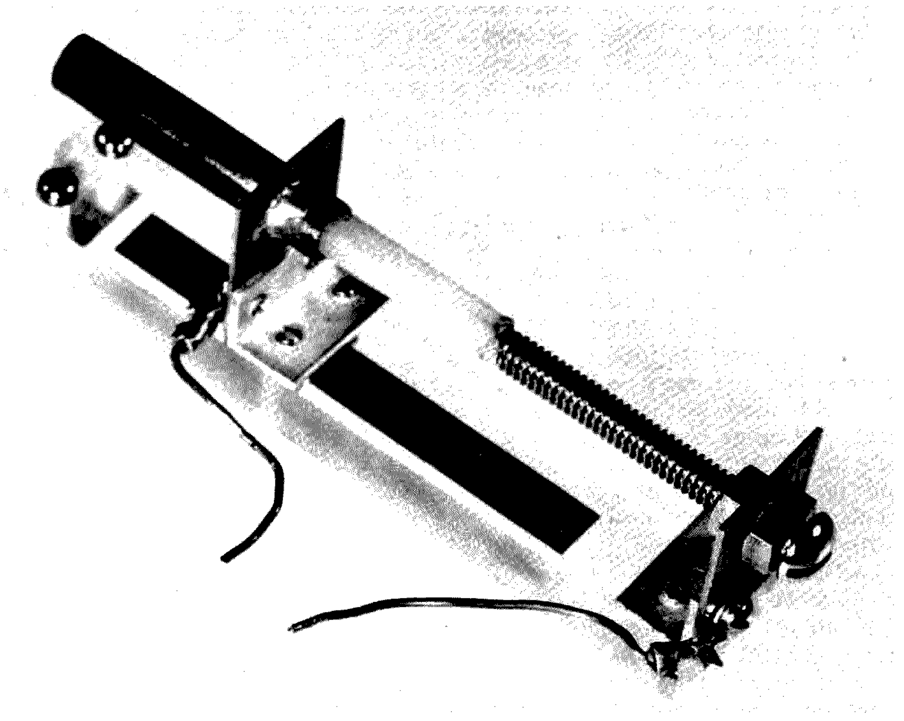
My old amplifier was getting tired; it had a bad case of flat feet, low emission . . . or something. So I accumulated all the parts for a new PA. Parts were all ready to go, except for the neutralizing capacitor. So, down to the big city. Big Apple, maybe, but big parts supplier, no.

The first clerk just did not understand what a neutralizing capacitor was. The next guy looked at me as if I had been recently turned loose from the funny farm. Finally, I made it to a shop where they once sold such items . . . only they hadn't seen any for years. I refused to be insulted for a fourth time and returned home to reconsider.



Why not roll my own? I pondered this. Old-timers used to do it . . . but now? As you know, there are two main classes of so-called neutralizing capacitors. The first type has half-round plates, the same as an ordinary variable capacitor, and the second utilizes a plunger-type of mechanism. Some of the older handbooks show examples of the first type, but I have yet to see home-brew examples of the in-and-out style.

Even so, I chose the second type. This construction roughly follows the capacitors developed by Millen, except that solid dielectric is used. This makes for a more compact design. A second advantage lies in the fact that the screw-in type of construction allows for easier calibration, if such be desired. Finally, the procurement problem

is easily overcome. Please don't laugh at that last item. The final design allows for anyone, anywhere, to make such a capacitor—even those hams in far-off lands. All that is needed are a brass nut and bolt, a few pieces of scrap metal, and a small piece of lucite or similar insulation approximately 5 inches long.

The materials list for the prototype follows:

1 base or plastic support form, 1" x ½" x 5";

3 pieces, right-angle dural or brass, ½" x ½" x 1/16", 1 inch long;

6 5/8" 6-32 nickel-plated brass screws, with copper lox;

4 ¼" 6-32 nickel-plated brass screws, with copper lox;

1 brass bolt 2" long (US ¼-20 thread or similar);

2 brass nuts, to match above screw;

2 pieces of brass (or copper) 1" x 1" x .050" thick;

1 piece of copper tubing, 2" long x ¼" inside diameter.

You can see that all the conductive parts should be made from brass, copper, or aluminum. Certain parts should be made only from brass or copper, since they require soldering. Oh, yes—I almost forgot! You will require a short piece of RG-8/U coaxial cable, about 3 inches long, for the rotor.

It is well to remember that all of the soldered pieces must be finished before assembly to the plastic base, which melts easily. You will be best served if you stick to the following schedule of assembly:

(1) Cut the base section to size—5 inches, suggested minimum.

(2) Cut the 2 pieces of right-angle material to size, then drill and tap to meet with the base and the brass 1" x 1" pieces.

(3) Drill holes through the plastic base to allow 3 right-angle brackets to be mounted.

(4) Drill 3 holes in the brass 1" x 1" pieces: two holes to meet with the holes in the right-angle pieces, and one hole to accept inserts (which are soldered in later).

(5) Carefully enlarge one hole to accept copper tubing. Solder it in (at right angles) with about 5/16 inch protruding from one end.

(6) Solder one brass nut to the proper spot on the other 1" x 1" piece of brass.

(7) Remove ¼ inch of insulation from a 3-inch piece of inner section of RG-8/U coaxial cable.

(8) Drill a small hole in the center of the brass screw, ¼" deep at most.

(9) Join the brass bolt and the brass nut to one brass 1" x 1" plate.

(10) Carefully insert and solder the exposed copper wire from RG-8/U cable into the small hole in the brass screw.

(11) The balance of construction follows. Just use common sense.

Your finished capacitor will have a capacity of 3.65 pF minimum up to 6.9 pF, a difference of 3.27 pF. These are actual figures. Capacity changes, per turn, are essentially linear. This may suggest its use as a tuning capacitor with very small changes in capacity for each complete turn of the feed screw. Capacity change was 0.103 pF for each turn.

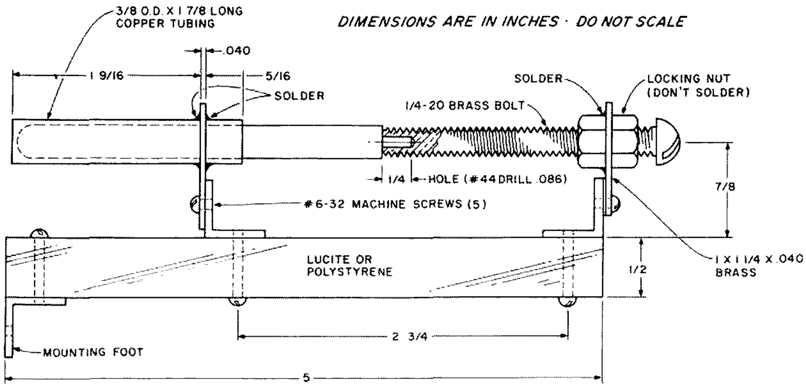


Fig. 1. Neutralizing capacitor.

Voltage breakdown? Forget it. A pal of mine fanned back the braid one foot from each end of a sample of RG-8 cable and then applied a test voltage of 100 kV with no ill effects. Personally, I helped to install a section of RG-8 cable between the power supply and the visual amplifier of a commercial TV rig. It's still working OK 10 years later, without a whimper, at 6500 volts.

So, try your hand at making such a capacitor, whether it be for neutralizing or for some other purpose, perhaps as a high-precision vernier capacitor having a small change of capacitance for each turn—approximately 0.103 pF. And please remember: All metal should be nonferrous. ■

The Europa-B Two Meter Transverter

—work OSCAR and 2m SSB with this British import

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What is smaller than a six pack, will put you on two meter sideband or on OSCAR, and is not made in the USA? The answer is, of course, the British-made Europa-B two meter transverter. This unit converts both received and transmitted signals on ten meters to the two meter band, with enough power to work both OSCAR 7 and OSCAR 8. You can also use it to work up to about 200 miles or so direct, using FM, AM, SSB, RTTY, CW, or any mode that you have an exciter for on ten meters.

The Europa-B comes in a package only nine inches wide, four and three-quarters inches high, and four and a half inches deep. It comes complete with a power cable for the Yaesu FT-101, FT-200, FT-277, or FT-250. It can be used with any rig having a 12-volt heater chain. A transformer is available for rigs with a 6.3-volt heater chain. In fact, a whole power supply in a package the same size as the Europa-B is also available, but it is not included in this review.

The Europa-B two meter transverter.

Construction

The receive side of the Europa-B is all solid state. There is a dual-gate MOSFET rf stage followed by a dual-gate MOSFET mixer. The converter is specified as having a noise figure of 2 dB and a gain of 30 dB.

The transmit side uses tubes. A maximum of 200 mW of ten meter drive is applied to a 6360 mixer. The resultant two meter energy is amplified by a second 6360 used as a driver for the final (which is a 5894). The final amplifier runs at about 200 Watts input and is specified as being at least 50% efficient. This is more than enough signal output to work through both the OSCAR spacecraft.

The selectivity of the tuned circuits is such that both the mixer and the driver plate circuits need tuning when a change of frequency of more than about 100 kHz takes place. The whole tuning operation takes about five seconds and is no bother to do. The narrow passband also acts to suppress unwanted mixer products.

The unit is well built. A double-sided printed circuit board is used as a chassis for both the transmit and receive converters, keeping the rig nice and small.

The ON/OFF switch is wired such that when the switch is in the ON position, the unit is powered and the heater chain to the exciter finals is broken. Putting the switch in the OFF position removes the 12 volts from the Europa and reconnects the heater chain to the finals of the exciter. This feature allows the exciter to be used on both HF and VHF without having to remove the power cord to the transverter. An accessory socket is provided on the rear of the Europa-B to supply voltages for a preamp or an rf relay for automatic switching of the rf input to the exciter between HF and VHF.

The manual supplied with the Europa explains the operation of the unit and is well written in a straightforward manner. It is also written in English. A schematic is supplied, as are operating voltages, in the event that troubleshooting is required. In fact, the operation of the unit is so straightforward that it can and was put on the air without reference to the manual.

Bad Points

The only undesirable features that I have found with the unit are that it gets very hot in use, and there is no way of removing power from the tube filaments when I want to use it in the receive-only mode. These features can and will be cured by fitting a fan to the top of the unit. A suitable one is that supplied by Yaesu for the FT-101. A small toggle switch can also be fitted to disconnect the tube heaters when required.

Results In Use

On opening the package that arrived by mail, I found that although the Europa is advertised as coming with all cables necessary to put it on the air with an FT-101, that only applies to dc power. There were no rf cables included in the package. The Europa-B uses British television-type coax connectors for the receiver output and transmitter input cables. These are commonly known as Belling-Lee connectors after a well-known manufacturer. As I didn't have any of these connectors, I was stuck. As luck would have it, a local friend did have some of them. Two nights later, the Europa-B was on the air driven by my FT-101.

I worked a couple of stations via OSCAR 6 and OSCAR 7 using a dipole mounted on my balcony. Then, after that, I tuned down to the low end of two to see what was doing there. At about 144.1 MHz, I heard a weak station in QSO. Choosing my moment, I gave him a quick call. He acknowledged my break (the G3 gets them every time) and told me that I was "lots of dB over nine." I could hardly hear him.

Further investigations showed that I was copying signals even though I had a dead MOSFET in the rf stage of the converter. I replaced it with a ubiquitous 40673. Now received signals were much louder and I was able to give out reports of the same order as I was getting. I compared the converter to my "Rochester" one and found that signals were slightly better on the Europa-B. The OSCAR 7B downlink is also pretty good. Later that evening, using only the dipole on the balcony, I worked SSB stations in New Jersey, Maryland, and Pennsylvania, receiving excellent audio reports.

How To Get One

The Europa-B is not readily available over the counter in the USA. It may be ordered by mail from the manufacturer in England and paid for by means of your VISA card, just as if you were ordering the unit by mail from a dealer in the USA. I ordered my unit in this manner and it came within ten days.

The price of the Europa-B is £87.50 complete or £75.00 without the tubes. It is sold without the tubes to let long-time VHF nuts who already have a supply of these tubes (6360s and 5894s, or QQV-03-10s and QQV-06-40s as they are called over there) to upgrade to the Europa-B at a minimum of expense. At the time of this writing, the British pound is worth about $2.00 and is rising. The cost for air parcel post is £7, and US customs will want a few dollars. The postman will collect their share COD.

The Europa-B may be ordered from Solid State Modules, 63 Woodland Road, Solid, Lockwood, Huddersfield, England.

The Europa-B is in use all over the world. In some places, the receive section is never used because there is only one active station on two meters and he is working OSCAR. It is about time that this fine piece of equipment was available and used in the USA. ■

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Zero In on Zero Beat

—an easy-to-make vernier for your tube-type oscillator

The recent article[1] in *73*, with respect to high-accuracy frequency measurements, brought to mind a method developed at W2OLU which is mechanical and somewhat simpler than the CRO technique. While the frequency standard described here is a tube-type affair, the precepts to be outlined apply equally well to all configurations, whether vacuum tubes, transistors, or integrated circuitry.

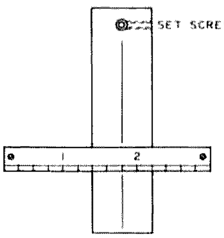


Fig. 1. Actual size of plastic arm in prototype is 5/8" wide, 1/4" thick, and 4" long.

A relatively small trimmer capacitor with a shaft is used for the purpose of "zeroing in" the local crystal-controlled oscillator with respect to the WWV emissions. Since the human ear is unable to respond to audio tones lower than 30 Hertz, we must conclude that there is a no-man's-land, so to speak, of some 60 Hertz. To obtain higher accuracy with respect to true zero beat, some method must be employed to attain this end. Most methods to obtain this require additional apparatus.

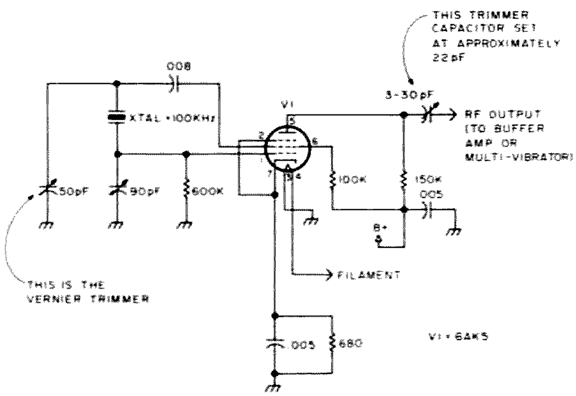


Fig. 2. Circuit of W2OLU, a crystal oscillator with vernier control for frequency variation.

The relatively simple solution outlined will not completely satisfy all purists, but it should enable any home brew artist to improve frequency measurements by several orders of accuracy. Furthermore, it does not require any additions or modifications to existing circuitry.

The shaft of the variable capacitor, having to do with shifting the crystal oscillator frequency, is fitted with a fairly long arm made from some kind of clear plastic. Near one end, a small hole is drilled. In our particular case, this was ¼ inch in diameter in order to fit the shaft of the trimmer condenser involved. Adjacent thereto, at right angles, a small hole is drilled so that a set screw may be installed. Kindly note that this hole must be drilled undersized, and subsequently threaded for the set screw. In our case, a 6/32 screw was used for this purpose.

Next, I scribed a straight line down the middle of the plastic arm. This may be lightly inked in order to form an indicator, or "cursor." This line should appear on the lower or "chassis" side of the plastic arm, next to the fixed indicator strip. This will help to avoid parallax and results in a higher order of accuracy. See Fig. 1.

Underneath the movable arm, I mounted a short piece of ruler which is graduated in fine divisions. General Hardware No. 616 is an ideal candidate for this role. It is relatively low in cost and graduated in fractions of an inch on one side and in hundredths on the reverse. There was insufficient space on the chassis for the entire 6-inch ruler, so I chose to use the upper end of the ruler, leaving the first part, zero to 3 inches, available for other uses.

Now to put the combination to work: With both the receiver and frequency standard suitably warmed up in the interests of stability, the coarse frequency adjustment to zero beat is made, preferably with the ruler-delineated capacitor at the midpoint of the high accuracy ruler. It then becomes a simple matter to move the marker arm slowly back and forth over the ruler. If the first audible tone appears at 16 markers on one side of

what appears to be center frequency, and the opposite direction of the swing arm shows first audibility to come in at 18 units on the ruler, then by averaging the two, e.g., 16 plus 18 equals 34, which divided by two, results in 17, a very close indication of absolute zero beat is obtained. A small plastic magnifying glass, costing about half a dollar, can be mounted over the plastic arm if desired. This will enable these measurements to obtain even greater accuracy.

Several amateurs have asked me where to obtain the plastic strip which is used for the indicator arm. A thorough search of catalogs generally available to amateurs and experimenters showed nothing. The best all-around answer probably will be found in the yellow pages of your telephone directory, under the heading "Plastics—Rods, Tubes, and Sheets." Other sources might be found in the local hobby shop. Possibly the plastic might be salvaged from various items found around the home, some of them broken.

And finally, it is possible to come up with a bare-bones type of indicator arm. This can be made from a piece of wood. Additional components are simple. A 6-32 nut and bolt, a small piece of brass (or two solder lugs), and a small nail or brad, which is used for the pointer. This alternate design can be put together anywhere in the boondocks, so I have named it "The Robinson Crusoe Special."■

Reference

1. "A WWV Primer," Thurber, *73*, August, 1978, p. 84.

Howard Knickerbocker K1DCS
92 Sparrowbush Rd.
East Hartford CT 06108

Andrew Weise N1XN
64 Old Andover Rd.
Hebron CT 06248

Robert Stielau W1WRO/N2XN
20 Hillcrest Ave.
Middletown CT 06457

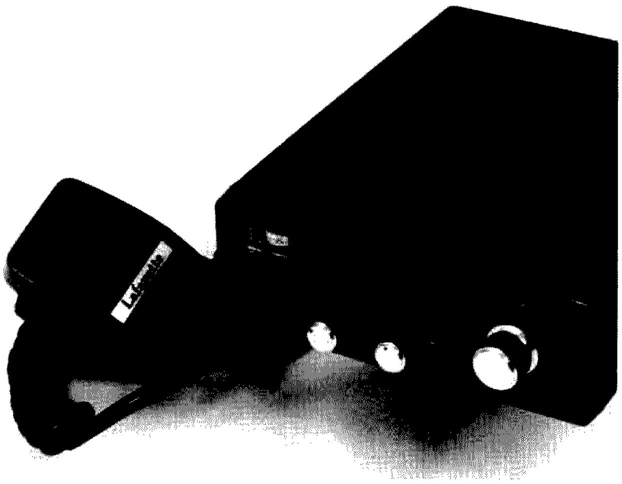
CB-to-10 FM

—best conversion yet?

While in the final stages of writing this article, we could just hear the moans: "Not another CB-to-10 conversion! When will it end?"

But look again; this is CB-to-10 *FM*. Why not try something different as suggested by Steve Herman WA7WYF in his article, "Try FM on 29.6 MHz?"[1] A channelized band complete with repeaters, a national calling frequency, beacons, and long-distance skip exists less than a megahertz above the proposed 10-meter CB-to-10 band.

But what about equipment for 10 FM? The Yaesu FT-901D and the newly-introduced Comtronix FM-80 are the only radios available from amateur manufacturers, so the FM portion of the 10-meter band from 29.0 to 29.7 MHz has long been occupied by a few hearty individuals specializing in surplus commercial 2-way FM conversions.



Front view of converted Lafayette rig. The CB channel switch has been replaced with a 10-position rotary. A pair of 7-segment LEDs have been added for direct frequency readout. Three toggle switches provide display on/off, simplex/repeat, and add 10-kHz to operating frequency.

Many wideband, tube-type boat anchors still live on. Within the last few years, repeaters, remote bases, and beacons have appeared as band occupancy has increased. Unfortunately, 95% of this activity has fallen on the national calling frequency at 29.6 MHz. Recently, a band plan has been generally accepted by those operating on the 10-meter FM band. The national calling frequency at 29.6 MHz is the pivotal simplex frequency. Another simplex channel at 29.5 MHz is included as a secondary direct channel, and four repeater inputs fall at 29.52, .54, .56, and .58 MHz. Their respective outputs are 100 kHz higher at 29.62, .64, .66, and .68 MHz.

You say, "Enough! I'm convinced to try 10 FM, but how do I get on the air?" Until now, the conversion of CB radios to 10-meter FM has been entirely overlooked in the haste to make rapid conversions of amplitude-modulated radios to 28.965 MHz. This article will present a simple method of converting a phase-locked loop Citizens Band radio to a state-of-the-art frequency-programmable narrowband FM transceiver having a 0.5 uV/20 dB quieting receiver and 5-Watt output power transmitter.

The units chosen for this conversion are available from several manufacturers but share the same printed circuit board. Fortunately, these radios are the $30 to $40 "loss leaders" at many discount houses. Recently, large quantities of Hy-Gain PC boards for these transceivers have come on the surplus market[2,3]. They offer all the electronics for this conversion minus front-panel controls, enclosure, microphone, and speaker. They are available in the $5-to-$15 range. A listing of the manufacturers and model numbers are included in Table 1.

Many CB conversion articles apply to early, unobtainable 23-channel

models. An advantage of this conversion is the large number of radios found available. The conversion is basically the same as described by Clay Walsh W1PI[4]. He gives an excellent set of instructions for converting these radios to AM operation. The addition of an FM discriminator and movement of a few wires to frequency-modulate the PLL oscillator are all that is needed to FM the radio.

Phase-Locked Loop Frequency Synthesizer

The following is a description for the existing Citizens Band programming. Understanding this operation is not necessary to accomplish the conversion, but may be helpful during tune-up or trouble-shooting. The heart of the CB transceiver, shown in a block diagram in Fig. 1, is the phase-locked loop frequency synthesizer or PLL. It enables precise, multiple-frequency generation and can be audio-modulated to produce high-quality FM.

The control integrated circuit (IC101) provides three functions. It contains the frequency divider for the reference oscillator, a programmable frequency divider, and the phase-sensitive detector. The three functions of the chip operate as follows. The 10.24-MHz signal from oscillator #3, the reference oscillator, is divided by 1024, providing a 10-kHz reference signal to the phase detector. The programmable divide-by-N counter is programmed (in binary) by nine control lines from the front-panel channel-selector switch. Programming is accomplished by applying positive 5 V dc to the appropriate pin on IC101 through the programming switch. Pull-down resistors are provided internally in the IC to hold the inputs at a logic low level when a line from the programming switch is in an open position. The phase detector compares the outputs of the two counter channels and provides a dc output which is proportional to the phase difference of the digital input signals. The phase detector is analogous to a frequency discriminator in an analog circuit.

During start-up operation of the PLL Q101, the voltage-controlled oscillator (vco), is running at some non-phase-locked frequency in the 40-MHz region. This signal is mixed with the 37.955-MHz from oscillator #1 at Q102 (mixer #1). The difference frequency (approximately 2 MHz) is low-pass filtered and amplified to logic levels by the Q103 stage. The 2-MHz signal is applied to the input of the divide-by-N counter at pin 6 of PLL02A (IC101). The frequency is counted down by the programmed divide-by-N ratio, and the output of this counter is fed to the internal phase detector. This counted-down signal is compared in frequency and phase with the 10-kHz reference signal. If the two signals are not coincident, a dc error signal is generated at pin 5 of IC101 by the phase detector. This error signal will force the vco to

Lafayette rig with bottom cover removed to show printed circuit board mounted. The speaker has been removed to make room.

the correct frequency. The dc signal is filtered by a passive, low-pass filter section to remove the 10-kHz component on the output of the phase detector. Any rf leakage on the dc control voltage would show up as sidebands on the carrier. This dc error, plus an offset voltage, is applied as reverse bias to the varactor diode, D101, which is the frequency-control element

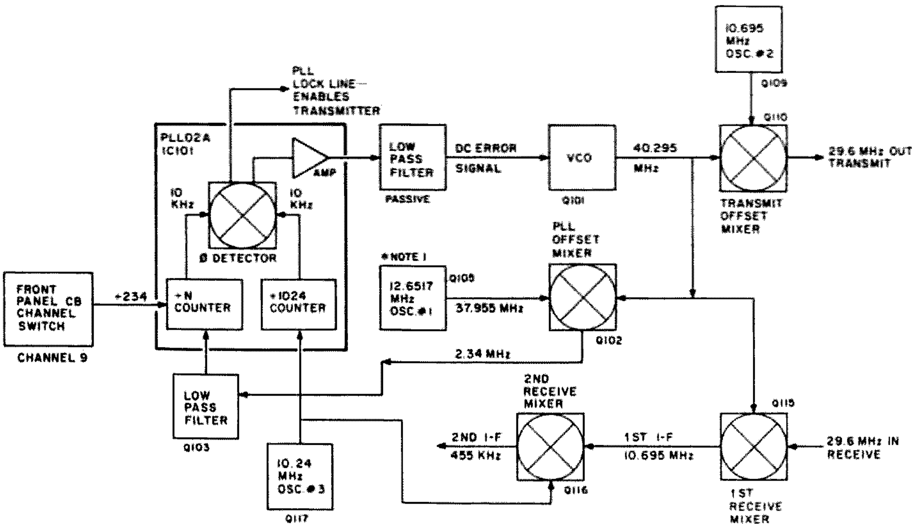


Fig. 1. FM frequency generation block diagram.

of the voltage-controlled oscillator. Transformer T101 makes up the inductive part of the vco parallel-resonant circuit and provides coupling of the vco signal to the rest of the transceiver. T101 is adjusted to keep the tuning voltage on the varactor diode, as measured at TP8, in the 1.5-to-3.5-volt range across the operating band of interest. If the voltage swings beyond these limits, the vco will latch, causing the PLL to lose lock, which also disables the transmitter to prevent out-of-band transmissions.

Transceiver Description

The transceiver has been designed to obtain maximum performance at minimum cost. Fig. 1 shows the frequency-generation schemes for the transmitter and the two receiver local oscillators. An operating frequency of 29.6 MHz is shown for the example. The existing 11.8066-MHz crystal at oscillator #1 has been replaced with one at 12.65167 MHz. The front-panel channel selector switch is set at channel 9. The output of the voltage-controlled oscillator in the PLL is at 40.295 MHz. The programming switch has a divide-by ratio of 234 entered to the PLL control, IC101. During transmit, the output of the synthesizer is mixed with a 10.695-MHz signal from oscillator #2 (Q109). The difference frequency is 29.6 MHz. The transmitter is enabled by the PLL "locked" output and keyed by a switch on the microphone. High-level amplitude modulation is applied from the integrated circuit audio amplifier to the driver and final transmitter transistors. The transmitter has four gain stages and is capable of a power output in excess of 5 Watts into a 50-Ohm load.

The receiver is a dual-conversion superheterodyne with intermediate frequencies of 10.695 MHz and 455 kHz. The received signal at 29.6 MHz is mixed with the frequency-synthesizer output of 40.295 MHz at Q115, the first mixer, to give a difference frequency of 10.695 MHz, the first i-f. The output of this stage is filtered to remove the unwanted sideband and applied to mixer #2, Q116, along with the 10.24-MHz signal from oscillator #3 which was previously mentioned in the phase-locked loop description. The difference frequency is 455 kHz, the second i-f, which is amplified and diode-detected. The detected output is fed to the same audio amplifier used for transmitter modulation, but now the output is coupled to a loudspeaker.

There are many accessory functions in these transceivers, such as squelch, noise limiter, noise blanker, rf gain controls, delta tune, and others. All units, no matter who the manufacturer or what the level of sophistication is, can be updated to include these functions. All the printed circuit boards are identical, so the added functions can be wired into existing holes on the boards and interfaced to the appropriate switches and potentiometers on the front panel. In FM operation, the only two controls

Parts List—Synthesizer Programmer

Item	Description
C1	0.01-uF disc ceramic
C2, 3	15-uF, 35 V dc tantalum, Mallory TDC156MO35GL or equivalent
D1	1N270 germanium diode
Dis. 1, 2	7-segment common-cathode LED readout
IC1	74LS147 TTL 10-line-to-BCD decoder
IC2	74LS04 TTL hex Inverter
IC3	74185 TTL binary-to-BCD decoder
IC4	74LS48 TTL BCD-to-7-segment decoder
IC5	7805 3-pin monolithic, 5-V dc voltage regulator with small heat sink
R1-13	470-Ohm, ¼-Watt composition resistor
R14	10-Ohm, 1-Watt composition resistor
R15	1k-Ohm, ¼-Watt composition resistor
R16	1.5k-Ohm, ¼-Watt composition resistor
S1	2-pole, 2-deck, 10-position rotary switch, Grayhill 44D36-02-2-AJN or equivalent (Rotate rear deck to facilitate wiring.)
S2-5	Miniature SPDT toggle switch, Alco MST-105D or equivalent

Parts List—455-kHz FM i-f strip

Item	Description
C1	15-uF, 35 V dc tantalum, Mallory TDC156MO35GL or equivalent
C2-5	0.47-uF monolithic, Centralab CY20C474M or equivalent
C6	0.01-0.02 uF disc ceramic, selected for proper squelch action
C7	As required to resonate T1 to 455 kHz
C8	22-pF disc ceramic
C9, 10	0.001-uF ceramic
C11	0.005-uF disc ceramic
C12-19	0.01-uF disc ceramic
C20	0.02-uF disc ceramic
C21	0.1-uF disc ceramic
D1, 2	1N270 germanium signal diode
IC1	LM3065 (National) limiter/discriminator, or MC1358P (Motorola) limiter/discriminator, or C6063 (HEP) limiter/discriminator
IC2	MC3403 (Motorola) quad op amp, or SK3594 (RCA) quad op amp, or C6129P (HEP) quad op amp
Q1	2N3904 transistor or equivalent NPN switching type
R1	51-Ohm, ½-Watt composition
R2, 3	560-Ohm, ¼-Watt composition
R4	1.8k-Ohm, ¼-Watt composition
R5-8	2.2k-Ohm, ¼-Watt composition
R9	4.7k-Ohm, ¼-Watt composition
R10	8.2k-Ohm, ¼-Watt composition
R11, 12	12k-Ohm, ¼-Watt composition
R13	15k-Ohm, ¼-Watt composition
R14	39k-Ohm, ¼-Watt composition
R15	100k-Ohm, ¼-Watt composition
R16	1 megohm, ¼-Watt composition
T1	455-kHz miniature i-f transformer

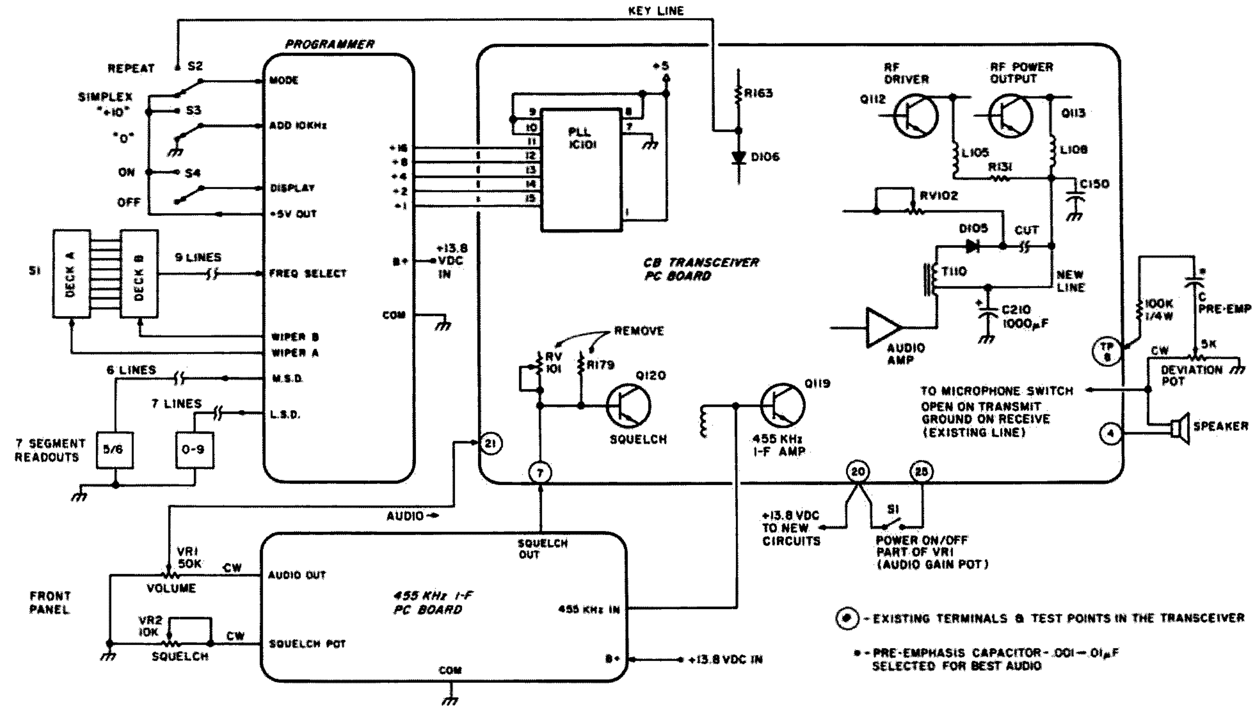


Fig. 2. Interconnection diagram.

which are useful are a noise blanker in the wide-bandwidth section of the receiver and the squelch. Unfortunately, the existing squelch is level activated. This is changed to a noise-activated circuit later in the conversion. The wisest course is to buy the cheapest models since extra features are wasted in the FM conversion.

Transceiver Conversion

The CB-to-10-meter FM conversion is only slightly more difficult than converting a CB for 10-meter AM operation and can range in complexity from a simple bare-bones modification to a deluxe treatment with digital readout and repeater capability. The conversion can be done in stages starting with the basic modification to whet your appetite and adding the additional features as time permits. A warning should be given here. As soon as you have one of these radios converted and operating on 10 FM, you may not be able to turn it off and add the remaining modifications.

Below is a list of four conversion steps with possible options. The steps will be described in detail later in the text. It should be noted that all four steps must be completed, but only one option per step is required.

Conversion Steps and Options

1) Change the vco offset crystal, X101, and retune the transceiver to 10 meters.

2) Modify the transmitter for FM.

3) Modify the receiver for FM.

(a) Slope detect and use the existing level-activated squelch.
(b) Add the 455-kHz FM detector/squelch board.

4.) Select the frequency programming scheme.

(a) Use the existing CB channel-selector switch.
(b) Install thumbwheel BCD programming switches.
(c) Construct the frequency-programming board without the 7-segment LED readouts.
(d) Construct the frequency-programming board with LED readouts.

The above steps are listed in the order in which the first conversion was accomplished. The transceiver was first converted to the high end of 10 meters and tuned for AM operation. The vco was then audio-modulated to produce FM in transmit. The receiver was operated with

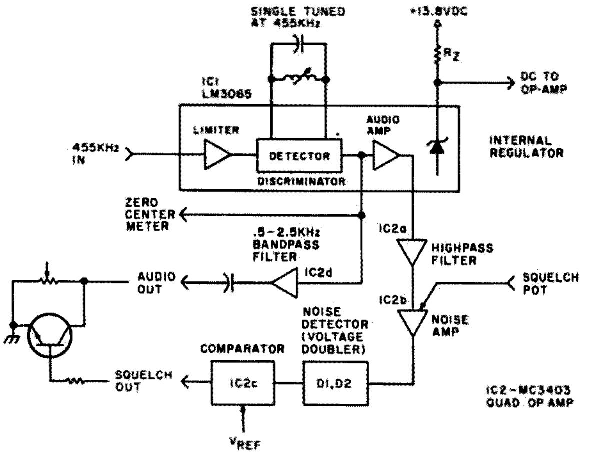


Fig. 3. Block diagram, 455 kHz limiter, discriminator, and squelch PC board.

Model	Manufacturer
2310B	Kraco
4010B	Kraco
2320B	Kraco
4020B	Kraco
Micro 223	Lafayette
HB 650	Lafayette
HB 750	Lafayette
HB 950	Lafayette
#1	Hy-Gain
#2	Hy-Gain
#9	Hy-Gain
Tiger 40A	Pierce Simpson
13-888B	Midland
13-882C	Midland

Table 1. CB transceivers suitable for this conversion.

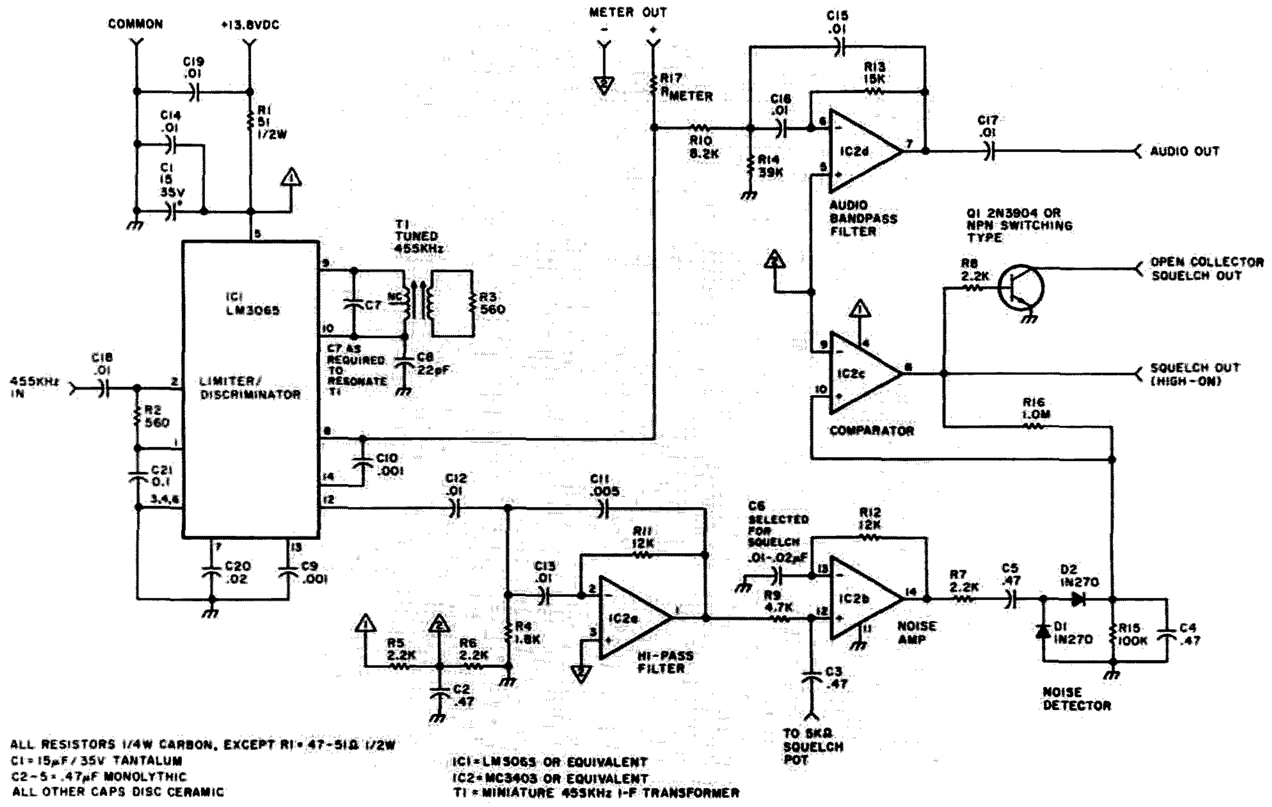


Fig. 4. 455 kHz FM i-f strip.

slope detection on receive; however, this proved to be unsatisfactory. A PC board with limiting amplifiers, FM detection, and noise-activated squelch was developed to provide improved FM reception. The final step was the evolution of frequency-programming techniques.

Step 1. Change the Vco Offset Crystal

Crystal Selection

The offset-crystal frequency is tripled and subtracted from the vco frequency. Thus, to raise the vco operating frequency, one can simply raise the offset-crystal frequency by 1/3 of the vco frequency increase desired. Looking ahead to step 4, one can see that selecting the correct offset crystal is important. If a crystal is special-ordered, 12.65167 MHz is recommended. This will permit later modifications to be made without purchasing another crystal. This crystal puts CB channel 1 on 29.5 MHz. For example, 29.5 MHz is 2.535 MHz higher than channel 1 (26.965 MHz). Thus, X101 is increased from 11.8066 MHz by 2.535 MHz divided by 3, or .845 MHz, to 12.65167 MHz. The transceiver can be operated from 29.5 (channel 1) to 29.690 (channel 16) with 29.6 MHz on channel 9 without changing the CB programming switch.

A crystal in the 37.9-MHz range can also be used for the offset crystal. A source of such crystals is older, crystal-synthesized, 23-channel CB sets. Many of them contain six crystals in the 37.6-to-37.9-MHz range. This is an inexpensive source for conversions using the existing CB channel switch.

Tune-Up

Install the new frequency-offset crystal in place of the 11.8066-MHz crystal at X101. The transceiver tune-up follows.

Vco Alignment

a) Set the frequency programmer to 29.5 MHz, or channel 1.

b) Monitor the voltage between TP8 and ground at the junction of R114 and R115.

c) Adjust T101 to obtain 1.5 volts.

d) Set the frequency programmer to 29.69 MHz (channel 16). The voltage should be approximately 3 volts.

Transmitter Alignment

a) Set the transmit frequency to 29.6 MHz.

b) Connect the output to a 5-Watt, 50-Ohm dummy load.

c) Connect an oscilloscope or receiver tuned to 29.6 MHz to the junction of T102 and C141.

d) Adjust L103, L104, and T102 for maximum signal at 29.6 MHz.

e) Monitor the signal on the base of Q112 and adjust T102 and T103 for maximum amplitude.

f) Monitor the output power for the remaining steps.

g) Adjust L106, L109, and L110 for maximum output.

h) Repeat the above, tuning for maximum power out.

i) Check output frequency and power out at 29.5 MHz and 29.69 MHz (channels 1 and 16).

j) Set the exact operating frequency by adjusting CT101, a trimmer capacitor in the offset-oscillator circuit.

Receiver Alignment

a) Set the receiver frequency to 29.6 MHz.

b) Connect a 29.6-MHz signal source to the input.

c) Adjust T104 and T105 for maximum signal.

Alignment Hints

Care should be taken in tuning these miniature transformers. Make sure you have the correct size non-metallic tuning tool and don't force them. All slugs will tune as you turn counter-clockwise out of the can. Less inductance is

needed at the higher frequencies. If a slug is broken and unremovable, the i-f transformer can be unsoldered from the board and the slug removed from the bottom of the can.

Step 2. Modifying the Transmitter for FM

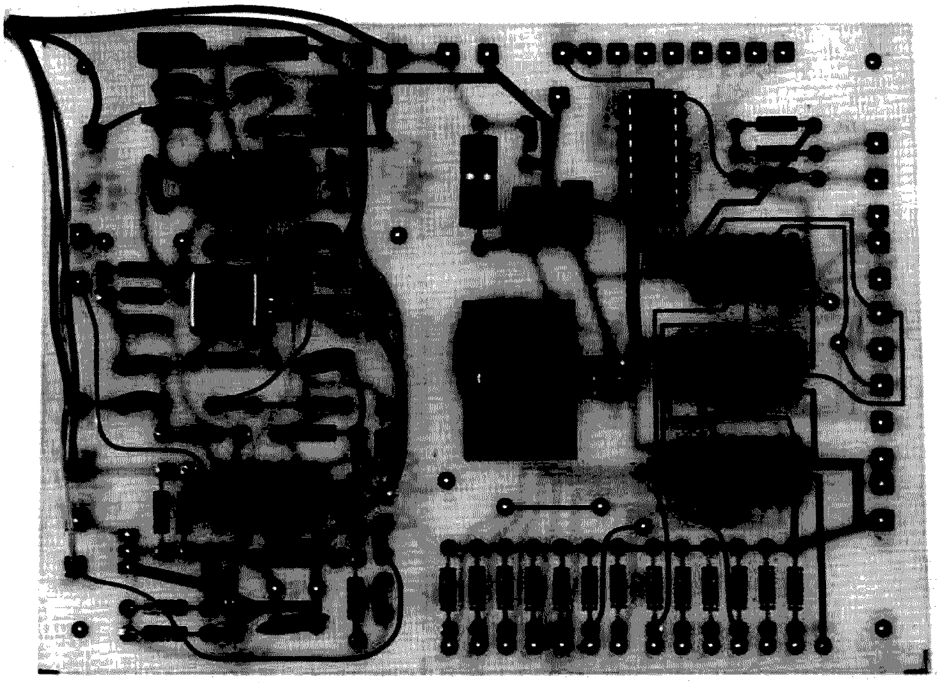
a) Disable the amplitude-modulated power-supply line that feeds the driver and rf power amplifier. This originates at D105 on the high end of the audio output transformer. Cut the circuit board conductor connecting the cathode of D105 to the junction of C150 and R131. Next, connect the junction of C150 and R131 to the positive side of C210, a 1000-uF electrolytic, to obtain pure dc for the transmitter.

b) Introduce FM to the phase-locked loop. Wire the transmit audio circuits as shown in Fig. 2, and drive TP8 which will FM the vco and likewise the output transmit frequency.

Step 3. Modifying the Receiver for FM

a) Slope detection can be accomplished by using the existing receiver delta tune which offsets the receiver frequency. The existing level squelch can also be used, but neither of these techniques can be recommended since all of the reasons for operating on FM are lost if no limiters and noise-activated squelch circuits are employed. The limiter will improve the signal-to-noise ratio and maintain constant volume. The noise-activated squelch will operate only on real signals, muting the receiver for any noise bursts which do exist on 10 meters.

b) The 455-kHz FM detector/squelch board replaces the level-activated squelch and slope detection which were not adequate for useful FM communication. To complete the FM conversion, a PC board consisting of two integrated circuits and 40 discrete components was designed to provide i-f limiting, FM discrimination, receive audio shaping, and a noise-activated squelch control output.



Top view of combination printed circuit board. The i-f strip is to the left and the frequency programmer is to the right. The board can be divided near the middle to separate functions or to make use of just one. The finished boards now have silk-screened component and lead identification.

A National LM3065 integrated circuit was used for the limiter/discriminator section of the circuit.[5] This IC was designed for 4.5-MHz TV sound service, but works well at 455 kHz for NBFM. The IC has an internal temperature-compensated voltage regulator which also is used to provide regulated dc to the remaining portions of the circuit. A Motorola MC3403 quad op amp is the second integrated circuit on the board. It is an excellent choice for this type of service since it is designed to operate from a single-ended power supply. The op amps are functionally equivalent to the standard 741 types.

The block diagram of the circuit board, Fig. 3, shows the major functions of the FM i-f strip. The schematic diagram of the circuit is Fig. 4. The 455-kHz bandpass-filtered signal from the last i-f amplifier in the receiver is applied to the input of IC1. The signal is amplified by three differential limiter stages. The 3-dB limiting point is about 200 microvolts. The FM signal is detected by the internal differential peak detector which is set to the i-f frequency by a single-tuned 455-kHz LC parallel network. Standard miniature i-f transformers were used. The secondary was resistively loaded. We obtained a bagful of transformers from Poly Paks® which were unmarked.[3] Two types were usable. The LF-115 resonates with 100 pF across the primary and the LF-116 with 220 pF. Silver-mica capacitors are recommended for temperature stability in the tuned network.

An output can be taken from this stage to drive a zero-center "frequency" meter. This is useful for netting off-frequency stations. Resistor R17 connects to the positive side of the meter. Resistors R5 and R6 provide a reference voltage at one-half the supply voltage. This point biases the negative side of the meter. The zero-frequency output of the discriminator is nominally at this potential. The meter should be a 100-0-100 uA movement. Potentiometers can be used in place of the fixed resistors to provide for gain and zero-adjust in the meter circuits.

The output of the detector is fed to section 2d of the quad op amp. This is an active bandpass filter with minus 3-dB points of 500 Hz and 2.5 kHz. The audio level at this section's output was sufficient to drive the existing audio amplifier in the CB set to full output. The output of the detector also is fed to an internal audio amplifier with 20 dB

Channel #	÷N Ratio	Frequency (MHz)
1	224	26.965
2	225	.975
3	226	.985
4	228	27.005
5	229	.015
6	230	.025
7	231	.035
8	233	.055
9	234	.065
10	235	.075
11	236	.085
12	238	.105
13	239	.115
14	240	.125
15	241	.135
16	243	.155
17	244	.165
18	245	.175
19	246	.185
20	248	.205
21	249	.215
22	250	.225
23	253	.255
24	251	.235
25	252	.245
26	254	.265
27	255	.275
28	256	.285
29	257	.295
30	258	.305
31	259	.315
32	260	.325
33	261	.335
34	262	.345
35	263	.355
36	264	.365
37	265	.375
38	266	.385
39	267	.395
40	268	.405

Table 2. Channel number, PLL divide-by-N ratio, and original CB operating frequency using the CB programming switch. For both 23- and 40-channel models.

of gain. The output of this stage is high-pass filtered by section 2a of the quad op amp. This signal path is used to amplify the noise component of the input signal. The output of section 2a is fed to section 2b which is a noise amplifier. The input to this stage is attenuated by the squelch-level potentiometer on the front panel to provide the proper squelch level for the receiver.

The output of section 2b is fed to the noise detector consisting of diodes D1 and D2. The detector is configured as a voltage-doubler whose output is filtered by R15 and C4 which also provides a time constant to discriminate against nuisance tripping of the squelch circuit. The detected and filtered noise signal is fed to section 2c of the quad op amp to be compared with the fixed reference voltage developed across the R5-R6 voltage divider. As the receiver is quieted by an input signal, the detected-noise components level falls below the comparison level and the output of section 2d falls to ground level. The output of 2d is at nearly supply voltage when the squelch is on. The squelch action is adjusted by varying the value of C6 so a 2- to 3-microvolt signal cannot be squelched out with the squelch control pot set fully clockwise. A typical value of C6 is 0.01 uF.

The existing squelch transistor can be keyed by the new squelch line or a transistor can be switched to ground potential at the volume-control potentiometer as shown in the block diagram, Fig. 3. Individual preferences determine the placement of the squelch switch in the circuit for the best listening comfort.

To convert the receiver to FM detection, install the FM i-f strip and run 13.8 volts and common to the board. Run a lead from the base of Q119 on the main transceiver to the "IF-IN" connection on the new i-f strip. Disconnect the squelch pot from TP7 and run it to "SQ-POT" on the new pc board. Run a lead from "SQ-OUT" to TP7 on the main board. Remove the lead from the top of the volume control pot to TP19 and run the lead to the "AO" (audio out) port on the new i-f board. A zero-center microammeter can be connected between M-Plus and M-Minus on the new board to monitor the discriminator.

Step 4. Select Frequency Programmer

a) Use the existing CB channel-selection switch with no changes to the transceiver. This requires no effort at all, but has some limitations since the CB switch skips certain frequencies which may be desired. For example, if the 12.65167-MHz offset crystal were to be installed, 29.68 MHz would not be obtainable directly with the CB switch. Since no effort was required for this step, why not look to the other options for more capability.

b) Install thumbwheel, octal, or BCD programming switches. This option requires some additional construction, but permits complete frequency coverage and, with the addition of a second set of programming switches, allows multiplexing transmit and receive frequencies for repeater operation. The switches can be BCD, octal, or individual toggle switches. Fig. 5

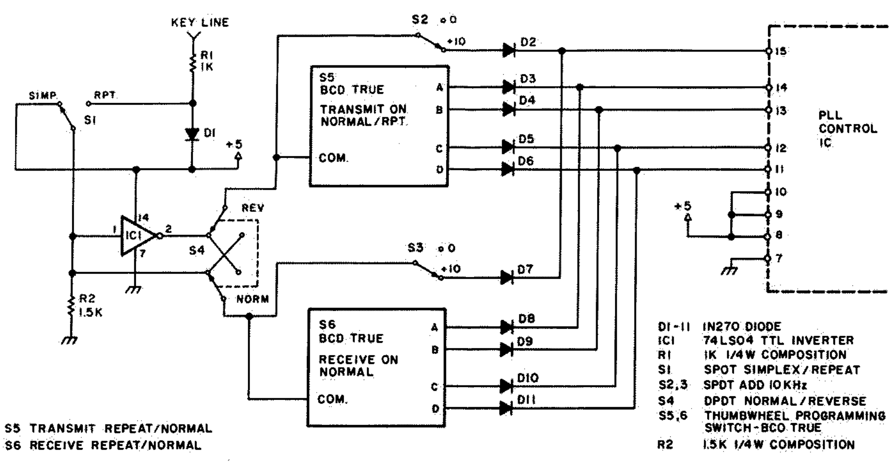


Fig. 5. BCD switch frequency programmer.

shows a programming scheme consisting of separate BCD-coded switches for receive and transmit. A toggle switch is included to add 10 kHz to either frequency. Steering diodes are used to logically OR the outputs of the switches to the PLL input. A key line in the transceiver is sensed to alternate between receive and transmit while in the repeat mode. It will be described in more detail in the following section. This is the simplest complete frequency-coverage scheme, but has a few problems. The non-direct frequency-reading switches, with each BCD digit equaling 20 kHz, leads to confusion. Repeater operation is not automatic. Both switches have to be set.

c) Construct the frequency programming board without LED readout. This step can be accomplished by omitting the readouts and 7-segment decoder chips from step 4d.

d) Construct the frequency-programming board with LED readouts. We finally bit the bullet after going through several generations of simple programmers, and designed a digital encoder that included 10-kHz steps from 29.5 to 29.7 MHz, automatic coverage of all the 100-kHz repeater splits and their reverses, one-switch frequency selection, and a 7-segment LED readout of the operating frequency.

The circuit in Fig. 6 was designed with low-power Schottky TTL. Five integrated circuits, a 10-position, 2-deck rotary switch, and 3 miniature SPDT toggle switches are needed for the design. To make use of this programmer, a 37.955-MHz crystal is used in the offset oscillator (12.65167 MHz × 3). The 5 least-significant divide-by lines are digitally programmed to the PLL control IC. The divide-by-32, -64, and -128 lines are fixed-programmed by connecting them to plus 5 V dc. The divide-by-256 line is disabled by leaving it open or grounding it. A divide-by ratio of 224 is entered to the PLL chip with no input from the programmer. The transceiver operates at 29.5 MHz at this no-input setting.

S1 is the front-panel programming switch. It is a 2-deck, 10-position rotary switch which was modified by rotating the rear deck by 180 degrees. This was done to make the wiring easier. Two single-deck switches could be used if repeater splits of other than 100 kHz are desired. S2 is the simplex/repeat switch. In the simplex position, 5 volts is applied to section F of IC2. This inverts the 5-volt signal to a TTL logic low and applies it to the selected input of IC1 through deck A of S1. This 74LS147 is a 10-line-to-BCD decoder which responds to a low-level signal on one of its inputs. A zero condition is decoded when the 9-input lines are high. No pull-up resistors are needed on the disconnected inputs since they will bias themselves to a high (off) state.

With S2 in the repeat position, the 9-volt transmitter key line in the transceiver is monitored at the junction of R163 and D106. This point is clamped to the 5-volt supply through R1 and D1 to make the signal TTL-compatible. The signal is a logic high in receive and a low in transmit. The logic low signal to IC1 will now toggle between the two wipers of S1, deck A on receive, and deck B on transmit. Each switch position adds 20 kHz, therefore a 100-kHz change is introduced with the 5-position switching in the repeater mode. 100 kHz is subtracted on transmit while receiving above 29.6 MHz and added on transmit while listening below 29.6 MHz. The output of IC1 is inverted from the true high logic needed to program the PLL IC. The 4 output lines are run through 4 sections of the 74LS04 inverter (IC2) to get the signal back to the true form. These 4 lines program the divide-by-2, -4, -8, and -16 inputs to the PLL IC. S3 will add 10 kHz to the operating frequency. It programs the least-significant digit (pin 15) of the control IC.

The plus 10-kHz line from the wiper of S3 and the four inverted outputs of IC1 are run to IC3 and IC4. These are the 7-segment display decoders. IC3 is a binary to BCD decoder. Its most-significant digit appears on pin 4. This output, when in the high state, is equal to an entered count of 100 kHz or more from the programmer, or 29.6 MHz and above. Only two segments of the most-significant digit 7-segment readout need to be changed to go from a 5 to 6. These are segments a and e. The switching to accomplish this change is done by section E of IC2. the least-significant digit (0-9) is decoded by the 74LS48, a BCD-to-7-line decoder.

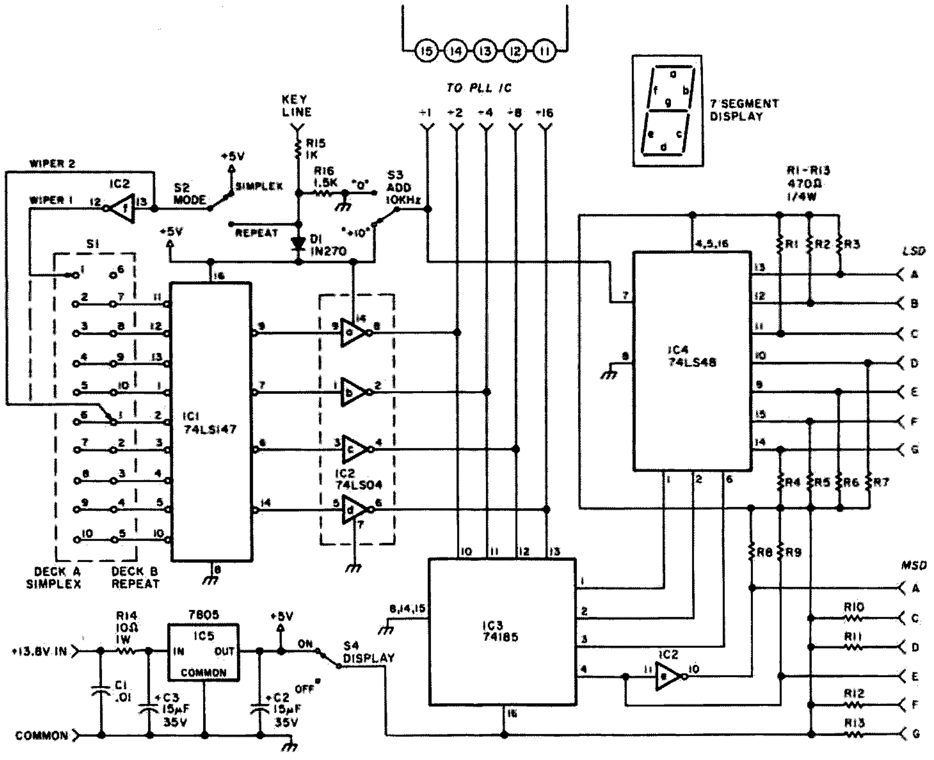


Fig. 6. Frequency programmer.

Since common-cathode 7-segment readouts were used, pull-up resistors are needed on each segment drive line to the displays. A DIP resistor package containing 13 resistors, with one side of each internally connected, could be used to save space on a printed circuit board. All of the logic is static, so there is no digital noise pickup in the receiver. Switch S4 will disable the display electronics as a power-saving measure.

IC5 is the monolithic 3-pin, 5-volt voltage regulator which powers this circuitry. It should be mounted on a small heat sink. Resistor R2 is used for dropping the unregulated voltage to the regulator to keep its power dissipation down. The internal speaker in the transceiver was removed to make space for the two added printed circuit boards. The internal speaker was unusable for mobile work anyway, due to its directionality.

Antennas, Amplifiers, and Such

We placed many of these transceivers in mobile service, so vertical polarization is a necessity in our local operating area. Any of the CB antennas can be used on 10 with some judicious pruning. A favorite of ours is the Antenna Specialists' "Star Duster" series. It is a ¼-wave vertical groundplane type that resonates across the entire 10-meter band by chopping 6 inches from the vertical radiator and each of the groundplane elements. Standard 8-foot whips are used in the mobile installations.

Five Watts of power was not adequate for mobile operation with our New England hills, so we put many CB "trucker special" 50- and 100-Watt, solid-state linear amplifiers to good use in mobile service before the FCC took a dim view of the goings-on at 11 meters. These amplifiers were all of excellent quality, and with the addition of a low-pass section on the output, met all the relevant spurious and harmonic specs.

A Few Closing Comments

Since the spring of 1977, approximately 40 of these rigs have been completed, and we are just scratching the surface of conversion possibilities. This is the first time a modern solid-state, synthesized transceiver has been available for pennies. We hope this article will force a few dormant soldering irons out of retirement.

Let's get some club projects going using these rigs for emergency communications. A split-site portable repeater using a microwave link looks like duck soup. How about a CW Novice rig using the printed circuit boards? A zero-to-30-MHz general coverage receiver, anyone?

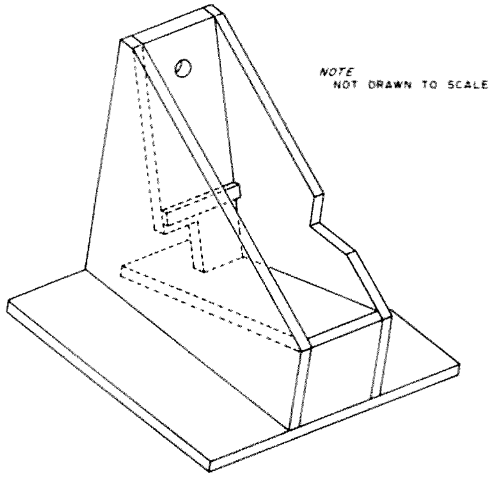
Many thanks to Denny Dittrich WA1VKS[6] for the printed circuit layouts. Denny has combined the i-f strip and the programmer on one PC board to save space and cost. The board is available for $7.00, which includes the postage. See you on 29.6 FM! ■

References

1. Steve Herman WA7WYF, "Try FM on 29.6 MHz," *73 Magazine*, November, 1978, p. 184.
2. Surplus Electronics Corp., 7294 NW 54 St., Miami FL 33166.
3. Poly Paks, PO Box 942, South Lynnfield MA 01940.
4. Clay Walsh W1PI, "CB to 10, Part XII," *73 Magazine*, October, 1978, pp. 254-255.
5. National Semiconductor Corp., *Linear Data Book*, 1976, pp. 10-138 and 10-139.
6. Dennis Dittrich WA1VKS, RFD #3, Box 88, Willimantic CT 06226.

Home-Brew Holders for Icom Portables

—keeps your IC-502, -202, or -215 on the level



Alfred Pacheco KH6IAA
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Hilo HI 96720

The Icom IC-502, IC-202, and IC-215 are popular transceivers. Although they were designed mostly to hang on a strap, many are in use as base station units or portable units on desks, car seats, etc. Operating them as such is difficult enough without having them topple over on their sides at times due to their narrow base width (less than 2-1/2 inches).

A wooden holder (such as shown in Fig. 1) made out of 3/8" pine plyboard makes the units convenient to operate from a desk or car seat because of its wide base width and slanted position. Anyone with even a very little knowledge of woodworking can construct one. Make and put a mike holder on the right side if you care to. Finish the holder with varnish or perhaps flat black enamel paint to match the units.

If desired, one can go further with modifications, moving the holder part to one side of the base board and building a slanted external speaker box alongside to match the holder. Another idea is to build a holder extending further to the right or left to accommodate mounting a key for those units with CW operation capability. ■

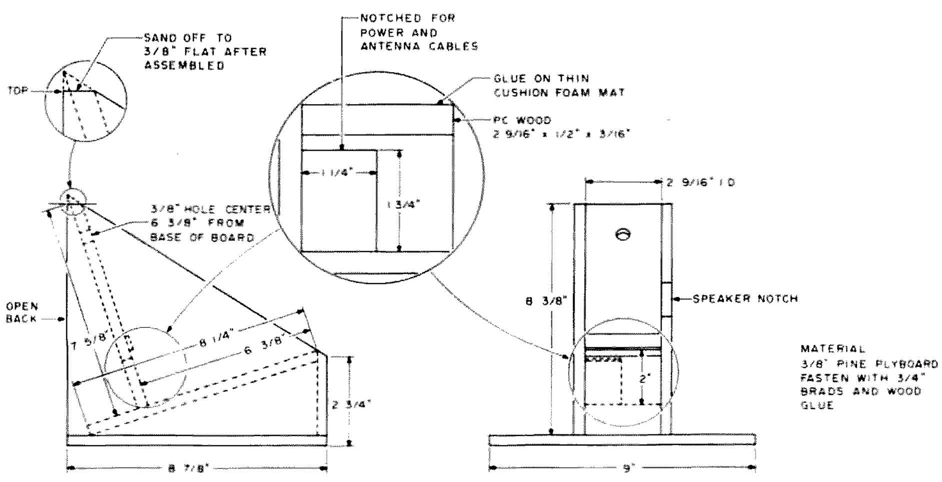

Fig. 1.

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Catch You on the Flip-Flop

—add a handy repeater reverse switch to your Memorizer

The Yaesu FT-227R Memorizer two-meter transceiver is fast becoming one of the more popular rigs heard on the band these days. Like many of its predecessors, it lends itself to many modifications. This modification, the repeater reverse switch, is very simple to install, requiring only a DPDT switch and some wire, yet it greatly enhances the operational capabilities of the rig.

Let me start by explaining what the repeater reverse switch does: It simply reverses the transmit and receive frequencies of the rig when used in repeater operation. For example, when you are using the local .34/.94 machine, you are transmitting on 146.34 MHz and receiving on 146.94 MHz. By throwing the repeater reverse switch, the rig would then transmit on 146.94 MHz and receive on 146.34 MHz.

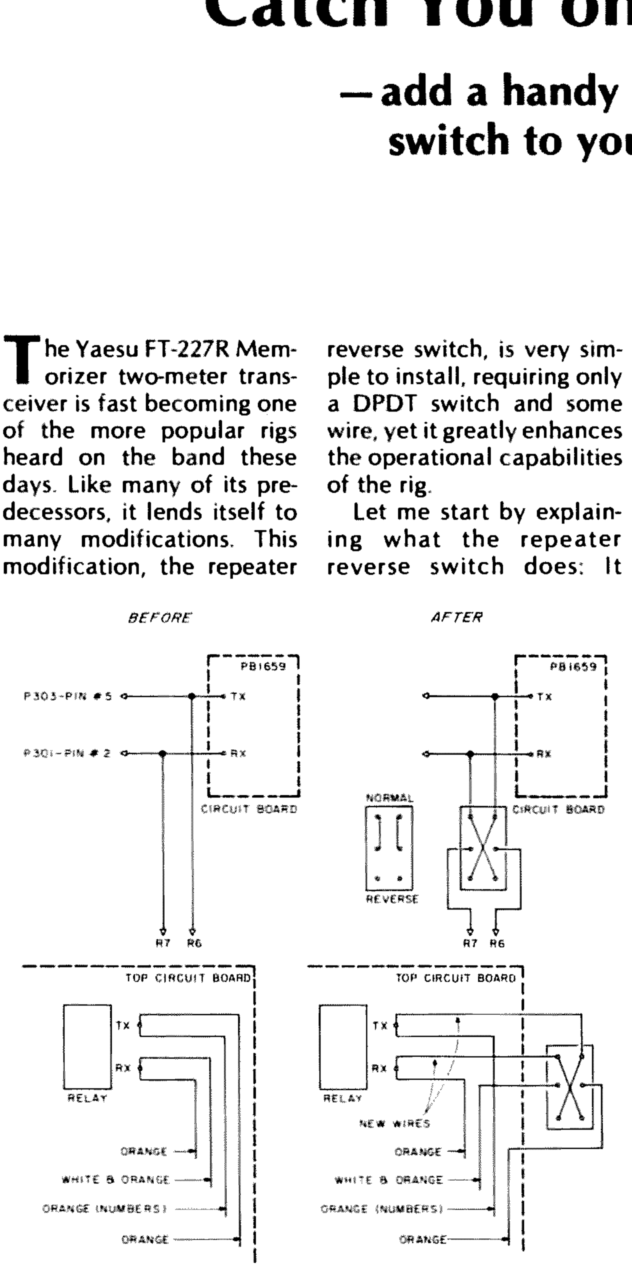


Fig. 1. The top shows how to change your rig schematic to conform to the modification, and the bottom shows wiring.

Imagine the following situation: You are mobile and have just contacted a friend on a long-range repeater, but wish to go to a different simplex frequency to continue the QSO so as not to tie up the machine. Your friend is also mobile, so you throw the reverse switch momentarily to check his input (direct) signal to see if simplex operation is possible. You find that he has a good signal, but before you can get back to him, your long-winded buddy times out the repeater. So you again use your reverse switch and listen direct to the rest of his transmission, never missing a word. Then, for some unexplained reason, the repeater fails to come back on so you leave the switch in the reverse position and transmit back to him direct on his listening frequency and arrange to QSY. He acknowledges, never realizing the machine is out. As you can see, the repeater reverse switch can be a great help to your everyday operation.

But wait a minute, you say; why not just use the memory function of the Memorizer to work repeater reverse? You can, of course, and this would be fine if you use only one repeater. If you use several repeaters as most of us do, you must reprogram the memory each time you change frequencies. This is not only time consuming, it is very difficult, if not dangerous, when working mobile. With the repeater reverse switch installed, you can change to any frequency and switch instantly to the reverse mode. Also, you have the added bonus that the rig's memory is now free to remember your favorite channel.

The electrical operation

of the switch is very simple. The Memorizer's phase lock loop is controlled by a crystal that is selected electrically from six crystals (X301-X306) depending on the position of the 5 UP switch, the function switch, and the T-R relay. This modification simply reverses the crystals selected for transmit and receive. It therefore reverses all frequency combinations that can be selected, including any non-standard repeater pair that is programmed into the memory. Simplex operation remains unaffected.

Prior to wiring up the modification, you should decide where to locate the switch. I mounted mine on the bottom cover just to the right of the meter. In this location it is out of sight and easy to operate. The modification is at dc level, so switch and wire placement should present no problems.

Start by wiring up the switch: Connect two short jumper wires from the terminals at one end to the terminals at the other end—making sure to cross them as shown in Fig. 1—and solder the terminals at one end only. Next, cut a pair of wires approximately 10 inches in length and solder one each to the terminals at the unsoldered end. Now set the switch aside for a moment, and locate the relay on the right rear of the top printed circuit board. Just to the right of the relay are several pins, two of which are marked Rx and Tx. Each has two wires attached: Rx has an orange and orange/white wire while Tx has two orange wires, one marked with printed numbers and one without. Unsolder the orange/white wire from Rx and the plain orange wire (no numbers) from Tx. Pull these two wires out of the cable harness, working toward the front of the printed circuit board, until you have four or five inches of loose wire. Shorten these wires, if necessary, depending on where you have decided to locate the switch, and solder the orange wire to one center terminal of the switch. Likewise, solder the orange/white wire to the other center terminal. It makes no difference which wire goes to which center terminal. Now take the unused ends of the two new wires previously soldered to the switch, cut them to the correct lengths, and solder one to Rx and one to Tx. Again, either wire to either pin. The wiring is now complete.

Next, you must determine which switch position is normal and which is reverse. After briefly checking your wiring, turn the rig on and leave it in the receive mode. Put the reverse switch in either position and leave it. Put the function switch to simplex. Program one frequency of your choice into the memory, and then manually dial up any different frequency, leaving the second frequency showing on the readout. Now, turn the function switch from simplex to MEM. If the readout remains the same, the reverse switch is in the normal position, but if the readout changes to the memory frequency, the switch is in the reverse position.

Now you can correctly label the switch. If you wish to reverse positions, simply reverse the switch center terminal wires, or, if you are using a toggle switch, simply turn it around.

The modification is now complete. I think you will find, as I have, that it makes a good rig even better.■

Personality Plus for your Repeater

—this low-budget voice IDer will really wow 'em

Bob Heil K9EID
#2 Heil Industrial Blvd.
Marissa IL 62257

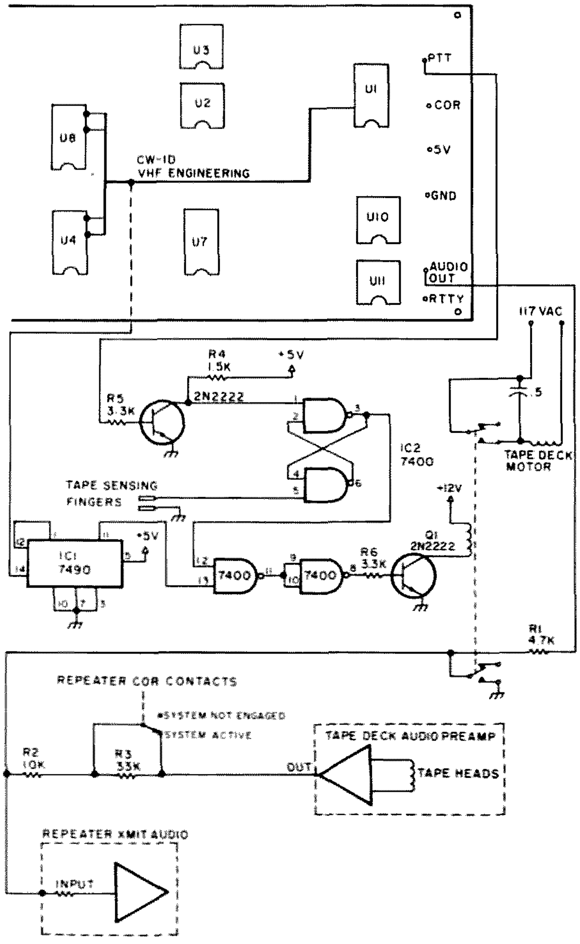


Fig. 1.

All repeater systems in use today are compelled to have some type of identification every three minutes during operation to satisfy the FCC. 99% of these systems use CW idents, generated very easily by CMOS or TTL packages.

Some of the more progressive technical groups are going to great pains to have voice identification instead of the CW, but in many cases there have been disasters in efforts to get the tape machine synchronized and reliable.

This article describes a simple, one-night project that will give a new dimension to your repeater system. It can be built to add on to the VHF Engineering, or similar, CW generation board.

The VHF Engineering CW identifier board produces a "high" pulse every three minutes (or thereabouts, as set by R6). This pulse is picked off at pin 13, output of the U1 flip-flop, and fed to IC1, a 7490 decade counter. If the repeater remains in use for 30 minutes, the U1 flip-flop will have sent 10 pulses to the 7490. On the tenth pulse, gate IC2 will receive proper information to turn on Q1 and turn RLY1 on, which switches OFF the CW audio to the transmitter, turns on the motor of the tape player, and also keeps the PTT line grounded during the duration of the tape message.

At the end of the message, a short piece of metal sensing tape is used to short the two sensing fingers of the tape player to ground, reversing the flip-

flop of IC1, which turns off the RLY1, causing the entire tape system to stop and begin counting those ten pulses produced by the CW identifier.

This gives you a voice identification once every 30 minutes, *if* the repeater remains in use. The length of the message is left up to you, since we use the sensing foil to shut the tape system off.

COR Controls Audio Level

One of the unique aspects of this voice ident system is that the audio fed from the tape heads is fed through R2 and R3. A set of contacts of the COR are connected in such a manner that should someone be using the repeater (meaning the COR would be activated), both resistors are in series with the tape head. If the repeater is not in use (COR de-activated), the COR contacts short out R3.

What this accomplishes is that if someone is talking through the system and the logic brings up the tape message, the audio level of the tape will be 30 dB below the user's own audio. If someone releases the system allowing the COR to de-activate, the tape message will come through the system at full deviation.

Construction

A simple method to properly house the voice ident system is to mount the tape player mechanism and the small PC logic board in a 17" x 3" x 9" chassis. Mount a 19" x 3" rack panel on the front of the chassis. You have the option of making a cutout in the front panel so that the tape cartridge can be changed easily without removing the unit from the rack. (In some systems, the technical crew may want everything totally enclosed, without access to any functions or the tapes.)

Tape Machine

The tape deck used here was purchased from Poly Paks for $12.95. These are excellent units, built by Motorola, which work very well. They have their own preamp audio boards with level controls.

I elected to remove all of that head switching solenoid business and mounted the playback head solid to the chassis. This ensures trouble-free service and more reliable head alignment.

The tape can be a 3- or 4-minute loop with many different 5-second messages. Use a piece of sensing foil at the end of each message. This will shut the system down as the foil passes over the sense fingers. If you had only one message on the 8-track loop, tape wear would be excessive. By using several minutes of tape, a variety of messages can be used and the tape wear will be greatly reduced.

The system has been in use since the spring on the massive Marissa, Illinois, 81/21 system and has been trouble free. The voices used to give the short idents were imitations of John Wayne, Amos and Andy, Henry Kissinger, and many others. These voices were done for the club by Ed Bolton WA8PUN, host of 3920 kHz each evening.

The voice idents add a lot of versatility to the repeater system and take some of the boredom out of its operation. If you or your club are interested, send a #10 SASE for information on a complete kit of parts available from Melco, PO Box 26, Marissa IL 62257. ■

A Better Overvoltage Protection Circuit

— the original was good . . . this version is better

Evert Fruitman W7RXV
2808 W. Rancho Dr.
Phoenix AZ 85017

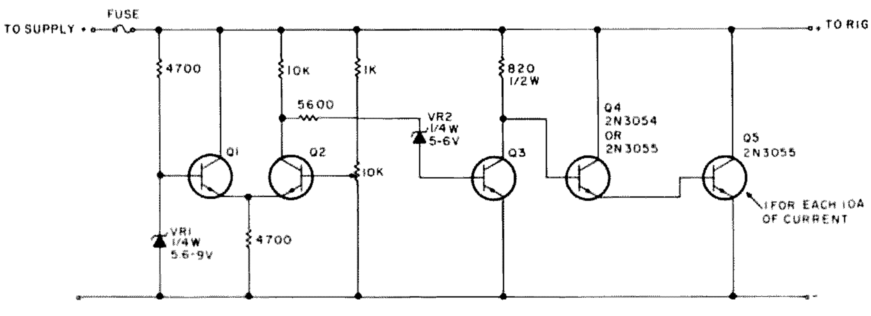


Fig. 1. The original overvoltage protection circuit.

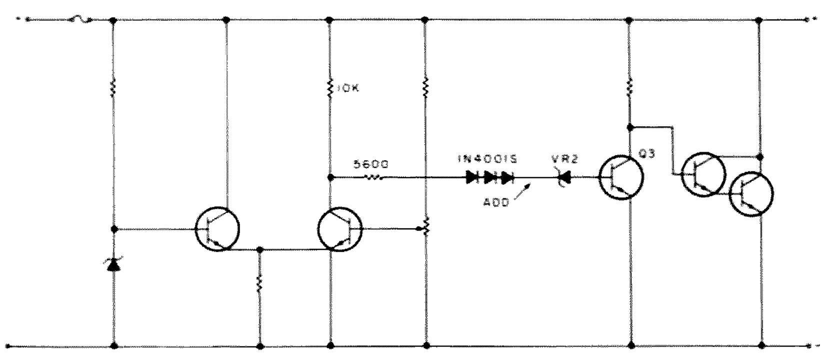


Fig. 2. Improved overvoltage protection circuit.

The following is in response to the requests for more information about the overvoltage protection circuit which appeared in the March, 1978, issue of *73*.

Let me begin by stating that the system was carefully tested *before* it was written up and submitted for publication. Since that time, it has come to my attention that one component could prove troublesome and somewhat improved performance can be obtained by making two rather minor changes.

VR_2 is listed as 5-6 volts and noncritical. However, it is the basis of the abrupt turn-on/turn-off characteristic found in this system. VR_2 suppresses the 5- to 6-volt offset voltage at the collector of Q_2.

At the low current level found in this circuit, the zener diode may not show a sharp enough turn-off

characteristic. This property will be helped along in the right direction by connecting 2 or 3 1N4001s (or other cheap silicon diodes) in series with VR_2 as shown in Fig. 2. An alternative solution would be to use a 6.8- to 8.2-volt zener for VR_2.

If voltage is applied to this circuit and *slowly* increased from about 5 volts to whatever level was intended, the system will malfunction. The voltage set/trip control will exhibit some unusual properties. This malfunction will happen only under the above stated conditions. It may be prevented by making the following simple changes:

1. Disconnect the 10k and 5600-Ohm resistors from Q_2 collector.
2. Disconnect Q_1 collector from B+.
3. Connect Q_2 collector to B+.
4. Connect Q_1 collector to the junction of the 10k and 5600-Ohm resistors that used to be tied to Q_2 collector. See Fig. 2.

At this point you are almost there. As it stands, after completing the above operation, the fuse will clear if the input voltage is *below* the intended set point. In order to correct that malady and finish the project, it is necessary (and highly desirable) to make the final modification.

Disconnect the zener diode, VR_2, from the base of Q_3, and connect it to the base of Q_6 (another 2N3414, etc.). Connect one end of a 1500-Ohm, ¼-Watt resistor to B+, and the other end of it to the collector of Q6 and the base of Q3. Connect the Q_6 emitter to ground. That's it! See Fig. 3.

The initial adjustment is done in the same manner as in the original, and it is very smooth and *very* resettable. This modification was checked out using a power supply that went from 5-25 volts with excellent results. The trip point could be set anywhere from 8 volts to 25 volts and it would consistently fire at the trip point ±0.25 volt.

I do regret any difficulties that may have been encountered in the construction and testing of the circuit. Either version (original or modified) should prove to be a reliable means of protecting your equipment. ■

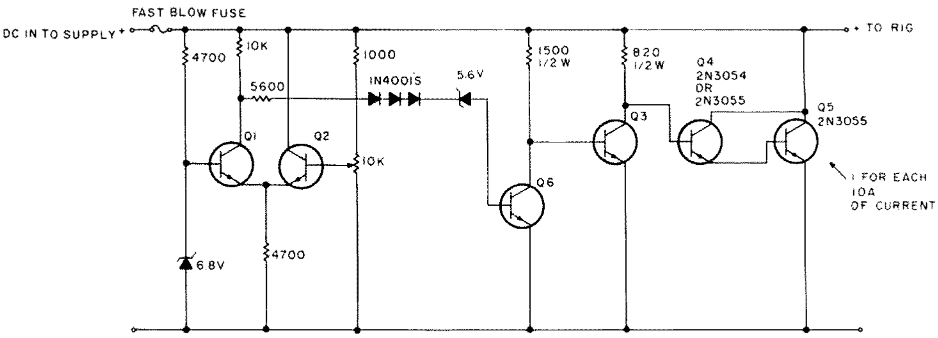


Fig. 3. The final modification.

Contests

from page 24

counted separately. Multi-operators may participate, but each prefix must be listed in the log. Use all bands 80 through 10 meters. The call should be made as "CQ TEST LIONS." Participating Lions or Leos should identify their club name. Only one QSO with the same station in each band will be counted. Phone and CW are counted separately as previously stated.

SCORING:

Score 1 point for QSOs within the same continent, 3 points between different continents. Score 1 extra bonus point for a QSO with a member of a Lions Club or Leo Club and 5 extra bonus points for a QSO with a member of Rio de Janeiro ARPOADOR Lions Club. Contacts between Brazilian stations and members of the Lions Club Rio de Janeiro ARPOADOR will count only 2 extra points. Contacts between members of the ARPOADOR Club will not count any bonus points.

ENTRIES:

One log should be kept for each mode. Each participant will note in his logs the callsign, report, and the sequential number of the QSO. When contacts are made with Lions or Leos, the name of the Lions Club or Leo Club contacted should be clearly identified in the log. Confirmation of contacts will be made by comparing the logs of the participants. Participants should send their log sheets, postmarked by air mail not later than 30 days after the contest, to: Lions Club of Rio de Janeiro ARPOADOR, Rua Souza Lima #310, Apt. 802, Rio de Janeiro 22081, Brazil, South America. Various medallions, trophies, and certificates will be awarded winners in each class, etc.

FREEZE YOUR ARCTIC OFF EXPEDITION

On January 19th, the Ford Tin Lizzy Club, North Metro Chapter, will have the second annual Freeze Your Arctic Off Expedition. The club will be operating from the frozen wastes of Lake St. Clair near the US-Canadian border. Operations will be from 2000 GMT January 19th to 1500 GMT January 20th using the callsign AD8R. Operating frequencies will principally be 7275 on SSB plus 21380 if propagation allows. Also, 2-meter operation will be on 146.52, .55, and .58.

All QSLs will be acknowledged with an 8 x 10 certificate commemorating this event. No SASE necessary; just QSL to Box 545, Sterling Heights MI 48078.

NORTH AND SOUTH AMERICA RTTY FLASH CONTEST

Operating Periods:
1800 GMT January 19 to 0200 GMT January 20
1200 GMT to 2400 GMT January 20

The contest is sponsored by the IATG Radiocommunications and is open to all RTTY stations operating on 80 through 10 meters. The DXCC list will be used for country status except that the VE/VO, W/K, VK, PY, LU, JA, and UAØ/9 call areas will be considered as separate countries. Operating classes include single- or multi-operator stations using a single transmitter and SWLs.

EXCHANGE:

Messages will consist of RST, QSO number, and the station's continent.

SCORING:

Exchange points are as follows: 80 and 40 meters = 1 point per QSO, 20 meters = 2 points per QSO, 15 meters = 8 points per QSO, 10 meters = 12 points per QSO. No points or multipliers are counted for contacts with one's own country. Only two-way RTTY contacts are valid. Multipliers are given for countries and continents worked. A multiplier is given for each country worked on 20 through 10 meters, but no country multipliers are given for 80- and 40-meter contacts. A separate multiplier may be claimed for the same country if a different band is used (max. 3 times). Only countries which appear in at least 5 other contest logs will be valid as multipliers. The continents are also valid as multipliers. For contacts with North and South America, the sender and receiver will each be assigned 100 points as multipliers. 50 points will be assigned for each of the remaining continents as contacted. An additional 100 points will be given for each contact with North and South America on 15 or 10 meters. Final score is the total QSO points times the number of countries times the number of continent points plus the total points for North and South American stations worked. Example: 600 points for total x 10 countries worked x 100 continent points = 600,000 plus 20 stations of North and South America worked on 15 and 10 meters giving a great total of 602,000 points.

Two promotional periods are included in the contest: Saturday, January 19th, from 1900 to 2000 GMT, and Sunday, January 20th, from 2100 to 2200 GMT. Stations operating from Europe, Africa, Australia-Oceania, and Asia contacting North and South America during these hours will *double* their points for these periods.

RTTYers entering logs in this contest who have not participated in previous contests will receive an additional 5% of the final score as a handicap. The contest is open to RTTY SWLs using the same scoring rules.

LOGS AND ENTRIES:

Use one log for each band. Logs must contain date and time in GMT, callsign, RST, number of QSO, continent sent and received, country and continent multipliers, points, and final score. Each station may be contacted only once on any band; additional contacts may be made with the same station if a different band is used. In order to qualify, all logs must be received no later than February

Results

RESULTS OF THE 1979 FRENCH CONTEST

Call	Points	QSOs
CANADA—CW		
VE1MX	159,238	157
VE1AIH	90,288	104
VE2WA	8,712	37
VE3DAP	214,964	179
VE3KZ	59,092	89
VE6LU	30,618	77
VO1KO	189,635	167
CANADA—PHONE		
VE2RV	1,542,752	737
VE2AFC	145,137	149
VE2EML	30,078	61
VE3KZ	1,592,730	605
VE3BR	5,400	20
VE4SW	8,100	30
VE7VP	35,345	68
log: VE1AIH		
USA—CW		
K1SA	343,360	245
W1BWS	51,220	83
WA1FCN	29,798	65
W1OPJ	2,040	17
W1PWK	819	9
W1CFZ	490	7
K2SX	323,175	212
W2GKZ	41,528	73
K2MQ	31,878	78
K2PF	22,770	52
W2NCG	22,386	54
W3ARK	328,600	222
W3HDH	105,892	120
K3NR	29,100	61
N3RL	640	8
WA4OML	104,960	128
WB4ENI	101,994	116
W4UNO	66,654	98
WB4YGL	3,888	25
N6AW	55,575	89
N6TW	2,002	15
N6OB	90	3
W8UVZ	284,994	210
N8DE	240,909	186
W8DSO	55,815	96
W8VSK	8,060	31
K8NMG	3,360	21
W9OA	302,085	228
K9FD	56,792	93
WBØGOB	54,780	83
WØWDW	10,730	37
USA—PHONE		
WB1CRG	25,080	57
W1BWS	3,570	21
F2YS/W2	501,835	304
K2JFV	129,612	155
KB2DE	41,440	74
HI3DJP/W2	11,070	41
W2QKJ	7,752	33
W2UL	1,680	14
N4NX	75,190	103
W4KMS	39,200	70
WA4AXT	27,280	88
WB5MSU	1,200	12
W6HX	68,884	102
N6TW	720	9
N7DF	12,383	43
KA8BAC	52,780	91
WA9FZQ	109,736	129
W9OA	105,469	118
K9HDE	79,725	107
W9QWM	16,502	48
WØCDC	13,200	40
WØPKO	1,820	14

20th. Send logs to: Prof. Franco Fanti, Via A. Dallolio n 19, Bologna 40139, Italy. For SWLs only, the same station is valid only one time on all bands.

AWARDS:

Grand prizes are reserved for the four first place winners. Consolation prizes along with medals and certificates will also be awarded. Remember that this contest is valid towards the final standing of the 5 Continent World Championship.

FRENCH CONTEST
CW
Starts: 0000 GMT January 26
Ends: 2400 GMT January 27
Phone
Starts: 0000 GMT February 23
Ends: 2400 GMT February 24

This contest is open to single-operator stations only and all contacts must be made with French countries (see list below).

EXCHANGE:

RS(T) and sequential QSO number.

SCORING:

Score 3 points per QSO within the same continent and 10 points per QSO with another continent. Multiplier is the number of French units from the list below on each band. Final score is total QSO points times the total multiplier.

ENTRIES:

Logs must be sent with a recap sheet; all multipliers should be listed for checking on each band. Entries should be mailed to REF French Contest, sq. Trudaine 2, 75009 Paris, France.

FRENCH UNITS:

95 French departments (2 figures). DA1/2 station of F forces in DL. French overseas countries – Mayotte FH, Reunion FR, Europa FR/E, Juan de Nova FR/J, Glorieuses FR/G, Tromelin FR/T, Guyane FY, St. Pierre et Miquelon FP, Martinique FM, Guadeloupe FG, St. Martin FG, St. Barthelemy FG, Clipperton FO, New Caledonia FK, I. Loyaute FK, Chesterfield FK, Wallis FW, Futuna FW, New Hebrides YJ, I. du Vent FO, I. sous le Vent FO, I. Australes FO, Rapa FO, Marguises FO, Gambler FO, Touamotou FO, Terre Adelie F/FB8Y, Kerguelen FB8X, St. Paul et Amsterdam FB8Z, I. Crozet FB8W.

CLASSIC RADIO EXCHANGE
Starts: 2100 GMT Sunday, January 27
Ends: 0400 GMT Monday, January 28

The contest is sponsored by the Southeast ARC of Cleveland, Ohio, and is open to all amateurs. The object is to restore, operate, and enjoy older equipment with like-minded hams. A classic radio is any equipment built since 1945 but at least 10 years old, an advantage but not required. The same station may be worked with different equipment combinations and on each mode on each band. General call is "CQ CX" on CW and "CQ Exchange" on phone. Non-contestants may be worked for credit.

EXCHANGE:

Name, RS(T), state/province/country, receiver and transmitter type, and other interesting pleasantries.

FREQUENCIES:

CW – up 60 kHz from low band edges.

Phone – 3910, 7280, 14280, 21380, 28580.

Novice/Tech – 3720, 7120, 21120, 28120.

Listen on the half hour to 20 for coast-to-coast DX and on the three-quarter hour on 15.

SCORING:

Add the numbers of different transmitters, receivers, and states/provinces/countries worked on each band. Multiply by total number of QSOs on all bands. Multiply that total by the classic multiplier: the total years old of all transmitters and receivers used with 3 QSOs minimum per unit. For transceivers, multiply the years old by two.

ENTRIES:

Send logs, comments, anecdotes, etc., to: Stu Stephans K8SJ, 1407 Hollywood Rd., Sandusky OH 44870. Include an SASE for copies of the *Classic Radio Newsletter* and results.

Awards

from page 18

(USKA).

Walter Blattner HB9ALF writes to present us with their awards program in more detail.

HELVETIA 26 AWARD

This award has been instituted by the Union of Swiss Short Wave Amateurs (USKA) with the object of furthering friendly relations and the competitive spirit between its members and radio amateurs abroad.

Foreign amateurs must submit QSL cards showing evidence of contacts with stations in each of the 26 cantons and half-cantons of the Swiss Confederation on any bands between 1.8 and 30 MHz.

All contacts claimed must be made on or after January 1, 1979. Crossmode contacts will not be valid. Awards will be offered for all phone, all CW, phone/CW mixed mode, radioteletype (RTTY), and slow-scan television (SSTV).

QSL cards submitted must clearly show the location (canton) of the Swiss station at the time of contact. Any QSL card from a Swiss station operating from a temporary or portable location at the time of the contact must show the canton of such location in order to be recognized as a valid contact.

In addition to QSL cards, applicant must submit a signed list of all contacts in alphabetical order by canton. Include the station's callsign, date and time in GMT, band and mode of operation, and RS(T).

The 26 cantons are as follows:

AG	Aargau
AI	Appenzell Inner Rhoden
AR	Appenzell Outer Rhoden
BE	Berne
BL	Basle Country
BS	Basle City
FR	Fribourg
GE	Geneva
GL	Glarus
GR	Grisons
JU	Jura
LU	Lucerne
NE	Neuchatel
NW	Nidwalden
OW	Obwalden
SG	Saint Gall
SH	Schaffhausen
SO	Solothurn
SZ	Schwyz
TG	Thurgau
TI	Ticino
UR	Uri
VD	Vaud
VS	Valais
ZG	Zug
ZH	Zurich

Applications for the award must have sufficient postage enclosed in the form of IRCs to allow the safe return of your QSL cards.

Mail your application to the attention of: Walter Blattner HB9ALF, PO Box 450, 6601 Locarno, Switzerland.

The awards custodian for the Newark News Radio Club, WB2MRA, sent me information regarding their new State Capitals Award. This award is not to be confused with the State Capitals Award being offered by the 3.905 Century Club Net.

STATE CAPITALS AWARD

The Newark News Radio Club of Newark, New Jersey, takes pleasure in announcing its sponsorship of the SCA – State Capitals Award – which is available to licensed amateurs throughout the world for working stations located in state capital cities of the United States on or after January 1, 1960. This award is also available to shortwave listeners on a "heard" basis.

The purpose of this award is to offer recognition for operating achievements and to offer still another worthwhile contribution to the field of competitive radio amateur operation.

It is hoped by the directors, officers, and members of NNRC that amateurs everywhere will accept the award as a gesture on the part of the sponsor to further promote and expand goodwill and better understanding among amateur operators and shortwave listeners.

The State Capitals Award is offered in three (3) classes: Class C – work 30 state capital cities; Class B – work 40 state capital cities; Class A – work 50 state capital cities.

There are no band or mode endorsements. Crossmode contacts will not be valid.

To apply, applicants should prepare a list of contacts claimed, listing them in alphabetical order by US state. Include the usual logbook information for each contact. Have this list verified locally by two amateurs, a local radio club

secretary, or a notary public. Do not send QSL cards. Have your verified list sent along with the $1.00 award fee to: S. J. Knox WB2MRA, 212 North Jerome Avenue, Margate, New Jersey 08402.

Checking my files, I find that information about foreign DX award programs outnumbers that of the domestic type four to one. Stateside clubs, societies, and organizations are encouraged to utilize this no-cost service to publicize your awards program. As you know, thousands of amateurs join our ranks annually and most are not aware of the various operating incentives available to them. It is the intent of this column to share the many achievement programs the amateur community has to offer. Why not research your local area. Perhaps your club doesn't sponsor an award. Maybe this is an area you might consider to bring worldwide recognition for your fraternity and help build your club's treasury.

As you know, January 1st marks a new year. Those pursuing the *73* Awards Program realize all contacts claimed for the *73* DX Country Club and the Worked All USA Award are based on a single calendar year. Get in on the ground floor and pursue these operating incentives and be the first in your area to proudly possess the beautiful awards being sponsored by the editors of *73 Magazine*.

We now have a supply of *73 Magazine* Awards Program booklets on hand. Send for your copy today. Be sure to enclose a large SASE with your inquiry. See you next month. Continue to climb the ladder of recognition.

Corrections

Please note the following corrections to "The MICROSIZER: Computerized Frequency Control," which appeared in the October, 1979, issue.

Parts List:

•C35 was listed as C31—there is no C31.

•R46, R26, and R33 are missing; they should be 10k, ¼ Watt.

•R40 was listed as 4.7k; it should be 1.5k, ¼ Watt.

•CR10 was listed twice.

•U10, U11, U12, and U13 are missing; they should be CD4510s. CD4029s can be used if power-up reset to 0000 is not required.

•C24 was listed as .47; it should be 47 μF.

•The values for U17 and U18 were interchanged.

Fig. 6:

•The unmarked IC in the lower right-hand corner is U14.

•The unmarked resistor between U16 and U15 is R34.

•The unmarked resistor between U7 and U15 is R32.

•R33 should be mounted in holes directly above pins 13 and 11 of U15. Note that the "Z"-wire placement in Fig. 7 shows "Z" wires here—this is incorrect.

•The heat-sink tabs on U17 and U18 are shown on wrong side. In and out leads are correct.

Fig. 7:

•In addition to the above problem, nine "Z" wires were omitted. The correct layout is shown here.

Additional notes:

•Jumper U16-4 to U10-12 on the back side.

•Connect the top and bottom sides of the PCB together with pieces of wire, using 4 pieces on each side.

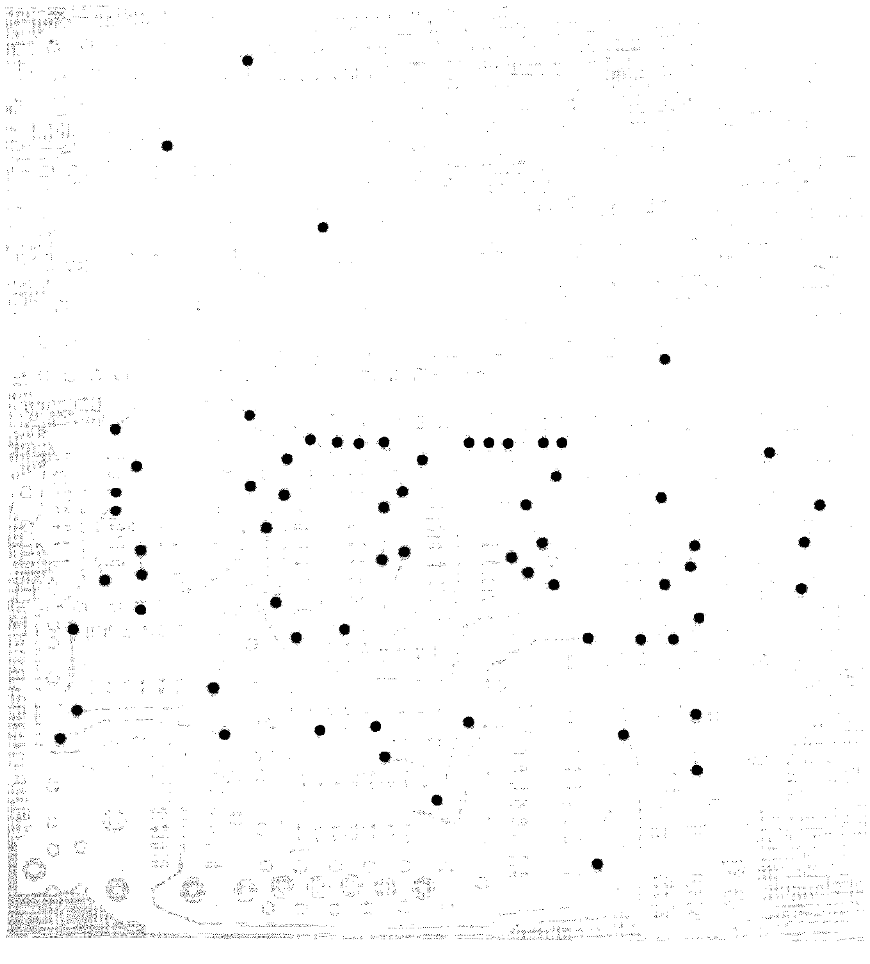
•There are two unused pads: One is to the right of U12-16 and the other is just above the left pad for jumper 9.

•All drilled holes are #65. Some may need to be slightly enlarged to accommodate variations in certain component leads.

•Make sure there is a good ground between MICROSIZER and transceiver; otherwise, some roughness of the CW note may occur.

•R43 should be adjusted to give vfo injection at the same level as the internal vfo. Too much level will cause spurious response problems.

Fred Studenberg W4BF
Tampa FL



Revised Fig. 7, "The MICROSIZER."

I would like to point out some items that need correcting in my article "Yes, You Can Build This Synthesizer!", which appeared in the October, 1979, issue.

There are four parts on the PC board layout on page 61 which have the incorrect values marked on them. R8 (180Ω) is correctly listed in the schematic and parts list, but is incorrectly shown as 270Ω on the parts layout. R22, located to the left of the 4059, is marked as a 2.2k; it should be a 1.8k. R19, located to the right of the 4001, is marked as a 270Ω; it should be 180Ω. Finally, C42, located in the lower right-hand side of the board, is marked as a 33 μF; it should be a 2.2 μF.

Z4 is incorrectly drawn in the schematic as a quad NAND gate; in reality, it is a quad NOR. However, since all of the gates are used as inverters, a CD4011 will also work as a pin-for-pin substitute.

I have also received numerous inquiries concerning the availabilities of the PC board and Y3, the 26.667-kHz crystal. Both items are available through me for fifteen dollars apiece.

Michael Di Julio WB2BWJ
Maplewood NJ

New Products

from page 26

first to offer "Soft Partitioning"™ of the memory unlike the "hard partitioning" utilized in all other keyers. "Soft Partitioning" means no wasted memory space. All of the memory can be allotted to one message location, or it can be divided up into as many as ten locations.

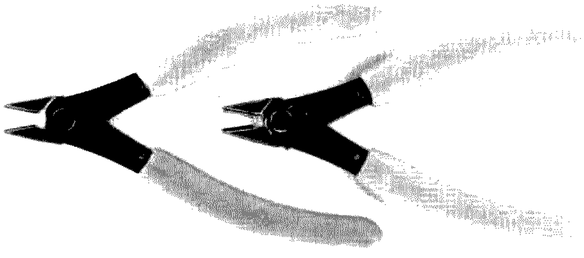
The memory can be loaded in automatic mode for perfect message formatting or it can be loaded in the real-time mode for individualizing a message. Memory can also be loaded in the automatic keyer mode (any dot and dash ratio) or in the semi-auto (bug) mode. Any message can be played back with any selected dot and dash ratio. Hence, the user can send a sloppily loaded bug mode message back with perfect 3-to-1-dash-to-dot ratio. Conversely, a perfectly loaded 3-to-1 dash-to-dot ratio message can be replayed later with as much as an 8-to-1 dash-to-dot ratio (sounding like a bug).

The MorseMatic can be used to key the transmitter for tuning purposes. The operator need only hit any keypad button or the key paddle to defeat the tune mode.

Editing a memory loading mistake is a simple task. If you are near the end of loading a message into memory and a mistake is made, it only takes seconds to erase the mistake and then continue with an error-free message.

The MorseMatic includes a sophisticated Morse trainer. It is the only trainer that will automatically increase the speed of the practice characters so that your brain is "fooled" into thinking it is still copying the starting speed.

For further information, contact *Advanced Electronic Applications, PO Box 2160, Lynnwood WA 98036; (206)-775-7373.* Reader Service number A94.



OK's new mini-shears.

POCKET SHORTWAVE RECEIVER

Measuring only 45 mm W x 73 mm H x 25 mm D, the Model EP-8 is believed to be the smallest AM/SW 2-band receiver available in the US. In addition to the standard "broadcast" band (AM), the Model EP-8 receives shortwave frequencies from 3.9 to 12 MHz (ideal for receiving WWV time signals on 5 and 10 MHz). Controls include a band-select switch, tunable dial for AM and SW, and volume control coupled with an ON-OFF switch. Audio output is via the supplied earphone only, and the receiver is powered by two hearing-aid type batteries (included).

The Model EP-8 has built-in ferrite rod antennas for both bands. While shortwave reception is satisfactory for powerful stations such as the BBC, Radio Canada International, Radio Nederland, Deutsche Welle, and others, better SW sensitivity can be obtained by placing the receiver near a telephone or ac line outlet. No direct antenna connections are necessary.

For further information, contact *Radios International, PO Box 6053, Richardson TX 75080; (214)-784-0862.* Reader Service number R39.

MINI-SHEARS

OK Machine and Tool Corporation has introduced two new flush-cutting mini-shears. Model MS-20 features a handy safety clip which retains cut leads, preventing them from flying and injuring the operator or contaminating the work. Model MS-10 is identical except that it has no safety clip. Both will shear component leads up to 16 AWG as well as wires as small as 30 AWG. The shears feature precision hardened and ground jaws for long life as well as comfortable cushioned grips to minimize operator fatigue. For further information, contact *OK Machine and Tool Corp., 3455 Conner Street, Bronx NY 10475.* Reader Service number O5.

KEYER ADD-ON PROVIDES PRACTICE AND MEMORY

An add-on accessory provides both random code practice and message storage for the Curtis Electro Devices EK-480 series. Called IM-480, this device will automatically send Morse code in random groups at speeds from 6 to 50 wpm. It also allows variable extra spacing between letters and groups to allow slow-speed copy with letters being formed at a higher speed. This feature enhances learning in the 6-10 wpm beginners range. A meter display of code speed allows accurate speed settings.

The IM-480 also includes a message memory function yielding four messages of approximately 32 characters each with an automatic repeat function. The messages are programmable from the paddle key on an asynchronous basis.

The IM-480 is the same size as the EK-480 (7" x 4½" x 2½"); the two units attach via a short length of 14-pin-DIP plug-terminated ribbon cable. Use of the Curtis 8046 and 8047 LSI ICs allows the compact packaging.

For further information, contact *Curtis Electro Devices, Inc., Box 4090, Mountain View CA*

Radios International's EP-8 shortwave receiver.

Curtis Electro Devices' IM-480.

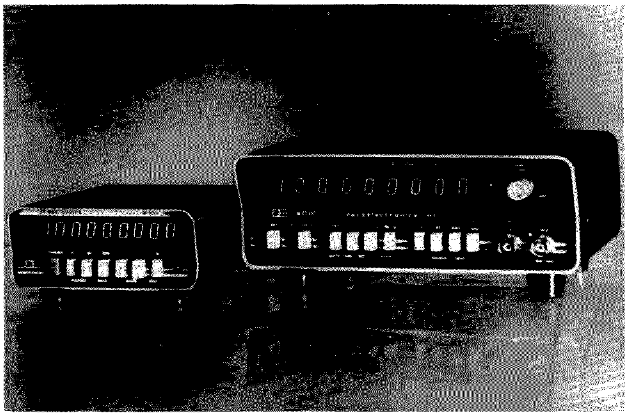
94040; (415)-494-7223. Reader Service number C90.

THE MODEL 299 TALKING COUNTER

The Model 299 Talking Counter from Ten-Tec is a self-contained frequency counter, speech synthesizer, and audio amplifier/speaker system which enhances operating convenience and pleasure for the blind ham operating in the HF spectrum. It can be used with any HF transceiver, analog or digital, or with any VHF transceiver with an appropriate prescaler. Also, it can be used with any signal generator below 22 MHz as a test instrument. When used with Ten-Tec transceivers employing a 9-MHz i-f, special built-in presets allow proper megahertz readout of the operating frequency, even though the counter is reading vfo output. The Model 299 will be available in February. For further information, contact *Ten-Tec, Inc., Sevierville TN 37862.*

TWO NEW HIGH-PERFORMANCE, LOW-COST FREQUENCY COUNTERS

Brand new from Optoelectronics, Inc., are the Model 7010 series miniature 600-MHz counters and the Model 8010 series 1 GHz/1.3 GHz counters. Both units include features such as rf-shielded, black anodized aluminum cases, 9-digit resolution, 1 ppm TCXO or (optional) 0.1 ppm precision TCXO 10-MHz timebases with external clock input, .4" red LED digits, and excellent sensitivity. 50-Ohm input sensitivity on the 7010 series is 5-40 mV from 25 MHz to 600 MHz; on the 8010 series it is 5-25 mV from 25 MHz to 1 GHz. Both units are offered with self-contained (optional) rechargeable nicad battery packs.



Optoelectronics' new counters.

For additional information, contact *Optoelectronics, Inc., 5821 NE 14th Avenue, Ft. Lauderdale FL 33334; (305)-771-2050/1, (800)-327-5912.* Reader Service Number O3.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

When I heard about the EIA plan to try to take the amateur 220-MHz band away and make it a CB band, I contacted Andy and talked with him about it. I told him I thought it was pretty crummy, him being an amateur and the head of one of the largest of the ham manufacturing firms, to bankroll the loss of a ham band. He said that business was business and that, after all, amateurs were not using the band, so if he didn't get it away for CB, some other service would grab it. He pointed out that we were weak because we had no lobby, such as the EIA, that money talked when it came to government, and that they had support from people at the highest level of the FCC for this move.

I countered, suggesting that we push for a code-free ham license for 220 MHz and thus keep it a ham band, rather than lose it permanently to CB. He felt that would be too restrictive, that they would settle for nothing less than CB for 220 MHz and thus be able to sell millions of people another radio. With the amateurs having virtually no clout in Washington, he felt it was just a matter of time before they got 220 MHz for CB.

There was no way to really write about this plot and name names, so I mulled it over and decided to go about this obliquely. First I put together a petition for a code-free ham band at 220 MHz and filed that with the FCC. I figured that the firms behind the 220 CB push would at first reject this, but if I could bring enough pressure, perhaps they would support it and this would serve the dual purpose of saving the band for hams and also act as a nice entry level experience for new hams. And we certainly did need new hams at this time (1969).

Next, when the EIA proposal for 220 CB was filed, I got after my friends in Canada and Mexico and got them to put on the pressure for a rejection of the plan on the basis that it would interfere with their amateur operations across the border. This was a key approach because this band was designated as amateur with ITU and thus our government would have to be sensitive to the complaints from other governments if we were proposing a non-permitted use for the band.

Despite the high level support within the FCC claimed by Andy, the protests of Canada and Mexico did in fact cool the CB proposal . . . a bit.

The manufacturers who were involved with this situation were convinced that the EIA had it made. If you remember, Regency came out with a 220-MHz transceiver. Well, this was not really for amateur radio; this was for CB. And ditto several others (Cobra, Midland, etc.) which appeared at that time. I was invited to visit Regency to preview the 220 rig and the president of the firm was willing to make a very substantial bet with me that the FCC was going to okay the 220 CB proposal soon. He already had the expense of the 220 ham rig on the line, so I decided not to venture any bets.

Things cooled a little bit more when the chairman of the FCC left and went onto the Nixon White House staff. Then we found pressure building up shortly after that via the White House Office of Telecommunications Policy. This obviously was pressuring the FCC, so I called the OTP and said I would start making a big stink over the White House connection if they didn't pull back. I don't know whether that did any good or not, but the pressure did seem to abate at that time.

Well, getting back to the CB screw-up. The manufacturers, via the Electronic Industries Association, were putting on the pressure for 50 CB channels. It looked as if they were going to get it through. Then someone got to worrying about possible interference to any radio equipment using a 455-kHz i-f if two CB rigs happened to be 455 kHz apart in frequency. Ooops. No one had considered that before.

The FCC ran some hasty tests and found two things. First, they verified that two CB rigs 455 kHz apart would indeed cause a mess with radios and other CB units. They also discovered, this apparently being the first time that they had ever tested the CB rigs being sold, that many were sending out all sorts of spurious emissions . . . they were dirty. Anyone living near a CBer could have told them that . . . but apparently no one did.

This killed the 50-channel plan, but it was quickly replaced with a 40-channel CB plan which would not permit two CB channels to be 455 kHz apart. Then came the blow which the industry never counted on . . . and the one which brought down the multi-billion dollar industry in flames. The Commission, under great pressure from the EIA and the White House OTP, okayed the 40-channel plan . . . but put off the sale of the new rigs for six months . . . until January first.

Up until that time, CB was going strong. We had CB movies one after the other . . . CB television programs . . . a whole bunch of CB records . . . the country was being CBed at every turn and was responding by buying CB sets as fast as Japan could make them and ship them over. CBers were getting on the air by the millions . . . asking about smokey and generally rag chewing. As one drove down the highway, just about every tenth car had sprouted a CB whip.

The announcement that there would be 40 channels, but that the new sets could not be purchased for six months, put an instant freeze on sales. Those shiploads of 23-channel sets were still coming in from Japan and the factories were turning them out by the hundreds of thousands. Within days, the shelves of dealers in the US became loaded and orders were frantically being cancelled. It took several months to shut down the flood of equipment being made in Japan and get the ships unloaded into warehouses all over our country. It was a disaster.

The bright side was that

come January, the industry would be allowed by the FCC to sell the new, cleaner 40-channel sets and then everything would be alright again. The manufacturers cheered each other up at meetings with plans for setting the prices high at first in order to make up for the losses. Other firms kept telling each other that it wasn't as bad as it looked. I went to some of these industry meetings and I have tapes of the self-delusion which was going on.

The manufacturers tried to get the FCC to move the deadline ahead so they could at least start selling their new sets during the Christmas rush, but the FCC was not to be moved . . . nor were the CB sets. You could now buy 23-channel sets for half their parts costs almost anywhere. I saw nice sets going for $10 and $20, and going begging. This was when I got started with the idea of hams buying them and converting them for 10m use. Unfortunately, only a few thousand were converted. Pity; I think hams missed out on a good and very inexpensive new band as a result. But this was at the bottom of the sunspot cycle and ten was stinko, so the 10m AM band did not catch on.

January finally arrived and suddenly the industry discovered that CB was no longer a fad. The movies were forgotten . . . the TV shows cancelled . . . even the hit CB songs were now oldies and CB joined the hula hoop in unpopularity. The great plans for making a killing on the new sets evaporated as prices skidded in a desperate effort to drum up sales. It didn't work and we then saw the major manufacturers folding up, one after the other. Pride collapsed. Johnson suffered terribly, but their commercial radio sales kept them in business. Hy-Gain disintegrated, with the ham end of things being picked up by Telex . . . and doing quite well, thank you.

Like millions of others, I have a CB set in my car, but I don't use it very much. It's handy when there are traffic problems or I am going on a trip and want to know if there are radar checkpoints ahead, but other than that it is just there in case of need.

The greed of the industry brought about its collapse. Unfortunately, this has had some effects upon amateur radio . . . and I've written about them recently. The CB craze also supported the HF band sales of ham gear, making hams have to wait to get equipment. Then, when CB sales . . . and HF sales, too . . . faded away, hams bought a lot of HF equipment and this caused many ham dealers to expand their business. Our ham clubs had set up classes and these were fed by CBers and HFers, making recruitment of new hams easy. Then, when CB went away, so did the recruits, and the result is that today amateur radio newcomers are few and our population is again decreasing . . . and ham dealers are hurting.

Fortunately, I think there are some things which we can do to get newcomers coming into amateur radio again . . . and I think I have some ideas which will bring amateurs back into building gadgets and buying new equipment. I will be discussing my plans for reviving amateur radio at the January Aspen Ham Industry Conference. I'll go into more details on this in future issues of *73*. I can't do this alone . . . but I can provide support for those who want to do something.

The FCC recently asked for comments on the proposed CB use of 900 MHz and I wrote up a lengthy proposal for that band. I do think that it will be possible to generate billions of dollars in sales of CB equipment for this band if it is established as I have proposed. I'll try to get my proposal for this into *73* in the near future for those interested in the concept. I have not proposed a service anything like the present CB eleven-meter mess. My idea is to provide a communications service more like the one originally intended by the FCC for CB. It would provide personal communications virtually anywhere at any time wanted. It would interface with the telephone, with computers, with beeper callers, etc.

Well, I'm sort of sorry about the drop in imports, but not too sorry. I do think that we should pester the hell out of our representatives in Washington to get rid of the capital gains tax so we will have investment money to rebuild our high technology industries. And we need to do this before we lose the last of them . . . microwaves and microcomputers.

THAT BANDWIDTH PROBLEM

An eon or two ago we suffered through a well-intentioned effort by the FCC to fix up our rules and permit some experimentation. But, as usual, there was more misery in the proposal than benefit, so amateurs overwhelmingly voted the proposal down.

We do have some ham frequencies where we have congestion. Ask any Novice about that. But, on the whole, we don't have any serious problems with finding frequencies to use for communications. We've built up something on the order of 4,000 or more repeaters for VHF communications . . . with a bit of a tight fit here and there, but accommodated overall. On the low bands, we do run into more signal packing than we like on weekends and during contests, but if you are even slightly adventurous, you know that we have lots of open channels.

During much of the day and night, the 20-meter band—at least the Advanced portion of it—has room for more signals. The General part is often filled with bunches of nets and presents more of a problem in finding open channels. I defy you to find a time when 15 meters is open and you are unable to find an empty channel . . . ditto ten meters. Lots of 'em.

But when we start talking in terms of getting more hams, we have to start thinking in terms of eventually solving a crowded band situation. To a large degree, we can spread out our hamming, using the off-hours for more interference-free contacts. But if we are going to think in terms of doubling or tripling (or more) the ham population of our country, then we have to start thinking in other terms.

I do have some technical ideas which may forever change amateur radio. I'll be developing these in conjunction with the ham industry and I think you'll like what I have in mind. I think it may revolutionize much of our operation.

Before we get into serious technical developments, I think we can look more carefully at amateur radio and the frequencies it requires. Of course, the concept of frequency is deceptive since we are actually talking about a factor which might be considered to be frequency x time. If you look at amateur radio communications as using a resource which is the product of frequency channels and time . . . what in computer terms is called "throughput" . . . we can get a better grasp on what is happening and what we may be able to do to improve the situation.

There are sampling techniques which remove about 80% or more of speech and you can't tell the difference. We may eventually get into some sort of time multiplex system which would enable us to stack five to ten contacts all on one channel without serious interference between them.

Then there is the redundancy of the English language. There are many techniques for compacting English messages so they will take much less time to transmit. But, speaking of redundancy, how about the average ham contact? Think how much that could be compacted with little, if any, loss of intelligence.

We do have several different basic types of ham communications. Some are much more adaptable to compacting than others. Take the average DX contact for the purpose of getting a new country . . . the callsign, report, and a confirmation are all that is needed. Now, obviously, that could be made a good deal more efficient than it is at present, list operations notwithstanding.

It may be possible for future DXpeditions to conduct a two-way contact with eager DXers, all within two seconds per contact. The bandwidth might be a bit more than we are using today, but the goal is exchanging information efficiently, and in this we want to take advantage of every minute that the band is open to a certain area. We can afford to expend frequency spectrum to buy time. If we are transmitting our callsigns at a speed of, say, one hundred words per minute, then it will take about one one-hundredth of a minute to send a callsign . . . that's about a half second.

By automating these DXpedition contacts and contacts with rare countries, we could salvage a good deal of the low end of 20 meters. This would provide more channels and time for hams to swap basic station information . . . which seems to take up a good deal of the ham spectrum. Again, this could easily be automated and most of the station data communicated within one second or two with some encoding standards.

But what about the rag chewers, you may ask. Well, if we are able to streamline the DX contacts, the hello-goodbye contacts, and contests, wouldn't that leave a lot more time and frequencies for rag chewing? But, you may argue . . . and I wouldn't blame you . . . rag chewers don't talk about anything much anyway. Well, maybe *you* don't, but *I* do. The fact is that I enjoy talking. I'm not quite so good on listening, but then neither are you. So I'll put up with you talking a lot as long as you'll put up with me doing the same.

Oh, I enjoy DX contacts, too, and I will get just as excited as you when the day comes and my printer occasionally prints out a line to let me know that my station has made another rare DX contact. Perhaps I would like to have a bell which would announce every ten new countries contacted.

Seriousness aside, I think we are going to be able to accommodate a lot more hams on our bands if we start thinking more in terms of throughput and automating those functions which can best stand the gaff.

OBJECTIVE RADAR REVIEW

Last May, Judge Nesbitt of Miami apparently got fed up with the police assurances that

radar evidence against a motorist was unimpeachable evidence of speeding. He called in both the proponents of radar and the opponents and heard nine days of testimony from engineers. This is the first known time when both sides of this field have had an opportunity to put their evidence on the line.

The judge's opinion was clear: Police radar, as now used, is unreliable and was not admissable in his court as evidence in speeding cases. He went into considerable detail about this, citing poor radar equipment and poor officer training as being the major problems. He found that certain types of radar could be dependable if used by knowledgeable officers under light traffic conditions.

Testimony on the cost of radar units surprised the judge (and me). He found that a $2,395 list price unit could be had in quantity for $375 . . . with the manufacturer still making a good profit. That would mean a manufacturing cost of around $100 . . . which might explain why so many radar units are not dependable. It was found that perhaps 30% of the speeding tickets go to the wrong person, leading more and more people to have less and less enthusiasm for supporting our system of police and justice.

The judge suggested some changes which, if implemented, might make radar evidence of more value. He said that the width of the radar signal should be narrowed considerably. Present units run to as much as 24°, which means that officers often have to just guess which car they are trying to read. Engineers testified that beamwidths could be brought down to around 2° without great expense.

Next, the judge suggested it was time to get rid of the buzzers, which were very undependable, and use direct reading systems. All of the gadgets which have been added make the systems less reliable. He said police should stop using moving radar, phase locked loop detectors, automatic speed locks, and beam interrupters. With the moving radar, it was testified that no matter how well trained an officer is, a certain percentage of the tickets handed out will be incorrect.

He recommended that police departments set up their own training and not depend upon manufacturers for this . . . or hire a consultant. Officers should be trained to understand how the equipment works *and* its limitations.

The judge felt that our judicial system will only work when people are treated fairly . . . and the present use of radar is defeating this concept.

My thanks to W2JTP for sending in this item.

SATELLITE TV FANS —GOOD NEWS!

Though many experimenters were not bothering to get one, until recently the FCC required a license for receiving signals from the TV satellite. The Commission moved recently to eliminate this requirement, so the lid is off on receiving these signals.

Considering the popularity of this . . . we might call it a hobby . . . I suspect we will be seeing better and better receivers coming available for this service . . . and at lower and lower prices. I noticed an ad by International Crystal (ICM) for a satellite receiver priced at $1995. It does take a fair-sized dish plus a low noise receiver to pull in these signals.

The receiver for the MDS signals we published in the August issue of *73* created quite a stir . . . and all sorts of attacks on us by the Common Carrier Association of Telecommunications (CCAT). They petitioned the FCC to take away the ham licenses of everyone involved in the publishing . . . plus asked the FCC to go for criminal action and assorted fines. I'll try to publish the public record on this in fine print for those who enjoy legal matters. The whole thing is nonsense.

CCAT backed up the petition to the FCC with a suit in a federal court, which is a big pain in the . . . er . . . neck. I sure hope that this attempt at what I think of as legal terrorism backfires and ends up with a clear statement by the courts that there are no restrictions on receiving satellite or MDS signals . . . which I know has to be the case. This might turn hundreds of firms loose with receivers for these signals and really give them trouble.

The FCC action on the satellite reception appears to open up the possibility for experimenters to not only receive the signals, but also to relay them via cable to friends on a nonprofit basis.

POLITICIANS . . . UGH!

The other night, while listening to a talk by New Hampshire's Senator Humphrey . . . one of those things one gets into as a member of the Chamber of Commerce . . . I got to thinking about politicians. Somewhere, in an article published recently, there was a description of the politicians we had back during the formative years of our country. It seems that in those days we did not have professional politicians . . . just people who were interested enough in their country or state to offer their time . . . usually for one term.

One of the results of this was that politicians of those days were not faced, immediately upon being elected, with the goal of getting reelected. This meant that they could be a lot more objective and vote for things which seemed in the best interests of their constituents.

Humphrey brought this to mind when one of the people present asked him how he was able to vote the way he thought best rather than follow popular emotions the way most senators do. He said that he had run for office because he wanted to try to do something about the mess things were in and that since he didn't really care whether he was reelected or not, he was completely free to do what seemed best.

We get so swept up in the power of the vote that we tend to forget that we have not yet decided to put all matters of public interest to a vote . . . only the election of our representatives. Most of us are so busy with making a living, with problems of loving, and with all the other factors which make or break our day, that the rush of major events is reduced to news—entertainment on television or in the newspaper.

There is no practical way that all of us . . . or even most of us . . . can find out enough about what is going on—and recognize the myriad of contributing factors—to be sure of coming up with the best solution to these problems on every occasion. If we are realistic about this, it is a tough job even for the people we've chosen to look out after these interests. But what do we do? We elect someone to office and then we try to put on the pressure to get him (or her) to vote according to our emotions or according to our own far-from-well-informed understanding of what is going on.

Congressmen, ever vigilant to pressures from the voters who will reelect them, bend in the winds of public emotion, trying to outshout each other to agree with the largest group. As a result, we are in one hell of a mess.

Heck, I see this to some extent even in the world of amateur radio. I've been around long enough and been in a position to know, probably better than anyone else, what has happened in the past to mold the way things are now . . . and to see how present emotions are molding the way things are turning. I've watched the great majority of amateurs take little interest in what is happening until something comes along which hits home . . . and then there is a blast of emotion, usually in the wrong direction because they have not been paying attention.

Senator Humphrey spoke on SALT and oil company profits. In both cases, it was clear that he had done a good deal of research and had a very good understanding of the situations. It seems to me that this should be the purpose of paying a senator . . . to get the facts on situations and then represent us as an expert and vote appropriately. He should do that even if I am sending him telegrams to do the opposite. The time for my input is when I have facts for him . . . facts he has no way of getting elsewhere . . . and when it comes time for me to assess his ability to see through the baloney and vote in the best interests of those of us who elected him.

The media . . . and I include television in particular . . . are out selling their product. If you are able to get the facts through all that emerdement, then you are a surprising person. When I see acts of terrorism, I also see money and power going to the media, for they play to our emotions with their coverage. Without television and the press, I doubt if there could be terrorism as we see it today. Terrorist groups have studied our media and know how to take advantage of it to get the maximum play.

Do you think that the Iranians would have taken US hostages if the whole thing would have been known only to our government? No, they knew that this would be on television all over the world . . . in special editions of the papers . . . in whole special issues of news magazines. We are in a time of the media and we are a prisoner of it. Oh, I'm watching the damned television news, too . . . cursing myself as I do it. I wonder if it is much different from going to the arena in Rome to watch the Christians get exercised by the lions.

No, I don't have any alternative to offer. I'm not in favor of censorship of the press, as much as I think their freedom is causing great changes in the world . . . and not necessarily for the better.

But perhaps, if we look at the TV news and recognize that each of the networks is battling for a tenth of a point increase in the ratings, we will better understand that we are being used by them to make money. They know exceedingly well how our emotions work and they are hard at it to produce the most reaction . . . and are succeeding. There is probably no way to keep us from turning on the news and watching in growing horror as they interview the relative of a victim, wondering if

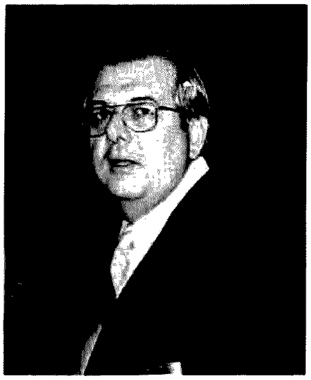
we should give in to terrorism and do what they want . . . not realizing that it is the media which is making the terrorism work . . . and our watching which feeds the media. We are the ones who agree to be terrorized.

Getting back to our representatives and their obsession with getting reelected . . . I wonder what changes it would make if all senators and reps were allowed just one term in office. Sure, we might lose some good talent, but it would make a big change in the type of people running for office and it might free us from the entrenched interests which have been running things for so many years. We might even be able to cut down on government. The few good people who would be lost to us would be more than compensated for by the garbage which would get thrown out.

Senator Humphrey was perhaps a bit more candid than he should have been when he spoke so contemptuously of the great majority of congress . . . but he sure is in a spot to know.

WAYNE'S PICTURE ALBUM

Every now and then, I look through some of the piles of pictures I've taken down through the years and I suspect that some readers may be interested in seeing some of them. I'll try to put a few into the magazine now and then, covering events which are recent . . . or long ago.



This is a picture of Bill Godbout (Godbout Electronics) which I snapped at NCC in New York last year. I think they conned Bill into attending NCC by getting him to participate in a panel discussion on the future of personal computing. Unfortunately, the several important things that came through as a result of this panel seem to have been lost in the rush of wind from many other talks and discussions. I get the impression that revealing anything important at an NCC session is a sure way of keeping it a secret from the world. Yes, I know about the mighty volumes published which contain the printed record of these talks, but I haven't seen any sign that these are ever opened by anyone.

The key here may be that these talks are for free and there is the concept that free things are not usually worth much. One of the same papers, published in a magazine as an article, would get maybe a thousand times the recognition. I suspect that a lot of talent and work has been virtually thrown away on papers for the technical talks at computer shows such as NCC and the Faires.

Well, getting back to Bill, take a good look at him here . . . before the telephone implant which is certain to be made. Bill spends about 26 hours a day on the phone. Bell, I understand, is planning on dedicating the new wing of their Oakland office to Bill. But, if you want to know what is going on in the microcomputer field, ask Bill. He's better than any newsletter. And if you want any hard-to-find IC, you can bet that he either has a ton of them or knows where they are. He's been building up a dealer network handling his ICs by virtue of his infallibility in finding sources.

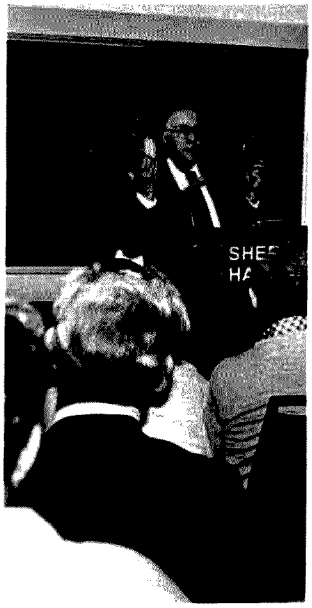
When Bill gets together with George Morrow and Tom Mullen, hold onto your intellectual stirrups. The ideas flow thick and fast . . . enough to supply a dozen companies with products.

The NCC panel was chaired by Portia Isaacson (left), now of Innovision and EDS. This may soon be the largest mail-order and direct mail firm in the microcomputing industry. Next to her is Richard Kuzmack, who did much of the work of organizing the personal computing aspect of NCC. Then we see Bill Godbout, opining. Next is Larry Stein, then Les Soloman of *Popular Electronics*, who came up with the Altair name for MITS . . . and for whom the Processor Tech SOL was named. And last, but least, me, on the right.

Chuck Martin WA1KPS, here seen with Judy Waterman, our bulk sales manager, and Sherry Smythe, our executive vice president, is enjoying a massive amount of southern fried chicken, biscuits, gravy, Smithfield ham, and all the fixin's at Aunt Fanny's Cabin in Atlanta. This is a yearly pilgrimage during the Atlanta Hamfestival.

While Chuck is out eating, we see Eric Williams WA1HON hold down the Tufts Electronics exhibit at the Hamfestival. That's Eric pulling out a pair of crystals for an HT. Eric, by the way, is one of the regulars at the yearly Aspen ham industry conference.

Another regular at Aspen is Steve Murray K1KEC, here seen (with beard) taking a meal break during the VHF contest atop Pack Monadnock mountain, about three miles from downtown Peterborough.



Yep, there I am, speaking at the ARRL New England Convention! The announced topic was microcomputers, but this was a thinly disguised stratagem to thwart the general manager. There have been years when the manager had enough clout to prevent *73 Magazine* from even exhibiting at an ARRL convention . . . and for years there was no way that a convention committee would be permitted to put me on the speaking program.

In this case I am, in the picture, showing one of the 10-GHz transceivers which I used to make the contacts with Chuck Martin WA1KPS (of Tufts Electronics) with seven different states. The fact is that Chuck did most of the work . . . getting the rigs to work and repairing them every few days as they would break down. It does look as if it is going to be a while before we have dependable 10-GHz communications.

While I did manage to talk a good deal about microcomputers and the state of that hobby, I also was able to answer some questions about WARC and overcome, at least perhaps for the group present, some of the propaganda which has been painting me as a "purveyor of doom," as it says in so many director newsletters. I'm pragmatic about WARC, feeling that a prudent person would do everything possible to achieve success there, rather than just rely on luck.

SEPTEMBER WINNER

It pays to be honest! "Confessions of a Teenage HFer" was voted by our readers the most popular article in our September issue, so author Hans Peter will be receiving that month's $100 bonus check.

OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR JANUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
23456	1	0005:48	69.0
23469	2	0100:05	82.6
23482	3	0154:21	96.2
23494	4	0053:40	81.0
23507	5	0147:56	94.6
23519	6	0047:16	79.5
23532	7	0141:32	93.1
23544	8	0040:51	77.9
23557	9	0135:07	91.5
23569	10	0034:27	76.4
23582	11	0128:43	89.9
23594	12	0028:02	74.8
23607	13	0122:18	88.4
23619	14	0021:38	73.2
23632	15	0115:54	86.8
23644	16	0015:13	71.7
23657	17	0109:29	85.3
23669	18	0008:49	70.1
23682	19	0103:05	83.7
23694	20	0002:24	68.6
23707	21	0056:40	82.1
23720	22	0150:56	95.7
23732	23	0050:16	80.6
23745	24	0144:32	94.2
23757	25	0043:51	79.0
23770	26	0138:07	92.6
23782	27	0037:27	77.5
23795	28	0131:43	91.0
23807	29	0031:02	75.9
23820	30	0125:18	89.5
23832	31	0024:38	74.3

OSCAR 8 ORBITAL INFORMATION FOR JANUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
9295	1	0035:54	57.6
9309	2	0040:54	58.8
9323	3	0045:54	60.1
9337	4	0050:54	61.4
9351	5	0055:54	62.6
9365	6	0100:54	63.9
9379	7	0105:54	65.2
9393	8	0110:54	66.4
9407	9	0115:54	67.7
9421	10	0120:54	69.0
9435	11	0125:54	70.3
9449	12	0130:54	71.5
9463	13	0135:54	72.8
9477	14	0140:54	74.1
9490	15	0002:41	49.5
9504	16	0007:40	50.8
9518	17	0012:40	52.1
9532	18	0017:40	53.3
9546	19	0022:39	54.6
9560	20	0027:39	55.9
9574	21	0032:38	57.1
9588	22	0037:38	58.4
9602	23	0042:37	59.7
9616	24	0047:37	61.0
9630	25	0052:36	62.2
9644	26	0057:36	63.5
9658	27	0102:35	64.8
9672	28	0107:35	66.0
9686	29	0112:34	67.3
9700	30	0117:33	68.6
9714	31	0122:33	69.8

OSCAR 7 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
23845	1	0118:54	87.9
23857	2	0018:13	72.8
23870	3	0112:29	86.4
23882	4	0011:49	71.2
23895	5	0106:05	84.8
23907	6	0005:24	69.7
23920	7	0059:40	83.2
23933	8	0153:56	96.8
23945	9	0053:16	81.7
23958	10	0147:32	95.3
23970	11	0046:51	80.1
23983	12	0141:07	93.7
23995	13	0040:27	78.6
24008	14	0134:43	92.1
24020	15	0034:02	77.0
24033	16	0128:18	90.6
24045	17	0027:37	75.4
24058	18	0121:53	89.0
24070	19	0021:13	73.9
24083	20	0115:29	87.5
24095	21	0014:48	72.3
24108	22	0109:04	85.9
24120	23	0008:24	70.8
24133	24	0102:40	84.3
24145	25	0001:59	69.2
24158	26	0056:15	82.8
24171	27	0150:31	96.4
24183	28	0049:50	81.2
24196	29	0144:06	94.8

OSCAR 8 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
9728	1	0127:32	71.1
9742	2	0132:31	72.4
9756	3	0137:30	73.6
9770	4	0142:29	74.9
9783	5	0004:16	50.4
9797	6	0009:15	51.6
9811	7	0014:14	52.9
9825	8	0019:13	54.2
9839	9	0024:12	55.4
9853	10	0029:11	56.7
9867	11	0034:10	58.0
9881	12	0039:09	59.2
9895	13	0044:08	60.5
9909	14	0049:06	61.8
9923	15	0054:05	63.0
9937	16	0059:04	64.3
9951	17	0104:03	65.6
9965	18	0109:01	66.8
9979	19	0114:00	68.1
9993	20	0118:59	69.4
10007	21	0123:57	70.6
10021	22	0128:56	71.9
10035	23	0133:55	73.2
10049	24	0138:53	74.4
10062	25	0000:39	49.9
10076	26	0005:37	51.1
10090	27	0010:36	52.4
10104	28	0015:34	53.7
10118	29	0020:33	54.9

Ham Help

Several months ago, a letter was printed from Dick Jastrow, a blind would-be ham in California (August, 1979, p. 168). He asked for help in preparing for his exams in the code as well as theory. Apparently, there were a number of responses, but, in moving from one hospital to another, most of these letters got lost.

Dick recently answered my own letter and requested that I write to see if some hams in the Los Angeles area would reestablish contact. I am sure that contact with blind amateurs would be especially valuable.

Although I am now inactive on the air, I am happy to help prospective hams if they ask me.

Dick's address is Richard Jastrow, Long Beach General Hospital, ward 800-A, 2597 Redondo Avenue, Long Beach CA 90806, (714)-427-9951, ext. 247.

Bill Withrow W5BZY
211 N. 8th Avenue
Teague TX 75860

I need the following states for my WAS award: Alaska, North Dakota, Nevada, and Delaware. If anyone would like to exchange cards, it would be appreciated. I have a General class license and can operate on 10-40 meters, CW or SSB.

Paul Gonicberg N1APW
265 Blackstone Blvd.
Providence RI 02906

I need to borrow for a few days the operating manual and the maintenance manual for a Dumont scope, type 329. I will return it promptly with reimbursement for postage.

Lloyd H. Yost K2YJP
Telecommunications
Technology Center
1 Research Drive
Shelton CT 06484
(203)-929-7341, Ext. 746

I need a schematic for a Heath general coverage receiver, the GR-91, with a 1961 copyright. The manual number is #595-492-01. I also need to know the specs on part #40-396, the band D antenna coil for the same rig, if at all possible.

I will be glad to pay copying expenses and postage. Thanks very much for any help.

Dr. Richard Sanchez
1805 Adeline
Hattiesburg MS 39401

I need a schematic or manual for a Hallicrafters model S-38. I will pay copying costs or copy myself.

Chuck Bennett WB8GQW
5667 Nike Drive
Hilliard OH 43026

FCC

Reprinted from the Federal Register.

Eliminating Applicability From the Six Meter Frequency Band (50-54 MHz)

AGENCY: Federal Communications Commission.

ACTION: Notice of Proposed Rule Making.

SUMMARY: The Commission issues a Notice of Proposed Rule Making which proposes to allow frequency modulation telephony (F3) operation with more than 6 kHz over a greater segment of the 50 to 54 MHz (6 meter) amateur radio band. Deletion of the 6F3 limitation from the 6 meter band would offer much more flexibility for the amateur radio community.

DATES: Comments must be received on or before December 10, 1979 and Reply Comments must be received on or before December 26, 1979.

ADDRESSES: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: Federal Communications Commission, Private Radio Bureau, Personal Radio Branch, Roy C. Howell (202) 254-6864.

In the matter of amendment of § 97.65(c) of the Commission's rules and regulations governing the Amateur Radio Service.

Adopted: October 25, 1979.
Released: October 31, 1979.

By the Commission:

1. On September 11, 1976, the Southern California Repeater and Remote Base Association (SCRRBA) petitioned for amendment of Part 97 in RM-3207 to allow frequency modulation telephony (F3) operation having an occupied bandwidth with more than 6 kHz over a greater segment of the 50 to 54 MHz (6 meter) amateur radio band. Subsequently, on January 16, 1979 the American Radio Relay League (ARRL) petitioned for a similar but not identical, rule change in RM-3313.

2. Frequency modulation is permitted now from 50.1 to 54 MHz (§ 97.61(a)), along with A1, A2, A3, A4, A5, F1, F2 and F5. However, § 97.65(c) requires ". . . between 50.1 and 52.5 MHz, the bandwidth of an F3 emission (frequency or phase modulation) shall not exceed that of A3 emission having the same audio characteristics . . .". Since an A3 emission (amplitude modulation telephony), in this instance is normally considered to occupy a bandwidth of approximately 6 kHz, F3 operation between 50.1 and 52.5 MHz is limited to an occupied bandwidth of 6 kHz (6F3).

3. In support of its request, SCRRBA states that permitting occupied bandwidths greater than 6F3 would result in increased occupancy between 52 and 52.5 MHz by amateur stations using repeaters. Moreover, they claim it is possible some non-repeater operation using 16F3 (16 kHz occupied bandwidth standard) would occur between 51 and 52 MHz. SCRRBA requests the 6F3 limitation be stricken entirely from applicability to the 6 meter band.

4. Numerous comments were filed in support of SCRRBA's petition by various amateur radio groups. However, the Six Meter International Radio Club filed comments claiming the proponents of RM-3207 have overlooked the rapid expansion in single sideband operation (A3J) in the six meter band. They question the need for additional repeater operation.

5. In support of its request, ARRL also states that permitting occupied bandwidths greater than 6F3 would permit ". . . the fullest possible use . . . of the repeater subband 52.0-54.0 MHz . . .". ARRL requests the 6F3 lower limit be moved only from 52.5 MHz to 52.0 MHz. Comments from amateur radio groups were also filed in support of the ARRL petition, including comments from SCRRBA. However, SCRRBA takes exception to the ARRL's proposed new lower limit of 52 MHz, stating they strongly believe 52 MHz is not appropriate. They argue that a more useful lower limit would be 51 MHz, and go on to reiterate their own proposal (RM-3207), for striking the 6F3 limitation from applicability to the 6 meter band. They state they " . . . seek the same flexibility for usage of this band as ARS (Amateur Radio Service) operators enjoy on the frequency bands above 144 MHz". The 6F3 limitations does not apply to these bands. SCRRBA also claims the ARRL petition would " . . . not facilitate the optimum utilization for this frequency band".

6. We believe that deletion of the 6F3 limitation from the 6 meter band would offer much more flexibility for the amateur radio community. As technology and interest in the many types of modulation schemes evolves, resolving sharing arrangements by the participants themselves would seem to be the most expeditious means for fulfilling the purposes of the service. Apparently, such has been the case on the 144 MHz, 220 MHz, and 420 MHz amateur radio frequency bands. This should also be the case for the 6 meter band. For the most part, 50 MHz has many of the characteristics of the higher frequency bands. For these reasons, the Commission proposes to amend § 97.65(c), as shown in the Appendix, to delete the 6F3 limitation from the 6 meter band. Comments on the amateur radio operators' ability to effectively resolve sharing arrangements, in this instance, are particularly invited. The Commission also proposes to delete the phase " . . . and the purity of emissions shall comply with the requirements of § 97.73" in the interest of eliminating redundancy. The purity and stability requirements would remain in effect, as stated in § 97.73.

7. Authority for issuance of this Notice is contained in Sections 4(i) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i) and 303(r). Pursuant to procedures set out in Section 1.415 of the Rules and Regulations, 47 CFR 1.415, interested persons may file comments on or before December 10, 1979, and reply comments on or before December 26, 1979. All relevant and timely comments will be considered by the Commission before final action is taken in this proceeding. In reaching its decision, the Commission may take into consideration information and ideas not contained in the comments, provided that such information or a writing indicating the nature and source of such information is placed in the public file, and provided that the fact of the Commission's reliance on such information is noted in the Report and Order.

8. In accordance with the provisions of Section 1.419 of the Rules and Regulations, 47 CFR 1.419, formal participants shall file an original and 5 copies of their comments and other materials. Participants wishing each Commissioner to have a personal copy of their comments should file an original and 11 copies. Members of the general public who wish to express their interest by participating informally may do so by submitting one copy. All comments are given the same consideration, regardless of the number of copies submitted. All documents will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, DC.

9. For further information concerning this rule making, contact Roy C. Howell, Rules Division, Private Radio Bureau, Federal Communications Commission, Washington, DC. 20554, (202) 254-6864.

Federal Communications Commission.
William J. Tricarico,
Secretary.

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended as follows:

In section 97.65, paragraph (c) is modified to read:

§ 97.65 Emission limitations.

* * * * *

(c) On frequencies below 29.0 MHz the bandwidth of an F3 emission (frequently or phase modulation) shall not exceed that of an A3 emission having the same audio characteristics.

LETTERS

from page 28

you going to harp on incentive licensing? After being a ham dropout for many years, I studied up a bit and got my Extra class back in 1963, long before the days of special callsigns. I did this mainly because I wanted to get permission to try out a couple of special modes of operation and thought I would have a better chance of getting permission from the FCC. Another reason for the Extra was to be able to operate in a portion of at least a few bands that would not be so full of signals. I guessed right in both cases.

So what's the big hassle about? Too many fellows wanting something for nothing, and quite willing to fight for just that? Sounds like a labor union.

Keep hounding the ARRL—they need it . . . even if a lot of it looks like nitpicking from out here in the boondocks.

Dave Hardacker W7TO
Sheridan WY

RADAR DEFENSE

I just read on page 171 of the October issue about illegal radar and hasten to write to caution all hams not to jump to conclusions. Radar principles have been well established, but the DC courts seem to base decisions on intrusion into the rights of private citizens rather than faulty radar. I do not think this is the best approach for a defense to a radar ticket.

For now, readers will be well informed to know the tests for law enforcement equipment, since it is up to the state to prepare a proper foundation for the evidence.

Some courts have found adequate foundations in various combinations of the following three means of testing radar speedometers:

1) A "run through" in which another police car closes on the site while holding a given speedometer reading (Query: How do we know the testing vehicle has been checked?);

2) Use of *calibrated* tuning forks intended to produce frequencies which will cause the machine, if accurate, to read particular speeds;

3) Use of a signal generator within the machine for the same purpose.

I know that in Massachusetts some foundation requirement is appropriate per a recent decision of the Supreme Judicial Court.

Duncan Kreamer W1GAY
Attorney at Law
Vineyard Haven MA

QSL STAMPS

This may be an old idea, but it has just occurred to me: Why not start a drive with the US Postal Service to come up with a 31¢ airmail stamp commemorating amateur radio?

This is the stamp that is used on most direct QSL mail and would be sent to every country in the world over a very short period of time. It could be themed, "Peace Over All The World Through Amateur Radio Fellowship."

Loren Carlberg WB5WDG
Muskogee OK

UV-3 REVISITED

I had to comment on the review of the Drake UV-3, as printed in the October, 1979 (p. 31), issue.

The two features that the author noted as "could have been left out" are, in my opinion, most valuable. I think that any serious amateur who has these

Continued on page 159

DX

from page 16

with help from several of the standard list-takers. A51PN and 9N1MM were welcome guests on both 20 and 15. YI1BGD still comes and goes and remains difficult for those strapped to a Monday-Friday work schedule.

New officers of the Iowa DX Association are: KØJSY, president; WØWP, vice president; KØLUZ, secretary-treasurer. The National Capitol DX Association also elected new leaders: N4MM, president; N4RA, vice president/activities manager; W3GG, secretary; and AA4M, treasurer.

The next team going to Macquarie will include VKØKH, to continue the work on the bands by VKØPK during 1979. P29JS has done yeoman service running the 14240 slot for these and others, around 0930Z.

More operations from Desecheo appear doomed; KP4AM's try for a /D fire-up for the *CQ* Phone Contest in October was thwarted by the US government and the signs are that no one will be allowed on the rock for amateur radio purposes. YASME's hopes were similarly dashed in October.

5NØDOG is a good catch this winter on 40 and 80 meters, now that the Nigerian rainy season has passed. Dave's company, TICAS (Falls Church VA), purchased a ticket for Kunle 5N2NAS to attend WARC in Geneva last fall.

Rick Dorsch plans to move to the Galapagos (HC8) late in 1980 or early in 1981. He is just back from a visit there. Rick hails from Michigan but has been signing HC5EE from Ecuador for several years. The last American visitor to the Galapagos was Chod Harris VP2ML in early 1979.

KH6IJ continues to recover from a stroke suffered in early 1979; radio operating is still difficult for him. He has resumed his column in the Honolulu *Star-Bulletin.*

As this is written (early November), WARC continues with little news coming out of Geneva. A press gag by Secretary-General Mili has inspired the American representatives to keep the news to themselves, and the amateur radio press suffers accordingly, not only in the US, but around the world. The main item of interest has been Article 41, concerning international Morse code requirements; apparently, CW will end up being a "recommendation" above 30 MHz, that is, each licensing authority (government) will have the option of requiring or not requiring CW proficiency above 30 MHz. Talk continues of an additional band at 24 MHz. 40 meters will probably not survive unscathed, with HF broadcast interests and their megabucks at work.

A reminder to contesters: Your *CQ* WW CW logs must be postmarked by January 15 and should be mailed to the new *CQ* address: *CQ* Publications, 76 North Broadway, Hicksville NY 11801. Do not enclose any correspondence, requests, etc., with your logs. This goes for sending contest logs to any organization.

HS1ABD out of Thailand operates on 40 and 80 meters; now is the time of the year to look for him, on 7005 and 3795 at 1300Z and 2200Z, respectively.

The East Germans begin using new prefixes this month; the callsign block is Y21A to Y99Z.

Careful about sending money overseas, please. Especially going to Africa and the Himalayan countries, your dollar bills may end up in some bureaucrat's pocket instead of in the pocket of the ham you just worked. FR7BP has mentioned this, as well as A51PN.

N6AR still collects old radio books to send to deserving hams and hams-to-be around the world. 20 *ARRL Handbooks* have gone to 9J2TJ, another ten to Eastern Europe via W6YY, and N6DX and N6ZV each took a handful on DXpeditions. *You* can send your unneeded books to N6AR and help another amateur.

Finally, the ARRL International DX Competition takes place next month. As we write this, there is talk of changing the format of this long-running activity again. An editorial in *QST*'s September "Operating News" column hinted at changes to come, and the administrators in Newington are toying with a new format more closely related to the *CQ* Worldwide style, i.e., everybody works everybody. This would drastically alter the ARRL competition from the standpoint of DXing, not to mention what it would do to the *contest* aspects of the activity. It hardly seems possible they could pull off a change this late, considering the time required to pass the word around the globe, but one would be well advised to watch closely for news before February.

Please send your input for this column to *73*. Photos are especially welcome. The material for this column came from *The DX Bulletin*, Vernon CT.

Leaky Lines

from page 22

situation, and that's the plain, unvarnished truth.

* * *

Is there, I wonder, a possibility that the relatively recent techniques of voice printing might be used to identify chronic malicious interferers? It is said that such prints are as dependable as fingerprints in establishing individual identity, and if some means were devised to extrapolate voice prints from audio signals, we could go a long way toward ridding ourselves of these nuisances. The very realization that the possibility of positive identification exists might prove to be a deterrent, and perhaps this would cause them to think twice about exposing themselves to discovery.

I know very little about this branch of acoustical science, but I imagine that there are some amateurs who possess the necessary expertise to come up with the answers. If so, I hope that they will consider investigating it and developing it to a practical level so that it can be used.

After all, forty years ago, who would have predicted the use of radar to detect violators of the highway speed laws? Why not voice prints to combat deliberate QRM?

RTTY Loop

from page 14

what, you may ask, is "specialty communications"? Well, only contacts made on RTTY, SSTV, or via EME (moonbounce) or OSCAR paths will be recognized. Two levels of operating achievement will be recognized: Class A will require working all fifty US states: Class A-1 requires working ten DX countries from the *73 Magazine* WTW list.

Application should be made by submitting a list containing date, time, band, and mode of each contact. Class A lists should be arranged in alphabetical order by state, and Class A-1 lists in order of callsign prefix. A signed declaration of the type and description of your equipment and antenna should also be included. This entire package should then be verified by two other amateurs, a local radio club secretary, or a notary public, and sent with $3.00 (or 8 IRCs) for each award to: Bill Gosney WB7BFK, Awards Editor, *73 Magazine*, 2665 North 1250 East, Whidbey Island, Oak Harbor WA 98277.

The mail is continuing to come in on Teleprinter Art, Ltd., and one thing is for sure, the "didn'ts" far outnumber the "dids." So far, as of this writing, in October, 1979, about a dozen of you report sending orders to Urbana and receiving nothing. One individual received his order as requested and notes he was pleased with the merchandise. I don't know if events subsequent to his order have changed things, but I am preparing all of the material I have been sent for forwarding to the proper authorities.

So as not to end this month on a sour note, let me take a moment to highlight one of *73*'s advertisers who appears to be doing a good job. Selectronics, in Philadelphia PA, has been running ads for years featuring component parts useful in the construction of video terminals and the like. A recent order from this QTH was filled promptly, with receipt of the merchandise via UPS in just a few days. One slight problem was handled quickly and efficiently by phone following receipt of the merchandise. A RTTY Loop-de-Loop to Selectronics.

Some more basics next month for those of you who have requested them, and remember to enclose that SASE if you wish a reply directly from me or any other *73* author.

RIPPED OFF?

If you have a serious problem with a ham firm, send them a letter with all the facts in detail, plainly and simply . . . and send a copy to Wayne Green W2NSD/1, c/o 73 MAGAZINE. 73 protects its readers more than any other magazine.

Looking West

from page 8

to travel through Baja; most listen to the advice and have the time of their lives amid the splendor that is Baja California. Some people don't listen and are lost in the wilderness. Each year, the local LA newspapers and TV stations carry stories of vacationers who didn't follow the rules and found themselves lost in a territory they did not know. Many have died before would-be rescuers could find them.

Baja is not immune from the rampages of Mother Nature herself. Her annual rainfall equals or exceeds that of southern California, and in this type of area, it means that communities are easily cut off from one another. Overall communication in Baja is not the greatest. It is for these reasons and others that the amateur community of Baja has undertaken to tie the area together using many existing amateur repeaters.

Phase one of the intertie involves five existing northern Baja repeaters: .93/.33 in Tijuana, .34/.94 some 40 miles south of Tijuana, .31/.91 in Mexicali, 145.34/144.74 in Ensenada (remember that Mexican amateurs have an advantage in that they are not restricted by repeater subbands as we are in the USA), and .37/.97, which sits about 8,000' above average terrain and can be worked from as far north as Santa Barbara, California, even though it's better than 200 miles south of the US-Mexican border. What you are reading about is not a dream. It already exists, giving hand-held saturated coverage throughout northern Baja.

Phase two involves linking further south about 200 miles to XE2ERD on 145.5/144.9 and then to Cedros Island, where a new system will have to be established using some form of "nature power," i.e., wind, solar, etc. There is no place to just "plug in" a repeater at that location. Once accomplished, about ¾ of Baja will have linked coverage and it won't end there. Alex also informed us that long-range plans call for linking to the Mexican mainland from someplace near Mazatlan and that amateurs in Mexico City are already at work creating plans for a nationwide interlink. What's truly amazing about the Baja story is that what has thus far been accomplished has been the work of about six dedicated amateurs.

What about Americans using the interlink? Is it legal? Only if you access it from the US side of the border or have obtained a Mexican amateur license to operate in Mexico. At present, no reciprocal licensing exists between the US and Mexico, although it is hoped by amateurs on both sides that someday it will. Meantime, to operate in Mexico, you must pass a Mexican amateur exam, and Mexican amateurs wishing to operate in the US must pass our exam. Exceptions are made during certain special events, such as off-road rallies, but remember that these are exceptions rather than the rule. As already stated, it is legal for US amateurs operating from US soil to talk with Mexican amateurs through Mexican-based repeaters. Many of the systems that lie near the US-Mexican border are accessible from a vast portion of southern California. If you are planning a visit to southern California, especially the San Diego area, you might try saying hello on one of the frequencies listed previously. I suspect you will find a warm welcome from our neighbors to the south.

Two final notes. Anyone interested in contacting Alex about the Baja intertie can do so through his *Callbook* address or through Looking West. Also, we will keep you posted on developments in this intertie as they occur.

Meanwhile, stateside, we received a letter from Ron Johnson WA5RON which reads as follows:

Dear Bill,

I always read your interesting columns in *73 Magazine.* I especially enjoyed the recent October issue where you suggest "growing" regional, and eventually national, VHF intertie systems by linking existing repeaters on UHF. I, too, am interested in intertie and am participating with others in a major UHF linking project in Texas. I would like very much to join in an information exchange program with other intertie builders around the country.

Since you quoted from the Texas VHF-FM Society *News* and W5OGZ, you may already be aware of our Texas Intercity Relay System project. TIRS will eventually link VHF simplex or repeater "dump" stations in major Texas cities. San Antonio and Austin are already connected. Equipment is being installed by local clubs in Dallas, Houston, and Beaumont at this time. Groups in other cities and towns have expressed interest in linking up. This intertie system is a grass-roots effort, local clubs or individuals providing the necessary equipment in their own area, with coordination and technical support from the state society. TIRS is a wide-open system, carrier operated, and any ham is invited and encouraged to use it. TIRS had a disaster communications objective, and its readiness for emergency use Is best demonstrated and practiced by frequent recreational use. Teletype signals, as well as voice, are welcomed on the TIRS frequency. It is not an "elite group" or by-subscription-only system.

I had not thought in the past that Texas was "west" enough to catch your interest, but since you asked for input on the intertie subject, I am sending you this info about TIRS. If you like, I'll be glad to keep you posted on future developments.

I would enjoy reading about other successful intertie efforts, either in your column or as articles in good ol' *73 Magazine*. Why don't you dig something up on the CACTUS network? I have enjoyed a QSO or two on that system during trips west of El Paso and have seen not one technical publication on CACTUS, except for their user's manual. An article describing the CACTUS hardware, control circuits, pictures of mountaintop sites, maps showing coverage, would be very good. Can't you goad those fellows into letting go of the soldering iron for a few minutes and sitting down to a typewriter? Surely the network isn't considered "secret" anymore. An article or just a short description in "Looking West" would be nice.

Those of us working on the Texas Intercity Relay System would like to find out about other systems being built in states surrounding Texas, particularly those who might be interested in linking to TIRS. If you hear about anything like that within range, please let me know or give them my address. Also note that we have a weekly meeting on 80 meters LSB for planning and discussion, 2130 local (Central) time at 3830 kHz every Sunday night.

I will be watching future issues of *73* for more on this subject. Thank you.

Ron Johnson WA5RON
3524 Greystone #194
Austin TX 78731

Well, we cannot fulfill Ron's request to make the little-known details about the famed CACTUS Radio Network public unless there comes a day when CACTUS wants to go public. They are a truly phenomenal organization, but they value their privacy and we will always respect that. Maybe some day, Ron . . .

TIRS, as you have already learned, is quite public. Write to Ron at the above address for more information.

That's it this month on the Nationtie project. If more input arrives before we write next month's column, we will include it. Meanwhile, it looks as if things are beginning to take shape.

Our closing story also comes from an out-of-area amateur, Jim Eagleson WB6JNN of Watsonville, California. Jim wrote to tell us about a new 23 cm linear translator now in service in northern California. Jim writes:

"Project OSCAR, the northern California group that put together the first OSCAR satellites, just put a linear translator into service on Mt. Umunuhm in the 23 cm band (1296). Additionally, the NBC (Narrow Band Communicators) two-meter translator is nearly completed with only integration of modules, site evaluations, duplexer tune-up, and related areas left to do. It is an embryo system (as is the 1296 system), but that's where we all have to start. Some on-the-air tests will be run in a few weeks for the two-meter system. The 23 cm system has been up for about three weeks."

More on this also as it develops. In the meantime, I hope that Santa brought you your dream rig.

Ham Help

I am attempting to locate all Extra class husband and wife teams. Any Extra who had a late Extra class spouse is also eligible.

We now have a nucleus of names, so we can perhaps consider a name for the group, an occasional news bulletin, a net, a mini reunion in conjunction with other ham gatherings, and, perhaps, a charitable donation.

Those who are qualified should drop me a line with your thoughts regarding any activity that we should undertake. I will summarize the ideas in a bulletin and mail it to those eligible.

Again, thanks to all, including Chris AI6S, for helping me.

Betty Baldo KB6P
3 Eton Court
Berkeley CA 94705

I need a schematic for a Heathkit model GR-91 receiver for use with our junior high school amateur radio club.

W. G. Schuchman W7YS
1400 N. Wakonda Street
Flagstaff AZ 86001

LETTERS

from page 154

two features can, with little trouble, see that their value is one of the biggest features of the radio.

The scanning feature is great when applied to the situation of wanting to monitor another repeater for important DX news or an emergency channel. The ham listening to an active repeater for social reasons can be sure of not missing what might be of interest to him, or her, on another usually quiet repeater.

The second feature, programming capability, is a gift from the gods. Having owned the UV-3, I can vouch for the relative difficulty of changing bands or channels in the mobile mode. As the author explains, it is like a checklist in an aircraft. Being able to simply turn one knob and be in a specific channel, rather than having to set an offset frequency by removing one's eyes from the road, is a *most* valuable feature and adds to safe mobile operation with this radio.

The programming of the diode boards is quite prone to errors, but not impossible. As a matter of fact, Drake offers to send you a diode placement chart to use as a guide in placing the diodes in the proper spaces.

Wallace B. Shapiro N2WS
North Woodmere NY

TO THE HILT

I am writing to you about the constant attacks on the ARRL you levy almost every month in your Never Say Die column.

After reading many of these editorials, I have come to the basic conclusion that you are trying to help the League realize its mistakes. I personally do not think that you are trying to tear down the ARRL, although one must admit that you take some pretty good stabs at it.

Many times you make comments about the League publication, *QST*. I agree that eighteen dollars a year is a bit much for a magazine that has half the feature articles of *73*. Also, there are constant references to the subject of the top directors' salaries. I agree with your comments on this subject also.

One thing that I do not like about your editorial is the constant reference to yourself. It seems that you are constantly making references to what you would do had you been offered the top job at the ARRL. If you have such good ideas, maybe you should try to get the proposed IRL formed.

In conclusion, I would like to say that I support your magazine to the hilt because it does provide more articles for the money than any other ham magazine.

Mark L. Parrish WD0DXM
Aurora CO

EME INFO

The following information may be of use to EME enthusiasts.

The *1980 Nautical Almanac* is now available and may be obtained by writing to: US Government, c/o Superintendent of Documents, Washington DC 20402. Ask for the *1980 Nautical Almanac*, #008-054-00079-7. The current price is $8.75, which includes postage. Your check should be made payable to "Superintendent of Documents."

As you may know, "H.O. 214—Tables of Computed Altitude & Azimuth" is no longer available. However, this series has been replaced with a newer version, "Pub. No. 229—Sight Reduction Tables for Marine Navigation." Listed below are the volumes available and their current price.

Latitudes	Volume	Price
0-15	1	$6.00
15-30	2	$11.55
30-45	3	$9.40
45-60	4	$9.40
60-75	5	$6.00
75-80	6	$6.00

These volumes are available by writing to: Defense Mapping Agency, Office of Distribution Services, Attn: Code DDCP, 6101 McArthur Blvd., Washington DC 20315. Make your check payable to: "Treasurer of the United States." The volume prices also include postage.

Brian M. Manns K3VGX
Seven Valleys PA

OTHERS DWINDLE

The QRM Annihilator (October, 1979, p. 50) is well worth the price of a subscription to Novice or old-timer alike. It is easy to build and a joy to use.

I breadboarded one immediately to try it out and was amazed at the results. Number two was built with variable resistances at R1 and R4 and two speakers; the one on the input monitors what is going in, while the output speaker delivers the message.

W5FOE built a demonstration model for the entire club's inspection and it was well received.

Two suggestions are well worth incorporating for the CW purist: 1) Change the output to sinusoidal rather than square wave for a more pleasant tone and less tiresome listening. 2) Input and output can be fed through a fader (one-knob control) to the speaker for ease of operation.

This article, like many others, is what makes *73* grow while others dwindle.

Wayne O. Brewer W5KD
Tow TX

THANK YOU

I thought that you might be interested to know that your magazine is one of the most important reasons I studied for and passed the test for my ham ticket.

After thinking about it for years—even to the extent of subscribing to *QST* several years ago—I had decided that the ARRL and ham radio were out.

Then I saw a copy of your magazine on the stand. I read it and I subscribed to it because it made the hobby look interesting.

On September 19th, I took and passed my Technician exam. When my ticket comes, I should be ready to take the code test for General.

Once again, thank you.

Ed Grubgeld
Palo Alto CA

BIOFEEDBACK

"Blueprint for Biofeedback Experimentation" (September, 1979) is a nice rapid tour through brain-wave applications.

Please encourage experimenters to follow safety rules when they connect electrical devices to the body. Obtain a book on medical electronics from your library; *never* connect equipment to the ac line, *any* of it. If you want to see your name in lights, do it with LEDs! Thanks.

Mitch Cohen WB4RXB
Margate FL

DATONG UPDATE

In regard to the Datong FL1 filter review (October, 1979): Unfortunately, due to the weakening dollar in the world market, we were obliged to increase prices, effective July 16th, 1979, to $199.95 from $179.95. Also, Datong Electronics' address was shown in the review as the place to write for information. Readers who do write will, of course, receive responses or be directed to my office here at AR Technical Products. Anyone else seeking information should contact us directly.

Roger L. Moss, President
AR Technical Products Corp.
PO Box 62
Birmingham MI 48012
(313)-588-2288

Ham Help

I am very interested in contacting hams who have used a VK2AOU-type antenna (*Ham Radio*, May, 1979), either home brew or commercially built. Any information would be gratefully appreciated.

Gene Smarte WB6TOV/1
Nubanusit Road
Hancock NH 03449

Raynet (Radio Amateurs' Emergency Network) in the United Kingdom—sponsored by the Radio Society of Great Britain—needs help. A Symposium to be held in April, 1980, near London will discuss emergencies of various kinds involving amateur participation. Can anyone lend any slide/tape lectures concerning such matters? Offers of suitable materials should be made to me. Thank you.

T. I. Lundegard G3GJW
Raynet Committee
c/o Tebrax Limited
63 Borough High Street
London SE1 1NG
England

Can anyone supply me with a schematic or tech manual for a Dage tube-type TV camera, model 101-AF?

I will gladly reimburse for photocopies, but I would prefer to borrow the original for a short period of time. I will pay postage. Thank you.

Al Cikas
2112 Stonehenge
Springfield IL 62702

Social Events

SOUTH BEND IN
JAN 6

A hamfest swap & shop will be held on January 6, 1980, at New Century Center, on US 31 by the river, South Bend, Indiana. Tables are $3.00 each. Food service, automobile museum, and art center are in the same building as the hamfest. Talk-in on 146.52/.52, .13/.73, .34/.94, 147.99/.39, .87/.27, and .69/.09. For information, write the Repeater Valley Hamfest committee, Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616, or phone (219)-233-5307.

LANCASTER PA
JAN 7

A 10-week Novice code and theory class course will be held at the Willow Street Vo-Tech, Lancaster, Pennsylvania, beginning the week of January 7th, 1980. For further information, call (717)-464-3359.

OAK PARK MI
JAN 13

The Oak Park Amateur Radio Club will hold its annual Swap and Shop on January 13, 1980, at Oak Park High School, Oak Park Blvd., Oak Park, Michigan. Doors will open at 8:00 am.

RICHMOND VA
JAN 13

The Richmond Frostfest III, sponsored by the Richmond Amateur Telecommunications Society, will be held Sunday, January 13, 1980, at the Bon Air Community Center. There will be a home-brew contest with four awards: most original idea, best electrical work, best mechanical work, and most deserving work, and prizes. FCC exams start at 10:00 am and completed Form 610s must be received in the Norfolk Office of the FCC at 870 North Military Highway, Bank of Virginia Bldg., Norfolk VA 23502, no later than January 9th. Admission is $3.00, indoor flea market tables are $3.00, and tailgaters are $2.00. Talk-in on .28/.88 and .34/.94. For further information, contact the Richmond Amateur Telecommunications Society, PO Box 1070, Richmond VA 23208.

SHARON PA
JAN 19

The third annual Mercer County Amateur Radio Club seminar will be held at the Holiday Inn, West Middlesex, Pennsylvania, off I-80, from 9:00 am to 5:00 pm. Come to hear speakers on your favorite amateur radio topics. Advance admission is $2.00. There will be door prizes. For further details, write K3LA, PO Box 673, Sharon PA 16146.

WAUKESHA WI
JAN 19

The 8th annual Midwinter Swapfest presented by the West Allis Radio Amateur Club will be held on Saturday, January 19, 1980, beginning at 8:00 am at the Waukesha County Expo Center, Waukesha, Wisconsin. There will be food, refreshments, and cash prizes. Tickets are $1.50 in advance, $2.50 at door. Tables may be reserved at $3.00 per four-foot table till January 11 or until half of the available tables are reserved. For information, write 1980 Swapfest, PO Box 1072, Milwaukee WI 53201.

ARLINGTON HEIGHTS IL
JAN 27

The Wheaton Community Radio Amateur Club will hold its Wheaton Hamfest Portable Nine on Sunday, January 27, 1980, at the Arlington Park Expo Center, Arlington Heights Race Track, Arlington Heights, Illinois. Doors will open at 8:00 am sharp! 300 free flea market tables will be available, plus 100 commercial booths. There will also be hourly door prizes. Tickets are $3.00 at the door and $2.00 in advance. For information, send an SASE to WCRA, Box QSL, Wheaton IL 60187.

MANSFIELD OH
FEB 10

The Mansfield mid-winter hamfest and auction will be held on February 10, 1980, at the Richland County Fairgrounds, Mansfield, Ohio. Featured will be prizes, a flea market, and an auction to be held in large heated buildings. Doors will open to the public at 8:00 am. Tickets are $1.50 in advance and $2.00 at the door. Talk-in on 146.34/.94. For additional information or advance tickets, contact Harry Frietchen K8HF, 120 Homewood, Mansfield OH 44906, or phone (419)-529-2801 or (419)-524-1441.

LIVONIA MI
FEB 17

The Livonia Amateur Radio

Club will hold its 10th anniversary Swap 'n Shop on Sunday, February 17, 1980, from 8:00 am to 4:00 pm, at the Churchill High School, Livonia, Michigan. There will be plenty of tables, door prizes, refreshments, and free parking available, plus reserved table space of 12-foot minimum. Talk-in on 146.52. For further information, send an SASE to Neil Coffin WA8GWL, c/o Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48150.

GLASGOW KY
FEB 23

The Mammoth Cave ARC will hold its annual Glasgow swapfest on Saturday, February 23, 1980, from 8:00 am to 5:00 pm at the Glasgow Flea Market, south of Glasgow on Highway 31E. There will be a large heated building with plenty of free parking. Spaces are available for $3.00 each. There will be no meetings or forums, just door prizes, free coffee, and a large flea market. Admission is $2.00. Talk-in on .34/.94. For additional information, contact WA4JZO, 121 Adairland Ct., Glasgow KY 42141.

LANCASTER PA
FEB 24

The Lancaster Hamfest will be held on February 24, 1980, at the Guernsey Pavilion, located at the intersection of Rtes. 30 and 896, east of Lancaster, Pennsylvania. General admission is $3.00, except children and XYLs. Doors will open at 8:00 am. All inside spaces are available by advance registration only and are $3.00 each for an 8-foot space, which includes a table. There will be free tailgating in a specified area outside, if the weather permits. There will be a two-hour Dutch Country tour by an advance registration of $4.00. Food will be served at the hamfest. Also, there are excellent restaurants and accommodations in the area. Talk-in on .01/.61. For information, write Sercom, Box 6082, Rohrerstown PA 17603.

DAVENPORT IA
FEB 24

The Davenport Radio Amateur Club will hold its ninth annual hamfest on Sunday, February 24, 1980, from 8:00 am to 4:00 pm, at the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th Street, Davenport, Iowa. Tickets are $2.00 in advance; $3.00 at the door. Tables are $3.00 each, no limit, with a $2.00 additional charge for ac electrical hookup. Talk-in on 146.28/.88 WØBXR repeater. Advance tickets can be purchased by writing to club treasurer Clarence Wilson WAØOEW, 1357 W. 36th Street, Davenport IA 52806.

MARLBORO MA
FEB 24

The Algonquin Amateur Radio Club will hold its 3rd annual ham radio flea market on Sunday, February 24, 1980, at the Marlboro Jr. High School Cafetorium, just off Rte. 85 North, Marlboro, Massachusetts. Admission will be 50¢. The event will be held rain, shine, or blizzard. Food will be available. Tables will be $5.00 in advance or $7.50 at the door. Talk-in on .01/.61 and .52. For more information or reservations, contact Charles D. McCarthy W1BK, 128 Forest Ave., Hudson MA 01749, or phone (617)-562-5622.

BLACKSBURG VA
MARCH

Virginia Polytechnic Institute and State University Department of Chemistry will hold three short courses in March, 1980, at the Virginia Tech campus, Blacksburg, Virginia. The first workshop, entitled Digital Electronics for Instrumentation and Automation, will be held on March 10-11, 1980. The second workshop, entitled 8080-8085-Z80 Microcomputer Interfacing, Design, and Software, will be held on March 12-14, 1980. The third workshop, entitled TRS-80 Interfacing and Programming for Instrumentation and Control, will be held on March 17-18, 1980. These programs will be directed by Dr. Jonathan A. Titus, Dr. Paul Field, Dr. Christopher Titus, and Mr. David G. Larsen. These are hands-on workshops with the participants having the opportunity to retain the equipment. For more information, contact Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg VA 24061, or phone (703)-961-5241.

CHRISTIANA DE
MAR 2

The Delaware Valley Amateur Radio Society will hold its Winter Fest and Computer Show on March 2, 1980, from 10:00 am to 4:30 pm at Christiana Memorial Hall, Rte. 273 and Old Baltimore Pike, Christiana, Delaware. Events include a transmitter hunt (Freedom Foundation Fox Hunters Sanction Number 80-1) and a frostbite tailgate section. Tables, food, and free parking will be available. Dealer inquiries are invited. Talk-in on 146.52, 223.36/224.96, and 146.355/.955. For information and advance tickets, write to DVARS, PO Box 426, New Castle DE 19720.

STERLING IL
MAR 9

The Sterling-Rock Falls Amateur Radio Society will hold its 20th annual hamfest on Sunday, March 9, 1980, at the Sterling High School field house, 1608 4th Ave., Sterling, Illinois. Advance tickets are $1.50; door tickets are $2.00. Over $2,000 worth of prizes will be given away. A large indoor flea market will be restricted to radio and electronic items only. There will be plenty of free parking, lots of bargains, and plenty of good food. Talk-in on .25/.85 (WR9AER). For tickets, write Don Van Sant WA9PBS, 1104 5th Avenue, Rock Falls IL 61071.

ALL BAND TRAP ANTENNAS!

Ham Help

I am wondering if anyone can help me beat the high cost of vacations. I have a three-bedroom home in Victoria BC and would like to visit the Disneyland area either at Easter break or in July/August. Easter would be preferred.

Don Ankersen VE7DHG
4142 Hawkes Avenue
Victoria BC V8Z 3Z1

I'm looking for the following manuals: NavShips 92175, MIL-R-12887, and documentation for the MD-141/GR and T-282D/GR units. Can anyone out there help me? I will gladly pay reasonable prices. Thanks.

Charles T. Huth WB8NLM
146 Schonhardt Street
Tiffin OH 44883

I desperately need manuals or schematic diagrams for the following equipment: Gonset G66B, Central Electronics 20A, and Knightkit tube tester, KG600B.

Jimmie R. Hall
820 Robert Ct.
Carlisle OH 45005

I'm looking for either an original manual or a copy for a Johnson model 240-122 vfo. The vfo was usable with many Johnson rigs and the manual for my Adventurer which I am using it on told how to get it hooked up, but I have no information on the vfo itself. Even a schematic would help.

I will pay a reasonable copying fee if required. Please advise by card first. Thanks.

Dave Brown W9CGI
R5, Box 39
Noblesville IN 48060

I need a schematic and parts list for an Ovenaire 1-MHz oscillator, type 15-10, used in Navy frequency counter AN/URM-207, circa 1963-64.

I also need a schematic for a Conar 223 tube checker and a Motorola D25 solid-state Dispatcher. I will copy and return.

Marvin Moss W4UXJ
Box 28801
Atlanta GA 30328

Does anyone have an instruction booklet for a Hallicrafters model TW 2000 (1952)? I will be happy to pay for a photocopy.

I would also like to know if any readers can suggest a source for spare parts and accessories for this same model. Thanks very much for any help.

Bob Freedman
686 Cragmont Avenue
Berkeley CA 94708

I am interested in building a "Morse-to-video" device that will sample the incoming CW signal from my rig, process it, and display it on a normal TV set.

Chuck Bowers WA6GZZ
3326 Sawtelle Blvd., Apt. 31
Los Angeles CA 90066

I would like to establish a ham radio club in my school. Our children are handicapped with language and hearing problems and we have very limited funds. Any useable equipment which could be donated will be greatly appreciated.

Robert Boykin WA2HUY
Industrial Arts Department
School for Language- and Hearing-Impaired Children
421 East 88th Street
New York NY 10028

A RTTY AMSAT information net is being started on Tuesday nights (Wednesday mornings, UTC) at 0230 UTC on 3620 MHz, 60 wpm, 170-Hz shift. I will be NCS.

Charles E. Martin AB4Y
PO Box 3370
Bowling Green KY 42101

I need a schematic of a high-serial-number Drake SC-6, 6-meter converter, or I will reproduce the manual and return.

You'll know the correct SC-6 by noting that it has 4 transistors. The rf stage is a pair of cascode J-FETs. Thanks.

Jack Ross W2NXC
1244 Crim Road
Bridgewater NJ 08807

For research purposes, I am interested in contacting anyone who has operated an amateur station from a "deleted country" as designated on the ARRL DXCC list.

Gary Mitchell WA1GXE
Box 1003
Fairfield CT 06430

I would like to get in touch with any amateurs interested in forming a net to learn the German language. We need some net members who are fluent in German to assist.

Robert E. Bunn WA0LKE
Rt. 3, Box 565
West Plains MO 65775

I would like to hear from anyone who has any modifications for a Swan 500. Thanks.

Hal Hansen N1APE
8 Abenaki Trail
Littleton MA 01460

propagation

by
J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	14	7	7	7	7	7	7	14	21	21A	21A
ARGENTINA	14A	14	7	7	7	7	14A	21A	21A	21A	21A	21A
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14	21	21	21A	21A
CANAL ZONE	21	14	7	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7	7	7	7	7	7	14	21A	21A	21	14	14B
HAWAII	21A	14	7B	7	7	7	7	7B	14	21A	21A	21A
INDIA	7	7	7B	7B	7B	7B	14	14A	14	7B	7B	7B
JAPAN	21	14	7B	7B	7B	7	7	7	7B	7B	7B	14
MEXICO	21	14	7	7	7	7	7	21	21A	21A	21A	21A
PHILIPPINES	21	14	7B	7B	7B	7B	7B	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	14	21A	21A	21A	21	21
SOUTH AFRICA	14	7	7	7B	7B	14	21A	21A	21A	21A	21	21
U. S. S. R.	7	7	7	7	7	7B	14	21A	14A	7B	7B	7
WEST COAST	21A	14	7	7	7	7	7	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21A	14	7	7	7	7	7	7	14	21	21A	21A
ARGENTINA	21A	14	14	7	7	7	14	21A	21A	21A	21A	21A
AUSTRALIA	21A	21	14	7B	7B	7B	7B	7B	21	21	21A	21A
CANAL ZONE	21	14	7	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	14	21A	21	14B	7B
HAWAII	21A	21	14	7	7	7	7	7	14	21A	21A	21A
INDIA	7B	14	7B	7B	7B	7B	7B	7B	14	7B	7B	7B
JAPAN	21A	14	7B	7B	7	7	7	7	7	7B	7B	14
MEXICO	14	14	7	7	7	7	7	14	21	21A	21A	21A
PHILIPPINES	21A	14	7B	7B	7B	7B	7B	7	7	7	7B	14
PUERTO RICO	21	14	7	7	7	7	14	21A	21A	21A	21A	21A
SOUTH AFRICA	14A	14	7	7B	7B	7B	14	21A	21A	21A	21	21
U. S. S. R.	7	7	7	7	7	7B	7B	14	14	7B	7B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	14	7	7	7	7	7	7	7	14	21A	21A
ARGENTINA	21A	21	14	7	7	7	7B	14A	21A	21A	21A	21A
AUSTRALIA	21A	21A	14A	14	7B	7B	7B	7B	14	21	21A	21A
CANAL ZONE	21	14	14	7	7	7	7	14	21A	21A	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	7A	21A	21	14B	7B
HAWAII	21A	21A	21	14	7	7	7	7	14	21A	21A	21A
INDIA	14B	14	7B	7B	7B	7B	7B	7B	7A	7B	7B	7B
JAPAN	21A	21	14	7B	7	7	7	7	7	7B	14	21
MEXICO	21	14	14	7	7	7	7	14	21	21A	21A	21A
PHILIPPINES	21A	21	14	7B	7B	7B	7B	7	7	7	7B	14A
PUERTO RICO	21	14	14	7	7	7	7	14	21A	21A	21A	21A
SOUTH AFRICA	21	14	7	7B	7B	7B	7B	14	21	21A	21	21
U. S. S. R.	7B	7	7	7	7	7B	7B	7B	14	7B	7B	7B
EAST COAST	21A	14	7	7	7	7	7	14	21A	21A	21A	21A

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

january

sun	mon	tue	wed	thu	fri	sat
		1 G	2 G	3 G	4 G	5 G
6 G	7 G	8 F	9 G	10 G	11 G	12 G
13 G	14 G	15 G	16 G	17 F	18 F	19 G
20 G	21 G	22 G	23 G	24 G/SF	25 F/SF	26 F/SF
27 P/SF	28 P	29 F	30 F	31 F		

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73 Magazine for Radio Amateurs

Info

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W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

ASIA FLEW

Next October, if you can get away, you should go on the IEEE tour of Asia. You'll love it.

Sherry and I went in 1979 and it frustrates me to have that much fun without getting others to enjoy it with me. How would you like to get a ham license in Korea and get on the air as a DX station for a while? How would you like to meet the only ham on Taiwan, Tim Chen BV2A? Or get together with most of the active hams in Hong Kong for a dinner . . . and some operating? A visit to the hundreds of electronics stores in Tokyo's Akihabara section is something you will see nowhere else on Earth.

The tour was set up to coincide with electronic shows in Taipei, Osaka or Tokyo, Seoul, and Hong Kong. These shows have the latest in consumer electronics, including some ham gear, plenty of microcomputers, calculators, digital watches, hi-fis, TVs, TV cameras, and VTRs. If you are able to come back without some gadgets, you are better than I am. We brought back a Sanyo midget TV/radio/clock, a musical calculator, and a calculator watch exactly like the Seiko, but at about half the $275 Seiko price.

The hams on Guam are dying to meet you and set up one hell of a party. So are the hams in Hawaii . . . so you can get some "rest" on the way back. The whole tour was under $2000 per person, which is very reasonable considering that they put on a lot of free dinner parties and entertainments. If we can get about 20 hams to go on the next trip, I think we can work up hamfests in at least seven countries. Game?

HL9WG

The hams in Korea made my visit there unforgettable. I'd stopped off there on a flight around the world in 1959, back when Seoul was a large village more than a city. Today it stretches for miles and has a big shopping district, complete with several department stores.

Sgt. Charles Milhans WA7QYI /HL9UN took off several days to show Sherry and me around Korea. He's there with the rather sizeable U.S. contingent. My ham ticket had been arranged ahead of time and was quickly issued by the U.S. Amateur Radio Operations Director, Major Smith. Charlie then got us together with Mike Wengert HMØOM, an American living in Seoul as a civilian. Mike is a Korean-speaking radio commentator who runs a weekly radio program telling the Koreans about the reactions of the rest of the world to events in Korea.

Mike and Charlie took us all over town, interpreting for us where needed and introducing us to the marvelous Korean food. I'd heard a lot about kimchee, a fermented cabbage, which is served with almost every Korean meal. Not being a big fermented food fan, I approached it with hesitation. It was great! It had some of the tang you get with hard cider which is fermented.

The most exciting part of the visit to Korea was the trip to put my foot into North Korea. I'm a collector of countries visited, so I hate to make a trip without adding at least one more country, even if it is only a step over the border. In this case, Charlie had been talking with Chris Wenstrom HL9KL, one of the Swedish team minding the South Korean border at Panmunjom, and had made arrangements for us to come up and visit.

Charlie, Sherry, and I started


HEADQUARTERS UNITED NATIONS COMMAND/
UNITED STATES FORCES, KOREA APO 96301

CERTIFICATE OF AUTHORIZATION
FOR AMATEUR RADIO STATION

This is to certify that Radio Station HL 9 WG is an official amateur radio station authorized by the Commander in Chief, United Nations Command/Commander United States Forces Korea, for operation under the control and supervision of WAYNE GREEN. This authorization is subject to the terms of the current regulations governing amateur radio operations in Korea, and will remain valid for two years from the date of issue unless sooner revoked or modified.

Certificate No. [illegible]
Date [illegible] AUGUST 1979

Signal Officer

W2NSD/1 became HL9WG in Korea, courtesy of the UN Command.

Just after talking with W2NSD/1 from Seoul, using my HL9WG call, this photo was snapped. Next to me is Namil Kim HM1HJ, seated is Mike Wengert HM0OM, our new importer for Instant Software in Korea, and on the right is Hea-Soo Ree HM1BO, the president of the Korean Amateur Radio League. 10:15 at night there is 9:15 am the same day back home.

out early in the morning on a bus and arrived at the demilitarized zone (DMZ) after an hour or so of bussing from one small village to another. It was a bit sobering when we signed the agreement that the U.S. would no longer be responsible for us as we entered the zone.

Chris took us all around the border area, showing us the meeting building, which is right on the border, with the North Koreans taking pictures of us every inch of the way. They had telescopic cameras for slides and movies. We'd been warned not to wave back when they waved at us, the intent being to have movies of us waving and immediately call for a meeting because our waves were considered as obscene gestures and thus a breaking of the peace agreement. Without waving, we went into the building, and, with the North Koreans watching every move and filming, we walked about twenty feet into North Korea . . . snapped some pictures as proof . . . and hastily went back into the South Korean half of the building. Country number 91 for me. Whew!

What I'd like to do next time is have a bunch of hams along and all bring those glasses with Groucho eyebrows and big noses . . . and everyone wear those while visiting the place. That ought to drive them crazy . . . or at least crazier.

All of the main roads in Korea have these underpasses. The idea is that should North Korea invade the country, explosives in the support columns would blow them away, leaving the roads completely blocked by the debris from above them. This reminded me a bit of the rails which are designed to spring up out of the roads (via radio control) in Switzerland should they be invaded. These are on all mountain roads and would most effectively stop tanks and other traffic.

We had a very nice lunch with Chris and the Swedish peacekeeping staff. It's much like a little country club up there . . . with the exception that things could go to hell at any moment. After lunch, I sat down and made a few contacts with Chris's rig. Since someone had just been kidnapped from our side the night before, it was exciting to walk along the border on a wooded path, hoping that this would stay a peaceful visit.

On our first night in Korea, Sherry and I attended a dinner arranged by the tour . . . a dinner show at the Sheraton Walkerhill Hotel. The dinner was fine, but the show was crummy . . . not quite up to Gong Show talent. The next night, we had another tour dinner and then went to visit Charlie, where I got on the air and worked a bunch of Ws.

The next night we went to see Mike. The head of the Korean Amateur Radio League (KARL), Hea-Soo Ree HM1BO, came over and visited, as did the KARL Supervisor, Namil Kim HM1HJ. I got on the air for a while using Mike's rig and made quite a few stateside contacts . . . the best one being with W2NSD, my home station at *73 Magazine*, operated by Jeff DeTray, the Assistant Publisher.

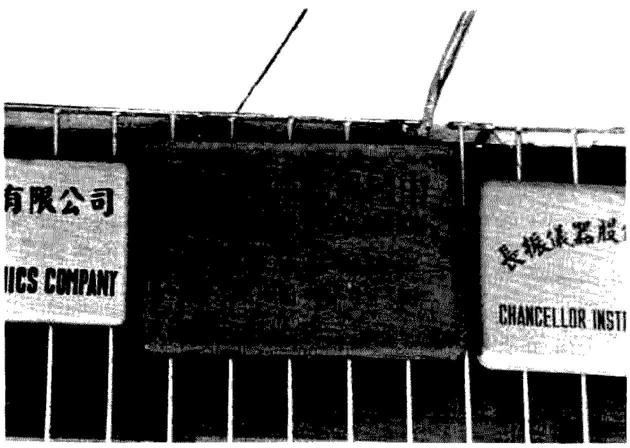
No sooner were we getting used to modern day Seoul than we were on the plane for Osaka and a second electronics show. The Japanese didn't have as many incredibly loud hi-fi exhibits as the show in Korea; however, it was a much larger show . . . spread out in three big buildings. One was devoted mostly to parts and equipment modules and the other two were consumer electronics, including quite a number of microcomputers. The state of the art has progressed in the last year in color home TV cameras. I was particularly interested in that because I'd like to update my theory audio tapes with video . . . in color.

They had some food booths at the show, so we lunched there and then caught our tour bus for a visit to the big shrine at Osaka. A couple of rolls of film later, we were bussed back to downtown so we could see the department

Japan Airlines gets you ready for the world of chopsticks on your way to Asia. Here's Sherry getting practice with some noodles.

Here I am shaking hands with Yasushi Oshima, the mayor of Osaka, during my recent visit to that city. That's the key to the city hanging around my neck . . . that and 100 yen got me a ride on the subway. The mayor was most gracious, and, in addition to the key, he laid a beautiful photo book about Osaka on me. His aide turned out to be JE3DTA.

A Japanese subway train is remarkably like those in our country . . . with a few exceptions. First, they are incredibly clean. Even the tracks are clean, with no papers or cans thrown down there. Second, they are filled with Japanese . . . and the ads are all in Japanese. A ride is charged by the distance, much like the London Underground, with short distances costing about 50¢ and longer about double that.



It isn't very prepossessing . . . just a carved wooden sign over the entryway. Upstairs are the offices of the China Radio Association, with all but one of the membership being not licensed. The Association publishes a quarterly magazine, with articles in the most recent issue covering satellite business systems, sunspots, Skylab, the radio and radar facilities at their new international airport, the Marisat satellite system, working ability of computers, biomedical instrumentation, and radio amateur activities.

YOKOTA

COMPUTER CLUB

YOKOTA AB JAPAN
APO SF 96328

There are enough Americans with microcomputers to have not just a computer club, but a very active one. They hold meetings weekly and fielded nearly a hundred for my talk.

stores. Whoops! There's a McDonald's! I found a number of our tour group inside pacifying Big Mac attacks. I tested the hot fudge sundae . . . just like the ones in Nashua, New Hampshire . . . not very good.

That evening, Mr. and Mrs. Inoue (the president of Icom) picked Sherry and me up for dinner. Naturally, they knew a wonderful restaurant and we had what was beyond a doubt the finest Japanese dinner of our lives. Tempura, Kobe steak, the works. We enjoyed having a chance to talk again, It having been several years since they had visited me in New Hampshire. At that time we took them up to the *73 Magazine* repeater site on some snowmobiles, courtesy of Chuck Martin of Tufts Electronics.

Prices are stiff in Japan if you don't know your way around. I made the serious error of having breakfast in the hotel (International) the first day in Osaka. It was not only crappy, it was $8.25 for just one breakfast. That was a small glass of undrinkable bitter orange juice, one over-easy egg which was hard as a carp, and a thick slice of cold toast. Ugh.

When we decided to venture out for dinner we took a taxi to the downtown area, first going to the department stores for some shopping (and money changing). The restaurants all have very lifelike plaster models of the foods in their windows, complete with prices. We looked over at least a hundred restaurants before settling on a Chinese restaurant. It was right across the street from a Baskin Robbins and next door to another McDonald's. The food was fine and the prices moderate . . . particularly for Japan. We decided to brave the subway system to get back to the hotel . . . and

Three bowls of dinner being cooked at one time on large Mongolian barbeque stove. You pick out the meat you want, frozen and sliced thin, add vegetables like you would at a salad bar, put on some hot sauces, and they cook the whole works in about one-half minute. You'll love it.

Like I said, in China you usually have about a dozen to a table, with a lazy Susan in the middle of the table. This is kept full of food, with many meals running to over a dozen different courses. Urp. These people were part of our tour group . . . Bob Chen at right, our tour leader.

had no problem. It is easy to use, being well marked, using the French metro system of signs. It's exciting to try something new like that.

We spent a little more time seeing the electronics show the next morning and then went to see the mayor of Osaka. He presented me with a key to the city plus a gorgeous book of photos of Osaka. His assistant turned out to be a ham.

After the key ceremony, we went back to the hotel and had lunch at a nearby American-type restaurant. I had one more meeting with a Japanese group wanting an exclusive license for our Apple programs for Japan. I bought two cups of coffee and one small cake . . . and the hotel bill was far more than for the lunch around the corner. Oh, well, this can happen to you in New York, too. I guess they ship television sets to the U.S. at a loss and make up for it with their hotel restaurants.

Right after lunch, we got on a bus and headed for the airport . . . and Taipei. I was looking forward to seeing Tim Chen BV2A. I'd contacted him from Seoul on 20m and gotten his phone number. The tour schedule was too busy the first day in "China" to see Tim, but we did get together the second day.

Busy? Right after breakfast we went to the electronics show. You know, they are making a lot of electronic equipment in Taiwan these days. The city, like Seoul, had grown up incredibly since my visit in 1959. Mopeds and motorcycles by the tens of thousands . . . chaos. They had some digital watches that got me to thinking again about importing . . . though the Otron watches I'd seen in Seoul seemed to have a couple more functions. I'd checked over the field a few months earlier at the Premium Show in New York and opted for Otron at that time . . . and had never been disappointed. It was very handy on this trip because it had two time zones at the push of a button . . . alarm, stopwatch . . . all those nice functions. But would hams want to spend $50 for a

Ever eat a Mongolian? Very good taste . . . when barbequed. The spelling in Hong Kong is not a strong suit.

Alas, even in China they have topless entertainment.

This is the lobby of the Grand Hotel in Taipei. Our tour group is heading upstairs for another fifteen-course lunch, complete with Peking duck. That's Tim on the left.

No, Tim Chen BV2A is not a midget; that's one hell of a big door. If you've contacted Taiwan recently, this is the chap you talked with.

nice watch like this? There are a lot of others that look similar, though they do not have quite as many functions.

Whoops, time to get on the bus and go to a luncheon put on by the Chinese Products Promotion Center. This was a big one and we were all seated at tables according to the products we were interested in. I sat at the computer table and quickly attracted two young chaps trying to export an inexpensive dot matrix printer. It needed a bit more developing of the driver circuits, but could be competitive. I aimed them at tour member Dave Freeman of Advanced Computer Products (one of our advertisers in *Kilobaud MICROCOMPUTING*).

We were all invited to a Chinese cocktail party that evening, so we rested up at the hotel for a bit and bussed into downtown and this event . . . arriving just a hair late. I was the first one into the party and grabbed the last hors d'oeuvre as a waiter took away the platters . . . and then the lights went out. We had to grope around in the dark to get back to the elevators and leave the hotel. Don't invite me to another Chinese cocktail party.

The dinner that night was arranged by the tour and it was excellent. The only problem, perhaps, was trying to pick up those big slippery mushrooms with plastic chopsticks. The show after the dinner was Las Vegas quality, not like the bomb in Seoul. Everyone enjoyed it.

The next day was October 10th, the biggest holiday of the year for Taiwan . . . they call it Double Ten. There were flags everywhere and balloons by the thousands. We watched the parade for a bit on television and then went out to see the town with Tim Chen, the only ham on Taiwan. The first stop was the club station, BV2A/BV2B. From there we took a taxi around town and ended at the museum . . .

This picture was taken on the biggest holiday of the year on Taiwan, Double Ten (October 10th) . . . hence the balloon in the center of the circle. That building across from our hotel (the Regency) is a department store. Handy. Still, this is almost two miles from the downtown area, where just a few years ago they had rice paddies.

Over 20,000 people participated in the Chinese Double Ten celebration in this sports arena. About 3,000 girls were used to hold up colored boards to make pictures and designs. They were kept busy with dozens of designs. The errors were surprisingly few considering that there was no way for them to get together to practice before the event.

The colored signs spell out a welcome for our group.

Now we see children at play.

running into our tour group there! This museum is a must.

Not far from the museum was the Grand Hotel, where we all had lunch. Tim didn't seem familiar with Peking duck . . . perhaps that is more of an American dish. But we had about twenty courses of excellent food, with Tim as our guest. The hotel is opulent.

We went for a visit to a shrine and then saw a bit more of Taipei before Tim had to leave for work. He is a representative for Columbia Pictures in Taiwan. Sherry and I rested a bit, trying the best we could to digest that enormous lunch before going out for another dinner at the expense of the tour. This was to be a Mongolian barbeque.

This was different. You go along a line like a salad bar and pick out the kind of meat you want . . . from a choice of beef, venison, pork, etc. The meat is frozen and sliced thinly. Then you add vegetables and sauces to the bowl. They take the whole bowl of food and dump it on a red hot stove top, turning it quickly to cook it . . . and back into your bowl. It was delicious. They had more meat on the table and some soup in a fondue-like pot so we could cook it at the table.

The biggest surprise was after the meal. We went by bus to a huge auditorium and sat for several hours watching one of the most spectacular shows I've seen. There were about 30,000 people present and groups of children of all ages took turns putting on very well produced and choreographed acts for us. Have you ever seen about fifty youngsters, maybe twelve years old, all juggling something like a badminton shuttle with their feet at once . . . without anyone making a mistake? They were standing up, not lying down, to do it.

They had some of the most complex rope jumping I've seen, too, with groups jumping rope within other ropes . . . within other ropes. Have you ever seen a triple rope sine wave with three groups inside jumping rope? Or two sets of double loops at right angles, with others inside all four loops jumping rope?

The networks would do well to get a remote to the Double Ten celebration next year. I know I'm planning on being there . . . how about you?

We still had one more day in Nationalist China . . . which meant another big lunch, more trade show, several miles of walking around town in the afternoon, a visit to more Taiwan products on display, and a mammoth Chinese dinner. Sherry passed this one up . . . I think the walk did her in. The head of the Chinese Chamber of Commerce ate at my table (there are always about ten or twelve to a table and a lazy Susan for passing the food around). He may just have won the office by being able to drink anyone else under the table. He went for four rounds of drinks at our table, drinking drink for drink with each person at the table . . . then he moved on to the next table! Amazing capacity.

After an early start from Taiwan, we arrived at Hong Kong (country number 92 for me . . . I'll get to 100 yet) in the early afternoon. We unpacked quickly and went off to the consumer electronics show in a downtown hotel. This was a smaller show, but certainly interesting. The prices in Hong Kong are about the best of the trip for watches. I was hoping to get some glimpse of the legendary TRZ-80 at this show, but no one admitted even knowing about it. I'd seen pictures of it in an Australian magazine, so I knew it was not imaginary.

Wiping our fingers from the

But no one can forget that not far away is mainland China and the constant threat of war for which Taiwan must be constantly prepared.

With a cheering section of 3,000, it is possible to come up with even the most complicated of Chinese characters.

Looking West

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I rarely comment on the work of another author, but in this case I must make an exception to my rule. Why? Because I believe that the November article by Bob Cooper W5KHT entitled "The Satellite TV Primer" was the most interesting piece ever to appear in this or any other amateur radio magazine. I don't say this lightly. I firmly believe that the real future of communications lies "up there" rather than "down here." People like Bob Cooper are aware of this, although it's only been lately that the overall populace of this nation has come to understand the capabilities of geosynchronous satellite communications. We are at the dawning of a new era. This is why it was so important that amateur radio retain its satellite frequencies; It was a truly sad day when most were lost at the ITU conference some years ago. In many ways, it's hard to fault the League for that debacle, since their shortsightedness came from their deep commitment to HF communications. When one is involved right smack dab in the middle of an "in" thing, it is sometimes quite hard to see past the end of one's nose. What is hard for Newington and many thousands of amateurs to comprehend is that the day of long-haul HF communications is fast drawing to a close, to be replaced by geosynchronous satellite relay. An announcement has been made of tentative WARC approval of three new HF bands at 10, 18, and 24 MHz. This has yet to be approved by the overall plenary council. While it may hold some small amount of significance if it is approved, it's far from earthshattering in overall significance. Oh, it will mean a bit more HF room and probably a new generation of highly touted, highly overpriced equipment, but nothing more important than that. If it would mean the return of the lost satellite frequencies, then it would be meaningful.

With more meetings on the horizon, the ARRL's job is far from over. It must learn and completely understand a totally new communications technology in record time if amateur radio is to survive the space race. The OSCAR program is just the tip of the iceberg. If we can somehow get back even the smallest sliver of what was lost in '72, then that will be a real victory. It might be wise to look toward AMSAT rather than Newington for leadership in this one, since those in AMSAT are the people who really understand the future and where it can lead. Today, we take terrestrial repeater stations for granted. They're everywhere, and a little 1-Watt hand-held radio lets you talk for miles. Someday, transceivers one-fourth that size may permit worldwide "amateur-to-amateur" communications, through some form of geosynchronous satellite network. The technology Is on its way. The only problem left is where there will be amateur spectrum for their use.

THE BAJA 1000 STORY

We close this month with an item that will be of interest to many amateurs. It's the story of the Baja 1000 Off-Road Race and how amateur radio participated in it. The following letter from Earl Grandison K6WS, vice president of the Baja Amateur Radio Racing Association, tells it all.

"I thought that a rundown of the Baja Amateur Radio Racing Association (BARRA) activities in support of the Baja 1000 Off-Road Race between Ensenada and La Paz would be of interest.

"We established eleven radio stations, including remote transmitting and receiving sites for the net control in Ensenada. These stations were located at Ensenada, La Paz, and nine checkpoints along the 985-mile off-road course.

"Besides handling passing times and broken vehicle reports, we also provided three aircraft for rescue purposes, each of which was equipped with amateur radio equipment to communicate on VHF directly with any checkpoint. The race began at dawn on Wednesday, November 7th, and finished Friday evening. The fastest vehicles completed the course in a little over nineteen hours.

"Thursday evening there was considerable concern over reports that a bike rider had suffered a broken arm and was somewhere on the 160-mile stretch between checkpoint 7 and checkpoint 6, and that car 100 had crashed somewhere along that stretch and the driver was out of water. Andrew Acevedo WA6DPR started north from checkpoint 7 in the dark in his four-wheel-drive mobile unit. Several hours later, he encountered a Mexican. Since Acevedo speaks fluid Spanish, he was able to determine that the injured bike rider had been taken to a small fishing village which was not on the map. He headed in that direction and reported via radio that he had the lights of a small village ahead and that a vehicle was approaching. The vehicle was driven by a Mexican citizen who was bringing the injured rider, Jesus Martinez (a resident of Ensenada) to checkpoint 7. He was transferred to Acevedo's vehicle, where it was determined that he had a broken collarbone. First aid instructions were provided by medics in La Paz and Acevedo immobilized the broken collarbone. He also learned from the Mexican citizen that car 100 was located 50 miles south of checkpoint 6, from which a rescue team had been dispatched to pick this driver up later that evening. The Helio Courier *Angel One* was at San Ignacio (checkpoint 6) and

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When car 204 checked into checkpoint 2, it was interesting to note that the right rear tire was flat and that the driver had 92 miles to go before he reached the next pit crew.

K6W's VW camper contained the high frequency radio station used during the Baja 1000. Members of BARRA used a Ten-Tec 544 running off two large marine storage batteries and a Ten-Tec tuner feeding into a 122' longwire (which can be seen coming out of the insulator behind the driver's door). Mike, the junior op of K6WS who was responsible for the campfire, is shown talking to Dick Hojaboom WA6YCG, the chief operator at checkpoint 2.

DX

November, 1979, while not as hectic as October, offered a fine assortment of operations and increased activity for the chaser of countries, zones, prefixes, and awards. November is always sandwiched by the two weekends of the *CQ* Worldwide Contest, each requiring at least a week's recovery for the serious contester and DXer. For most of the world, the only band which allowed one any sleep at all during the contests was 10 meters, and then only five or six hours per night. If you operated 15, you missed some interesting dead-of-night openings if you crashed in bed.

6 meters opened during November, enabling many to complete Worked All States and starting others thinking of nabbing all continents. WL7ACY and AL7C supplied contacts with Alaska while KH6BZF and other Hawaiians worked all comers. On November 17, AL7C reportedly worked all 50 states. EI2W struggled mightily to cross the Rocky Mountains, while JA stations were worked as far east as Philadelphia. At this time, it appears the great barrier to WAC this sunspot peak will be Africa, where there is no activity on 50 MHz except for South Africa (ZS), which is a difficult proposition for North America.

With sunspot counts over 200 and solar flux measurements at 325 and above, all bands 1.8-50 MHz showered the active operator with worldwide opportunities during the autumn and early winter of 1979; DXing has never been better, not even during the sunspot peak of the late 50s, which had more sunspots. The reason? Activity, along with improved equipment. A glance at DX bulletins and reports in the magazines in 1958 and 1959 shows plenty of DX worked on 20, some on 15, but little on 10. Six meters was plied by the dyed-in-the-wool VHF operator, but equipment restraints kept most of the world's amateurs off both 6 and 10 meters. Reports from the old-timers of "10 meters open both short and long path to everywhere in the world 24 hours a day" in 1959 appear to have been greatly exaggerated.

Sunspots and the HF conditions they bring are of greatest value when an important expedition hits the bands, as the Saudi Arabian-Iraqui Neutral Zone 8Z4A operation in mid-November illustrated. While this group did not make their "goal" of 50,000 contacts, surely everyone who needed a contact with this "country" was able to work their S9 signal on at least one band. 8Z4A was everywhere at once, it seemed at times. They were observed on 80-10 meters during their ten days of activity. The expedition was mounted by a group of active Jordanian DXers, who took the best in equipment and antennas to ensure a successful operation. The final ingredient, a long run of operating, ruled out disaster in the form of a two- or three-day propagation wipeout from solar flares or magnetic storms. QSLs for 8Z4A are handled by Mary Ann Crider WA3HUP, RFD 2, Box 5A, York Haven PA 17370.

KH6GB came on from Wake Island (KH9) with an Argonaut during November for a few days; Wake's rareness had already been reduced considerably by an operation by Dan Lynch WD6CDU in July, 1979. KH6GB/KH9's five Watts were readily workable by many who had missed previous operations from Wake Island. QSL to KH6JUO (in the *Callbook*) or Harvey Sandal, 98-1077 Mahola Pl., Aiea HI 96701.

Another good one (two, actually) to get in November was SV0AA operating from, first, Crete, as SV0AA/9, then a week later as SV0AA/5 from the Dodecanese Islands. QSLs are via N2OO in the *Callbook*.

The YASME Foundation is sponsoring more operations by Iris and Lloyd Colvin, W6s QL and KG, respectively. They began a winter trip operating from Grenada, formerly VP2G and now J3. Signing J3ABV, the Colvins logged 10,000 contacts on 160-10 meters. They worked DXCC during the first week and then again during the *CQ* Phone Contest. Altogether, they worked 152 different countries, the most ever for them during a 3-4 week stay in one place. Grenada had a peaceful revolution and change of government recently and the Colvins were forced to post a very large cash bond to cover their radio equipment.

The Colvins departed Grenada on November 9 and began operations a few days later from St. Vincent as VP2SAX. They were active during the *CQ* WW CW Contest and into early December, then were on to J7, St. Lucia. All QSLs for YASME operations go to YASME, PO Box 2025, Castro Valley CA 94546.

While we are on the subject of YASME, here is their latest press release, dated November 26, 1979:

"Effective 23 November 1979, there has been a reorganization of the YASME Foundation QSL-handling personnel. Primary sort of all incoming mail and first response to each operation is being handled by W6BSY, with assistance from WB6DOQ. Continuing response to all YASME Foundation DXpeditions, past and present, is being handled by WA6AKK. Mail for all YASME DXpeditions should continue to be sent to The YASME Foundation, PO Box 2025, Castro Valley CA 94546.

"The previous team of YASME QSL handlers was led by Ferne Hughes and WA6AHF, with assistance on continuing response by K6YK, K6PBT, and WA6CPP. They have now concluded their association with the YASME Foundation, and I wish to thank each of them for their many hours of time and effort.

"The speed of response to your QSL card request is determined by many factors, some of which are beyond your control. However, there are several things which should be done by anyone submitting a QSL card to the YASME Foundation, which will ensure the most expeditious return of the QSL card which is being sought (I cannot presume to speak for other QSL handlers, but I feel these same items would get good results from any source).

"These things to do are: 1) Always send a self-addressed envelope with enough of the sender's postage affixed, or include IRCs, to cover the cost of mailing your envelope back to you; please note that in the U.S., an airmail envelope must have airmail postage affixed to it or it will be returned. 2) Always use UTC, GMT, or Zulu (they're all the same!) for the date and time of the contact. 3) Always send a separate QSL for each contact you wish confirmed. 4) Never send cards for more than one callsign (being handled at the same location) in the same envelope. 5) Never send more than one request for confirmation of the same contact unless you have waited a reasonable time (six months in many cases) to receive a reply. 6) It is suggested that one return envelope be provided for each card submitted for the fastest possible response. 7) Try to remember that the cards you seek are being answered by volunteers who have jobs, families, and other commitments and activities in their lives, as we all do, and give them the courtesy you would expect were you in their shoes."

Perhaps the above should have been titled "Novice Corner" for this month! Actually, we hear that managers of QSLs still receive 5-10 percent of cards with other than UTC, or the wrong date, or "I worked him sometime the third week of March; can you find me in the log?"

As predicted on these pages last month, the ARRL has indeed changed the format of the winter DX activity they sponsor. It is now called the ARRL International DX Contest. You can read the rules on page 94 of the December issue of *QST*. They aren't even used to the change down in Newington; the name of the activity has been changed from "Competition" to "Contest," yet the person who made out the table of contents in *QST* labeled it a Competition, while the announcement titled it a Contest. They are soliciting donors of plaques; for $35 you can donate a plaque to be awarded to a fellow contester and deduct it from your taxes as a contribution to a nonprofit organization! ARRL HQ for details.

The WARC will end about a week after this is written; news from Geneva has been virtually non-existent due to pressure from the conference chairman. Calculated guesses at this point on the effect of the conference on DXing would seem to indicate possible new HF bands, opening up of the 50-MHz band in Europe, lowered CW requirements above 28 MHz, and

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Awards

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In the November, 1979, issue, I outlined the entire awards portfolio being offered by the Central Radio Club in Moscow. Thanks to Paul Schuett WA6CPP/WA7PEI for pointing out the fact that I failed to mention that both the R-10-R and R-15-R Awards have a 24-hour time restriction. Perhaps our readers would like to pencil in this addition to the rules for future reference. It is my understanding that the applicants may have to wait approximately one year (or even longer) for their awards to be processed rather than the three- to four-month period previously announced.

Last year I confronted the ARRL about their WAS Award Program. Having just completed my 6-band effort and well on my way to Working All USA on 7 bands, I thought for sure they would recognize such achievement by issuing a certificate or plaque. To make a long story short, they do not have any awards, nor did they show any interest in the concept.

As merely a method of gathering support from our readers, I would like to hear from those persons who at this time could qualify for Working All USA on 6 bands, 7 bands, or 8 bands if such awards were made available. This "poll" should not be construed to mean *73 Magazine* is going to sponsor such a program; however, once I can gather support from other amateurs who can qualify at the time this article appears, I will lead a pursuit to acquire such a sponsor. By the way, I am seeking response from those who've achieved these multi-band goals anytime in their amateur career. There would be no time limit or starting date requirement. Be sure to enclose an SASE if a reply is expected.

DX AWARDS FROM ITALY

A very good DX friend of yours and mine, John Paul I8KDB, recently wrote a very complimentary letter about our awards column and asked that we share the awards program sponsored by the Associazione Radiotecnica Italiana (ARI). John Paul noted that the following general rules apply to all HF awards issued by the ARI and recommended they be read together with the conditions governing each individual certificate.

All inquiries and/or applications shall be addressed to the ARI Awards Manager, G. Nucciotti I8KDB, Via Fracanzano, 31-80127 Napoli, Italy, together with 2 IRCs for airmail reply.

ARI awards will be issued to any amateur who will submit:

- A letter, dated and signed, with applicant's name, address, and call. He must certify to have complied with all rules governing amateur radio in his or her country and to have kept fair play and good sportsmanship in operating toward the award for which the application is claimed.
- The complete list of QSLs, with callsign, date, frequency, reports, time, and type of emission (CW, AM, SSB, RTTY).
- QSLs for checking. QSL cards must be submitted without corrections, erasures, or additions and must be clearly readable.
- US $1.00 or 10 IRCs for foreign applicants. The Marconi Award is free; only a mailing fee is charged.

To get an award in a specific class, the cards must show the corresponding data in a clear format. Foreign applicants may avoid sending QSL cards by submitting a checklist of the cards duly certified by an appointed or elected official of a national amateur radio affiliated society or club. The ARI Awards Manager reserves the right to check, on request, one or more claimed contacts as necessary.

CERTIFICATO DEL MEDITERRANEO (CDM)

The CDM is issued to those amateurs who can show confirmation of a two-way contact on the HF bands since June 1, 1952, with (a) a fixed station in at least 22 countries of the list shown below, and (b) at least 50 amateur stations located in peninsular Italy, both for a accumulated total of 72 QSLs.

The same station may be worked once only. Two classes of CDM are offered: Mixed (AM, SSB, CW, RTTY) or Phone Only (AM, SSB). The minimum reports allowed to qualify are RS 33 or RST 338.

Countries List: Spain, Balearic Islands, Ceuta and Melilla, Morocco, France, Algeria, Corsica, Sardinia, Sicily, Lebanon, Egypt, Greece, Dodecanese Islands, Crete, Mount Athos, Turkey, Syria, Yugoslavia, Albania, Malta, Gibraltar, Cyprus, Monaco, Tunisia, Israel, and Libya.

WORKED ALL ITALIAN PROVINCES (WAIP)

This province award is issued to those amateurs who can show confirmation of a two-way contact on the HF bands since January 1, 1949, with a fixed station in at least 60 provinces of the Italian Republic for foreign amateurs or in 75 provinces for Italian amateurs. The same station may be worked twice or more if in a different province each time. Minimum reports acceptable are RS 33 and RST 338. Starting January 1, 1978, this award may also be endorsed for single band and/or for all 95 provinces.

List of Italian provinces:

Agrigento, Alessandria, Ancona, Aosta, Arezzo, Ascoli Piceno, Asti, Avellino, Bari, Belluno, Benevento, Bergamo, Bologna, Bolzano, Brescia, Brindisi, Cagliari, Caltanissetta, Campobasso, Caserta, Catania, Catanzaro, Chieti, Como, Cosenza, Cremona, Cuneo, Enna, Ferrara, Firenze, Foggia, Forli, Frosinone, Genova, Gorizia, Grosseto, Imperia, Isernia, L'Aquila, La Spezia, Latina, Lecce, Livorno, Lucca, Macerata, Mantova, Massa, Matera, Messina, Milano, Modena, Napoli, Novara, Nuoro, Orlstano, Padova, Palermo, Parma, Pavia, Perugia, Pesaro, Pescara, Piacenza, Pisa, Pistoia, Pordenone, Potenza, Ragusa, Ravenna, Reggio Calabria, Reggio Emilia, Rieti, Roma, Rovigo, Salerno, Sassari, Savona, Siena, Siracusa, Sondrio, Taranto, Teramo, Terni, Torino, Trapani, Trento, Treviso, Trieste, Udine, Varese, Venezia, Vercelli, Verona, Vicenza, Viterbo.

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Contests

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1980 International SSTV Contest
See page 177!

More and more announcements are arriving too late for inclusion in the contest calendar. Material for this February issue had to be received at my QTH no later than November 25th. Please send material as early as possible and send it directly to my home QTH as shown. Sending information via Peterborough only delays delivery as it has to be forwarded to me. If you are still working on the contest rules but have decided on a date, send me a quick note so I can at least list the date as early as possible. I continually try to list contest dates as far in advance as possible to help avoid too many contests being scheduled on the same dates.

CWSP INTERNATIONAL DX COMPETITION
Starts: 0000 GMT Saturday, February 2
Ends: 2400 GMT Sunday, February 3

Amateurs throughout the world are invited to participate in this annual event. Entry classes include single-operator and multi-operator (only club stations, single transmitter), all-band only. All contacts must be on CW.

EXCHANGE:
RST and QSO number starting with 001. CWSP members will add "/CWSP" after the report.

SCORING:
QSOs within the same country count for multipliers only; no QSO points are given. QSOs with other countries in the same continent count 1 point per QSO. QSOs with other continents are 3 points. Multipliers are given for each ARRL DXCC country and for each Brazilian prefix (PY1, PT7, PS8, etc.). Countries and prefixes count only once regardless of band. Final score is the sum of all QSO points from all bands times the final multiplier.

AWARDS:
First place in the world will receive a cup and award. First place in each continent will receive a medal and an award. Awards will also be issued to first place in each country, CWSP members, and clubs.

ENTRIES:
Logs must contain times in GMT, worked station, exchange, multipliers, and points per band. Logs and summary must be mailed no later than March 15th to: CWSP Contest Committee, Caixa Postal 15098, Sao Paulo, Brazil.

SOUTH CAROLINA QSO PARTY
Starts: 1800 GMT Saturday, February 2
Ends: 2400 GMT Sunday February 3

Sponsored by WA4SJS, N4AKO, and WA4YUU; all amateurs are invited to participate. The same station may be worked on each band and mode and SC stations may work other in-state stations. Novices and Technicians must sign /N or /T to identify their class.

EXCHANGE:
RS(T) and state, province, country, or SC county.

FREQUENCIES:
Phone—3980, 7280, 14280, 21380, 28580.
CW—3550, 3710, 7050, 7110, 14050, 21050, 21110, 28050, 28110.
No repeater contacts are allowed.

SCORING:
SC stations score one point per QSO and two points for QSOs with Novices or Technicians. Final score is the QSO points times the sum of SC counties, states, provinces, and DX countries worked. For all others, score one point per SC QSO and two points per SC Novice or Technician QSO. Multiply total QSO points by the total number of SC counties worked (46 maximum).

ENTRIES AND AWARDS:
Certificates to top-scoring stations in each SC county, state, province, and DX country. Also to Novice and Technician winners in each SC county and US state. Include a summary sheet with your entry showing the scoring and other information. Logs must be mailed by

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Calendar

Feb 1-10	ARRL Novice Roundup
Feb 2-3	South Carolina QSO Party
	CWSP International DX Competition
	Marconi International DX Contest—Phone
Feb 2-4	New Hampshire QSO Party
Feb 9-10	QCWA QSO Party—CW
	Two Land QSO Party
	PAØ Contest
Feb 16-17	ARRL DX Competition—CW
Feb 23-24	French Contest—Phone
Feb 23-25	Vermont QSO Party
Mar 1-2	ARRL DX Competition—Phone
Mar 8-9	QCWA QSO Party—Phone
Mar 9-10	Europe and Africa RTTY Giant Flash
Mar 22-24	BARTG Spring RTTY Contest
Mar 29-30	YL International SSBers QSO Party—CW
Apr 5-7	QRP ARC International QSO Party
Apr 19-20	YL International SSBers QSO Party
Apr 26-27	Helvetia Contest
May 17-18	Florida QSO Party
June 28-29	ARRL Field Day
Sept 13-15	Washington State QSO Party

Results

RESULTS OF THE H26 CONTEST, 1979

European Scores	
C31QA	60
DK7XS	30885
DM3PQO	31680
EA7ALG	8103
F9KP	24338
G4FDC	13050
GD4GWQ	1440
GI4GDV	612
GM4FSA	780
GW3INW	5445
HA3KNA	13680
I2LVN	45
LA9HW	9768
LZ1XL	17820
OE1DSA/3	31590
OH2DW	21924
OK3KAG	27216
ON7YD	7425
OZ7SAC	2964
PA2TMS	7200
SMØCCE	17493
SP9PDF	9717
UK3ACR	31155
UA2FCB	16524
UK5IBM	37962
UC2WAZ	6336
UP2BAW	12600
UQ2GEC	3024
UR2RKS	27
YO3CR	17490
YU2CRM	11094
4U1ITU	63

SWL	
BRS 32525	29160
Non-European Scores	
K9PNT/DU2	576
EA8TY	864
HS1ABD	2394
JA1ADN	5766
KP4V	5202
LU2DPW	504
OA4ZP	1242
OD5LX	60
PY1BOA	2205
UK9HAC	24300
UD6DHC	2592
UH8BO	240
UJ8JCQ	231
UL7MAR	30246
UM8MBN	2106
VE2FGL	10209
VE3DMC	7437
VO1AW	4059
VK2BAC	1254
N1NA	16983
K2SX	351
W3ARK	7371
W4OEL	17013
W5EIJ	330
W6UA	1581
K7CU	495
W8DA	13500
WØBMM	1104
YV1OB	1581
ZL1AJU	4455
HB9BA/4X	10146

Microcomputer Interfacing

Jonathan A. Titus
Christopher A. Titus
David G. Larsen
Peter R. Rony

Since microprocessors like the 8080 and 6800 do not have multiplication and division instructions, subroutines (that contain addition and subtraction instructions) must be written to perform these operations. A typical paper-and-pencil decimal and binary multiplication for two different sets of numbers is shown in Fig. 1.

As you can see, the "mechanics" of multiplication are very similar in these two examples. As the multiplicand is multiplied by larger and larger powers of ten or powers of two, the result of the multiplication has to be shifted to the left by one, to increase the significance of the result. For instance, when 1024 is multiplied by the 9 in 596, the result (9216) is shifted to the left by one place, because the multiplication is really 90 x 1024 and the result is really 92,160.

To multiply two binary numbers, the 8080 must examine the multiplier, a bit at a time. If the bit is a logic one, the multiplicand is added to the *partial sum* (initially zero). If the bit examined is a logic zero, then the multiplicand is not added to the partial sum. Regardless of whether or not that addition takes place, the partial sum *must* be shifted one bit position, after each bit in the multiplier is examined.

```
   1024              00100110
 x  596            x 00011011
   6144              00100110
  92160             001001100
+ 512000           0000000000
 610304           00100110000
                 001001100000
                0000000000000
               00000000000000
           + 000000000000000
             0000100000000010
```

Fig. 1. Decimal and binary multiplication examples.

To keep the 8080 multiplication software example (Example 1) as simple as possible, we will write a subroutine that multiplies two eight-bit numbers. These two numbers must be stored in the 8080's D and E registers and the 16-bit result will be stored in registers B and C (register pair B). When the MP88 subroutine is called, register pair B is cleared because it will be used to store the *partial sum* and finally the 16-bit result of the multiplication. The L register is loaded with the number of bits in the multiplier, octal 010, hexadecimal 08, or decimal 8. At NXTBIT, the multiplier that is contained in register D is moved to register A, shifted once to the right, and saved back in register D. These instructions shift a single bit of the mutiplier into the carry, so that the state of the bit (logic one or logic zero) can be tested with software instructions.

```
          00001110
1011 ⌐ 10011011
       - 1011
         10000
        - 1011
           1011
         - 1011
          00001
```

Fig. 2. A binary division example.

If the state of the carry after the shift is a logic zero, this means that the multiplicand is not added to the partial sum, so the JMP to NOADD (*NO ADD*ition) is executed. If the carry is a logic one, the JMP to NOADD is not executed. Instead, the multiplicand, contained in the E register, is added to the partial sum which is contained in register pair B.

At NOADD, the 16-bit number contained in register pair B is shifted to the right by one bit position. The multiplier's bit count, which is contained in the L register, is then decremented by one. When this bit count is decremented to zero, the 8080 will return from the MP88 subroutine, with the 16-bit result of the multiplication in register pair B. If the bit count is non-zero, the JMP to NXTBIT is executed, so that another bit in the multiplier can be tested and any additions performed.

The multiplication of the two eight-bit binary numbers was performed by an *add and shift algorithm*. Binary division can be performed by a *subtract and shift algorithm*. An example of binary division is shown in Fig. 2. Binary division is more complex than binary multiplication. To divide two binary numbers, the divisor is subtracted from a larger portion of the dividend, which has less and less significance. If the divisor is larger than the part of the dividend that it is being subtracted from, a borrow occurs. In this case, the divisor is added to the *result of the subtraction* to "regenerate" the original part of the dividend that was being tested. A zero is then entered in the quotient for the bit position being tested. If no borrow occurs when the subtraction is performed, the result of the subtraction is used as the new partial dividend and a one is entered into the quotient since the divisor was successfully subtracted from the dividend. The subroutine listed in Example 2 divides the content of the E register (the dividend) by the eight-bit content of the D register (the divisor) and the eight-bit result (the quotient) is saved in the H register and the remainder is saved in the C register.

The LXIH instruction in the DIV88 subroutine (Example 2) loads the number of bits in the divisor (octal 010, decimal 8) into the L register and the H register is loaded with zero. This is done because the H register will be used to store the quotient. The MVIC instruction loads the C register with zero. The C register will be used to store the *partial dividend*. At NXTBIT, the dividend is shifted one bit to the right. The most-significant bit (MSB) is shifted into the carry and the remaining bits of the dividend are saved back in the E register. The partial dividend in register C is then moved to register A, and the bit from the dividend is shifted from the carry into the least-significant bit (LSB) of register A. The SUBD instruction subtracts the divisor from the partial dividend, which was in the A register. If the divisor is subtracted from a larger or equal number, the JMP to NOADD is executed. If the divisor is greater than the partial dividend, a borrow occurs,

Continued on page 141

```
MP88,   LXIB    /SET THE REGISTER PAIR THAT WILL HOLD THE
        000     /RESULT OF THE MULTIPLICATION, TO
        000     /000 000 (HEXADECIMAL 0000)
        MVIL    /LOAD L WITH 8 (DECIMAL), THE BIT COUNT
        010     /OR THE NUMBER OF SHIFTS TO TAKE PLACE
NXTBIT, MOVAD   /MOVE THE MULTIPLIER INTO A
        RAR     /SHIFT IT ONE BIT TO THE RIGHT
        MOVDA   /THE CARRY IS EITHER 1 OR 0, SAVE THE MULTIPLIER
        JNC     /IF THE CARRY IS 0, JUST SHIFT THE
        NOADD   /RESULT.  IF THE CARRY IS A 1, ADD THE
        0       /MULTIPLICAND TO THE RESULT, THEN SHIFT IT
        MOVAB   /GET THE MSBY OF THE RESULT
        ADDE    /ADD THE MULTIPLICAND
        MOVBA   /AND SAVE THE MSBY OF THE RESULT
NOADD,  MOVAB   /NOW SHIFT THE 16-BIT RESULT ONE
        RAR     /PLACE TO THE RIGHT.
        MOVBA   /SAVE THE NEW MSBY
        MOVAC   /NOW SHIFT THE LSBY TO THE RIGHT.
        RAR
        MOVCA
        DCRL    /HAVE ALL 8 BITS OF THE MULTIPLIER
        JNZ     /BEEN TESTED YET ?  NO, TEST ANOTHER BIT
        NXTBIT
        0
        RET     /YES, THE ANSWER IS IN REGISTER PAIR B
```

Example 1. An eight-bit by eight-bit multiplication subroutine.

```
DIV88,  LXIH    /LOAD THE L REGISTER WITH 010 (DECIMAL 8)
        010     /OR HEXADECIMAL 08 AND LOAD THE H
        000     /REGISTER WITH 000 (THE RESULT WILL BE IN H)
        MVIC    /LOAD THE C REGISTER WITH 000
        000     /THIS REGISTER WILL BE USED FOR STORAGE
NXTBIT, MOVAE   /MOVE THE DIVIDEND TO A
        RAL     /SHIFT THE MSB OF A INTO THE CARRY
        MOVEA   /SAVE THE SHIFTED DIVIDEND BACK IN E
        MOVAC   /GET THE PARTIAL DIVIDEND STORED IN C
        RAL     /SHIFT THE CARRY INTO THE LSB OF A.
        SUBD    /SUBTRACT THE DIVISOR FROM THIS NUMBER
        JNC     /IF THE CARRY=0, THE SUBTRACTION DID NOT
        NOADD   /PRODUCE A BORROW.  THEREFORE, SHIFT THE
        0       /QUOTIENT.  OTHERWISE ADD THE DIVISOR BACK TO A
        ADDD    /ADD THE DIVISOR BACK TO THE CONTENT OF A.
NOADD,  MOVCA   /SAVE THE PARTIAL DIVIDEND BACK IN C.
        CMC     /COMPLEMENT THE CARRY.
        MOVAH   /AND SHIFT THE CARRY INTO THE LSB
        RAL     /OF THE H REGISTER.  IF A BORROW, C=0
        MOVHA   /IF NOT, C=1
        DCRL    /HAVE ALL EIGHT BITS BEEN SHIFTED YET?
        JNZ     /NO, SHIFT ANOTHER BIT OF THE
        NXTBIT  /DIVIDEND AND TRY ANOTHER SUBTRACTION
        0
        RET     /THE ANSWER IS IN H WHEN THE 8080 RETURNS
```

Example 2. An eight-bit division subroutine.

New Products

NEW HF MOBILE ANTENNA

Discoil Corporation has introduced a new high-performance high-frequency mobile antenna that covers a frequency range of 3.5 to 30 MHz without changing coils or adjusting rods.

The DISCOIL is the first mobile antenna to be manufactured utilizing aerodynamic design principles to prevent excessive layback while in motion, reducing detuning effects found in conventional mobile antennas. The "wing" on top of the coil acts as a wing on an aircraft, tending to hold the antenna in a more vertical position. The vertical portion of the antenna (the coil) acts as a rudder reducing sidewobble. The wing also acts as a capacity hat, reducing the amount of inductance required in the coil, increasing antenna efficiency.

The 2½-foot circumference, plated, printed circuit coil is three times larger than any other commercially available antenna coil, allowing more actual radiation from the coil itself.

The 108" overall length, center-loaded antenna features stainless steel upper and lower sections and fits any standard 3/8-24 antenna mount.

Factory-set coil taps are supplied for the center of 15-, 20-, 40-, and 75-meter phone bands. Other taps are easily installed for other frequencies, such as MARS, CAP, etc. Frequencies and bands are simply changed by clipping a lead to the predetermined tap.

For further information, write *Discoil Corporation, PO Box 1076, Brackettville TX 78832.* Reader Service number D75.

INFO-TECH M-200E TRI-MODE CONVERTER

For those readers who are not yet aware of it, there is a revolution going on in non-voice two-way communications. While hams still will be required to interpret Morse code reception to pass their exams, they now have another option available to them for on-air operation.

Automatic Morse senders and readers are now available as an operating aid. If you can type, you can send perfect CW, and if you can read, you can copy at incredible speeds! At present, there are two classes of instruments available to accommodate this luxury: the digital reader and the video converter.

As an extra bonus, most manufacturers of these new devices include RTTY capability as well. Info-Tech's M-200E is a luxurious example of just how much fun RTTY and CW can be.

The flexible M-200E is lightweight and compact, especially considering its enormous versatility. 3½ inches high, 9 inches wide, and 12 inches deep, the unit weighs a scant five pounds! Power consumption is 20 Watts at 120 V ac. The front panel is white enamel and the cabinet is black; bright LEDs signal various status conditions during actual operation. An internal character generator provides a full alphanumeric display when used with any standard video monitor. 32 characters per line is standard; 72 is available at extra cost.

CORRECTION

The Madison Electronics ad for Belden products which appeared in the December issue was incorrect. Please refer to the Madison/Belden ad elsewhere in this issue for the correct prices. *73* apologizes for the error.

In our lab test, we fed the M-200E output into a Radio Shack TRS-80 video monitor (an internal connection must be made to this monitor; it will not take video directly through its interface cable). Video output is a 5 x 7 matrix, positive (white on black), 2.5-volt p-p negative sync.

For those operators who wish hard copy, loop outputs are accessible on the rear apron for an ASCII printer or for conventional RTTY teleprinter. Automatic scrolling (line feed) and carriage return are featured.

Morse Reception

For those of us whose code speed has dwindled over the years, the M-200E puts us up at the head of the pack! Speeds from 5 to 60 words per minute (and higher with an internal adjustment) are automatically copied!

For receivers without tuneable bfo's, a rear-panel fine tuning control permits CW pitch adjustment from 800 to 1200 Hz. The passband is sharp, so receiver stability is essential.

A phase-locked loop separates the actual CW note from background noise, and a front-panel LED signals the operator when the signal is properly adjusted within the passband.

For CW operators who can't stand noise, there is an input for a key on the rear apron which allows soundless code practice! While the CW reader portion will allow the poor band conditions, it *demands* a good fist. Erratic keying will be displayed as invalid characters.

RTTY Operation

Perhaps the real beauty of the M-200E is its RTTY flexibility. Speeds may be selectable as 60, 66, 75, or 100 words per minute and 110 baud ASCII. RTTY shift may be selected as 170, 425, or 850 Hz. Non-standard shifts may be copied by straddle tuning, utilizing the panel meter as a tuning indicator.

While proper speed selection may be determined by the classical trial and error method of switching back and forth until legible copy is demodulated, the M-200E has a special feature: By simply pressing the reset button twice in succession, correct speed will be displayed on the monitor (or printer)!

Audio input impedance to the tri-mode converter is nominally 1000 Ohms; it will perform with impedances as low as 4 Ohms, however.

Automatic threshold control may be selected for single-tone copy, an aid to non-standard RTTY signals. Hard limiting is also available to preserve error-

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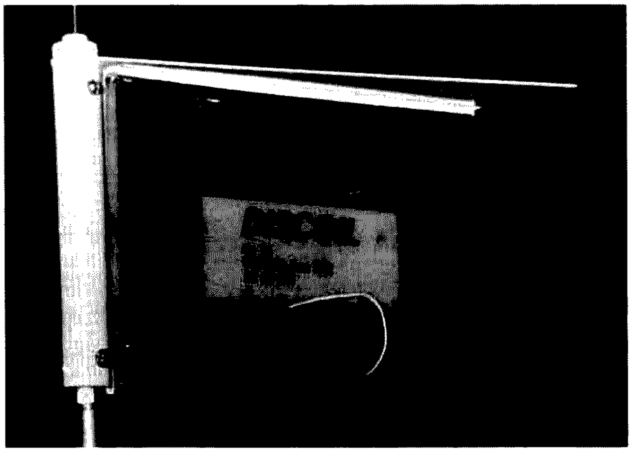

New HF mobile antenna from Discoil.

Info-Tech's M-200E tri-mode converter.

LETTERS

AED IS OK

Every once in a while, someone comes along with an idea in either kit form or in a completely assembled shape that is so unique and so easy for the average ham to understand and assemble that some mention should be made.

I am writing because I have just put together the standard kit supplied by AED Electronics, 750 Lucerne Road, Montreal, Quebec H3R, for a 220-MHz Midland digital read-out transceiver. The instructions are simple and straightforward. The circuit board is silk-screened for the components, so there is no need to be an electronics engineer to assemble the kit.

When I turned the scanner on, I was amazed at the number of repeaters that are not listed in the book that come up and that I now know are available to me and other hams. There is no way, without the scanner, that you could find these repeaters without a lot of manual manipulation of the dials.

I might add that the scanner for the 220-MHz Midland radio is so ingeniously designed that it fits into a compartment as if it was originally equipped by the manufacturer. The price for it in kit form is less than half of other scanners that I have seen on the market.

I think some mention should be made in the magazine to alert the hams to this very unique and usable item.

Martin D. Shapiro WA3IFQ
Philadelphia PA

OLYMPIC QSLS

The amateurs of Franklin County NY will be distributing special 1980 Winter Olympic QSL cards to each of their contacts for a period before, during, and after the Olympics in Lake Placid NY.

The cards contain the primary Olympic logo, the Franklin County seal, and the standard QSL information. The Franklin County Legislatures both printed and paid for the cards. Anyone that would like more information on the cards can get in touch with me.

Shawn D. McGovern KA2BSC
117 Webster Street
Malone NY 12953

SSTV DXCC

Not so long ago, during a QSO when I told you I was getting within sight of my 2x SSTV DXCC, you asked me to let you know when this did happen and to send you my photo with details, etc.

By DXCC Award Authorization dated September 28, 1979, I was informed that I had been awarded DXCC Certificate No. 3 for Two-Way SSTV contacts with 101 countries.

The significance of No. 3 is that it is No. 3 in the world and puts me automatically on the Honor Roll behind W8YEK with 108 countries and G3IAD with 101 countries. Actually, I then had 103 countries but with only 101 confirmed; since then, AP2AD has sent his QSL card and ZK1AA (June 5, 1979) says his QSL is in the direct post!

I have been active with SSTV on all bands from 80m to 2m since November, 1972, chiefly with Robot equipment starting with their 70 monitor and 80 camera, the model 61 fast-scan monitor, and, for the last two years, the 400, the latter with UK modifications designed by G3UEU and G3OQD.

Rf wise, I use a Heath SB-401 transmitter and 303 receiver, an Autek QF-1A filter, and an SB-220 to either a TH6DXX or 40/80m Lazy H at 56 ft. I also run an FT-901 through the SB-220. 2m equipment includes an FT-221R with a Lunar rf-switched preamp through a NAG 144XL linear to a pair of 16-element Tonna yagis stacked vertically above the TH6DXX (at 58 ft.), with the top one at 72 ft.

Richard Thurlow G3WW
March, England

Richard Thurlow G3WW.

GAG ORDER

In the November issue of *73 Magazine*, there were two letters pertaining to the atrocious operation on the Hurricane Net during the time hurricane David was approaching the US. The letters regenerated the disgust I felt while I also was monitoring the net.

It seems to me that the biggest violation of good operating habits was that many radio operators could not keep their mouths shut. Whenever an interfering signal appeared, the many unsolicited comments that followed were as damaging to the net operation as was the deliberate QRM. In time of emergency, no station should transmit unless called upon by the net control operator.

Obviously, there are times when the control station cannot hear all the signals on the net and, in such cases, the information must be relayed. But, what I heard on the net wasn't a case of merely relaying information—it was operators who insist on getting their little trivial and redundant comments aired. To such operators, I say "Horsefeathers!" Let the control operators do the chatting.

It was also very ridiculous to hear the continual inquiries for weather data. Instead of calling for the weather information, stations on the net should monitor the circuit and allow the control station to repeat the data at reasonable intervals, thus allowing the net to be clear for more important traffic.

To the net control operators: You did a great job under conditions that were, at times, unbearable and unnecessary. I hope, in the future, we in the amateur radio community will be more considerate and try to cooperate so that not only will emergency conditions be managed efficiently, but also so amateur radio will not be degraded.

Bill Farris K1WF
Chatham MA

MEDICAL ADVICE

Memorial Hospital Medical Center is an 850-bed facility located in Long Beach, California, on the Pacific Ocean. Know-

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Leaky Lines

Dave Mann K2AGZ
3 Daniel Lane
Kinnelon NJ 07405

Many who have been licensed for years fail to realize that some of our number, being inexperienced, need some patience and understanding. And it is up to us to provide it. If we dig down into those long-forgotten crevices of memory, we will undoubtedly discover, each and every one of us, that someone once gave us encouragement, way back when it really counted. If amateur radio operators constitute a "fraternity," as we are so fond of terming it, then it is difficult to account for some attitudes as expressed on the ham bands.

We proclaim our universal equality. Ham radio brags about the fact that it is so democratic; there are no aristocrats. Oh, to be sure, there are some of us who possess wealth and fame. But, on the air, we like to think of ourselves as equals who are friendly and solicitous of each other. King Hussein of Jordan, JY1, one of the world's most privileged individuals, has never been heard to push his weight around on the bands, lording it over just plain commoners. Neither do hundreds of others like him who enjoy the advantages of position and affluence.

But there are some hams who delude themselves with a totally alien concept. They regard newcomers not as colleagues in a common enterprise, but as interlopers and outlanders. They refer to their inexperience as one might speak of leprosy. They lose no opportunity to treat them with contempt and open hostility, and, in so doing, they reflect poorly on all of us.

There used to be one of these self-styled aristocrats who would call CQ in the following obnoxious manner: "Hello CQ, CQ, CQ. No As, no Bs, no kids, no lids, no space cadets." And he would sign his call (two letters, of course). His reputation was anything but enviable; he made quite a name for himself as some sort of a nut and instead of the approbation and respect he thought himself entitled to, he earned nothing but disdain and the reputation of a latter-day Ebenezer Scrooge.

His disciples are still among us. They constantly berate others with deprecatory references to CB and some even resort to the foulest language. They show no patience toward others and, undoubtedly, cause much pain and embarrassment.

New amateurs have a right to expect fairness. According to the terms of their class of license, they are entitled to no less than others, and have a right to be properly indignant when they are denied common courtesy by those who have an exaggerated sense of their own importance.

Just to demonstrate how hypocritical some guys are, I'd like to recount a recent incident.

There are thousands of DX chasers who would give their eyeteeth for a crack at a 5R8. So when one of these elusive stations showed up on 20 meters recently, you can imagine the excitement it generated. It began with only a dozen or so stations in the know, but the word spread quickly to the hinterland and, before long, virtually everyone within earshot arrived on the frequency.

Things were cool; no one wanted things to get out of control, for experience clearly demonstrates that if there is anything that will drive a rare DX station away, it is one of those bedlams where you can't even hear yourself think. Everyone on the frequency was circumspect in his behavior, that is, everybody except a certain moron in South Carolina whose call sign I won't repeat, merely in the interest of avoiding becoming involved in lynching or a tar-and-feather party.

The operator of 5R8TV requested that someone take a list so that he could work as many contacts as possible in the limited time available. The moment a list was mentioned, the 4th-district idiot began announcing his pronunciamento. You would have thought that he was speaking from Mount Sinai—all the righteous indignation burst forth from his rotten mouth like lava from a volcano. He fulminated loud and long, polemicized like a filibustering politician, and rent the air blue with invectives.

The others on the frequency were unable to hear anything, and you can imagine what this sounded like in Malagasy. 5R8TV left for parts unknown, leaving the frequency to the imbecile. And the hopes of hundreds of DXers bit the dust!

About a week later, it became known that Juergen TN0HL was about to work some Americans on either 10 or 15 meters. A German-speaking W9 and a few others from various call areas were slated to assist in the operation and all others were admonished to be on their good behavior, since this DX operator is known to be strongly opposed to boisterous pileups and would probably leave at the first sign of disorder.

On the first day, things went perfectly. Several stations worked the TN (including K2AGZ—how lucky can I get?), and there was fine cooperation from all on the frequency. So much so that Juergen told Bill WB9TTM that he had enjoyed the experience and intended to come back. It was clear that if decorum could be maintained, he would come on a regular basis, and since he is scheduled to remain in TN-land until next June, this would mean that all of us would get a shot at this elusive country.

Well, what do you think happened next?

The very jerk who had maligned list operations so viciously and had created all the chaos which chased the 5R8 away was heard trying to get on the list for Juergen! Imagine, this hypocrite who was so opposed to lists was not above attempting to get on one of them. It was clear that this dogmatic opposition did not apply when it came to a prefix that he needed for himself. He was only against lists for other people.

His arrant hypocrisy angered all who had heard his prior diatribe. Many of them said that even if they had made the list, they would rather pass up the contact than remain on the same frequency with this boor. Several stated that if Juergen had shown up (which he didn't), they would have seen to it that the South Carolina lid would never have been permitted to hear his signal report from TN-land. I can't say that I blame them a bit.

Someone ought to circulate the idea that anyone who can identify such a creep (and there are many who make speeches without identifying themselves) ought to be urged to divulge his identity and thus expose his stupidity. Maybe that would help to rid us of all the self-appointed policemen and monitors who are forever parking themselves on the frequencies of DX stations so they can issue their orders and comments to everybody else. I don't know what makes these jerks feel that they have a right to act as supervisors, but there is a hard core of such lunatics who systematically show up.

It would be nice if a volunteer goon squad went around the countryside sticking pins into their coax cables. Better still, why doesn't one of those brilliant young geniuses with all the solid-state savvy design a circuit that will send a shot of about 50 kW right into the tank circuit of such offenders? Maybe it's possible to construct a sophisticated rf sniffer that can track down the exact location of radio pests, follow it just like one of those heat-seeking missiles, and wipe it out.

If someone were to come up with such a circuit, I know about a hundred DXers who would pay almost anything to get one. In fact, I'm willing to buy the first one. I guarantee you that a certain jackass in South Carolina would be walking around with frizzled hair-ends and singed eyebrows if ever I got the chance to zap him with a shot of rf! Boy, wouldn't that be just great!

Ham Help

I am looking for manuals, schematics, etc., for an old Clough-Brengle Type CRA "Graphoscope." I would be happy to cover costs of mailing, copying, etc. Can anybody help?

Roy Moses WD5ICY
2002 Cindy Lane
Denton TX 76201

I wish to purchase a 6-meter CW-AM-SSB receiver to match my Heathkit HX-30 transmitter.

I also would like to convert a Royce 640 SSB-AM CB transceiver to 10 meters and need info and a schematic.

Gordon Juvell WB0ZSA
10925 Morris Ave. S.
Bloomington MN 55437

RTTY Loop

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

In our continuing efforts to inform newly-arrived RTTY addicts of the "stuff" available out there, this month's column will address the question of machine availability. While a comprehensive review is beyond the scope of one column, I hope that readers with specific problems might find some useful information herein.

"Where do I get a Teletype™ machine?" is a question I have heard posed more times than I can count. There are surely several sources for machines, not all of which may be obvious to the newcomer. First of all, open a mouth! Make it known in your area that you are looking for a teleprinter. Tell the guys at the club; if you are not a member—join! Maybe there is a local pub or store where hams congregate. Sally on over there when the crowd is present and ask around. You never know what is sitting in someone's basement. Okay, you say, that's been tried and it is strike one; now what? Start checking the ads on local store bulletin boards and club newsletters. Maybe place a "wanted" ad yourself. When you find a machine for sale, try to find a knowledgeable person to look at it with you, to be sure it works and all that. Then haggle a bit for price, and you've got a machine. Whoops, strike two, you say? Well, it's time to start checking the ham ads in national magazines looking for something reasonably close by to look at. I really would not be too keen on buying a "pig-in-a-poke," that is, a Model 35 shipped sight unseen from California, unless there was some assurance that the machine was worth the money. But that is for the individuals involved in the transaction to work out.

Now, there may be one more way for the enterprising individual to get a machine at a reasonable price. It's chancy, but can pay off. At the end of most metropolitan newspaper classified ad sections is a list of "auction sales." These usually are companies that went broke and are selling off their inventories, fixtures, and business machines to pay off their creditors. Now, every once in a while, a teleprinter will be part of these sales. Although ASCII machines, such as ASR-33/TELEX machines, are the most common, you never know, and it does not hurt to have one more source. Besides, if you pick up an ASCII machine at a good price, it might pay to convert Baudot to ASCII to use the machine. When ASCII is legal on the ham bands, you would be ready to go. If you have no interest in eight bits whatsoever, you might be able to swap with a Baudot-owner-newly-turned-computerist.

Now, you may notice that I have not said too much about commercial dealers. There is a good reason for that. With few exceptions, and they really are not worth mentioning, no dealer to my knowledge has shown any ongoing concern for the ham market. They might sell you a machine now, but they let letters of inquiry and complaint sit around for a few months. Their prices tend to be a bit higher than buying from another ham, although they tell you they have "reconditioned" the machine. I leave it to you, with a large "caveat," when it comes to dealing with commercial teleprinter firms.

Next month, we will continue with information useful to the neo-RTTY-phyte with a brief survey of some terminal units available: assembled, kit, and scrounge-your-own-parts versions.

Turning to the lighter side, the winner of this month's RTTY Loophole award is the ARRL. It seems, in an effort to keep all of us in line, *QST* for October, 1979, carried their "annual updated list of abbreviations," on pages 65-66, to "clip out for easy reference." Trouble is, "RTTY" is listed as meaning "radiotelephone." Thanks to the boys in Newington for that one!

John Bates KAØCCD/8 noted with interest the comments on connecting the TS-820 to run RTTY with most ordinary demodulators. Fig. 1 is the circuit John has been using to connect his TS-180S to a Flesher TU-170. Using a 4N25 optoisolator, John is able to use the TTL level output of the TU to key the transmitter. This should work with any TU that provides a TTL level output. Thanks, John.

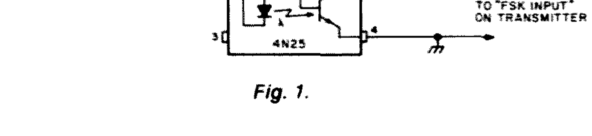

Fig. 1.

Interest in receiving non-ham RTTY signals is quite high and has generated a number of letters. Bud Riegert KØYIP of St. Louis, Missouri, is looking for stations transmitting in ASCII so that he may check out an ASCII-to-Baudot routine for his Apple-II. Anyone with specific information on such stations may forward it along to this column for future inclusion.

Along the lines of the "weather" transmissions covered a few months ago, a letter was received from George P. Firmin WA4FSK (not a bad call for a RTTY enthusiast) who wonders about decoding transmissions he has received, like this:

66228 05210 05315 05323 04928
66028 06525 06234 05838

Well, George, while I am fairly certain that these, too, are weather information transmissions, I do not have the key to decoding them. I am sure that one of our readers does, however, and hope to be able to pass that along to you in the near future.

The Stark RTTY Group's *Watts Happening* is still coming out of Massillon, Ohio, and contains a new wealth of information, ranging from simple circuits to local sources for RTTY equipment. Write to Joseph Ebner WB8RVM, 138 Page Street N.W., Massillon, Ohio 44646, if you are interested in joining the group.

Don't forget *73*'s Specialty Communications Achievement Award, mentioned last month. Drop a line to Bill Gosney WB7BFK, care of *73*, for information, or check elsewhere in this issue. I am waiting to print the name and call of the first to win this award on RTTY right here in RTTY Loop.

Next month we will cover a few ways to enter the demodulator market. Until then, have a Happy Valentine's Day, and keep those green keys active.

Ham Help

I am a cardiovascular physiologist at the medical school in Recife and a radio amateur (PY7CPC). Teaching physiology with a limited amount of lab equipment is surely a challenge! One of the most useful pieces of equipment is a polygraph recorder (and one of the most expensive items, too).

Can any of my radio amateur colleagues come up with a B/W TV adapter/modulator through which a student could display an EKG or EEG signal? A 1.0-mV/cm vertical display and a sweep of 2.5 cm/sec is what is needed. The EKG has a frequency response of 0.05 to 85 Hz (not very critical for student labs).

This would be a tremendous boon to physiologists and pharmacologists who can't afford to buy expensive recorders for their student labs, and could use their B/W TV as a display. Perhaps somebody could adapt a TV game chip to do the job!

Carlos Peres da Costa, MD PhD
Ave Boa Viagem 4520
Recife PE 50.000 Brazil

I have recently converted a 23-channel CB rig (AM) to 10 meters and am interested in building a mobile linear amplifier for it. I would appreciate receiving copies of schematics of such equipment that others have homebrewed or being referred to recent magazine articles on the subject. The amplifier can be anywhere in the 10- to 50-Watt range. Thanks for any help.

Steve Zahos KR4S
13817 Barne's Spring Rd.
Midlothian VA 23113

I recently acquired a linear amplifier and, after many phone calls, found the successors to the original manufacturer who say that they cannot help me.

I'm looking for an operator's handbook and/or schematic for a Westrex 9200 100 W LPA. It is a rack-mount government style and covers 2-30 MHz. Any help would be greatly appreciated.

Paul T. Petty KB7BP
Box 366
Hawthorne NV 89415

CB-to-10 FM Continued

—another way to join the fun on 29.6

John Sehring WB2EQG
P.O. Box 306
Oradell NJ 07649

Recently increasing FM activity on 10 meters between 29.5 and 29.7 MHz has led me to investigate methods of getting on this interesting mode. Actually, the thing that got me started occurred one Saturday afternoon as I tuned above 29.5 MHz looking for a local 10-meter FM repeater. Much to my surprise (who in the heck ever tunes up this high on 10 meters, anyhow?), there was plenty of activity. In particular, WR2ANW's 10-meter-to-2-meter crossband link was hopping, and there were plenty of stations on the simplex frequency (29.6 MHz), too. I noticed that the combination of sometimes terrific 10-meter propagation and the QRM- and QRN-suppressing characteristics of FM was quite intriguing—DX signals often sounded just as clean and quiet as locals. After hearing all this, I thought it would be nifty to talk to the boys on 29.6 as well as the local 2-meter gang via the crossband repeater link. (There are easier ways of getting on 2 meters, though!)

I sat down to figure out the fastest and easiest way of getting on 10-meter FM. Unfortunately, there was no surplus commerical lowband FM (30 to 50 MHz) gear around the shack; such gear would have been relatively easy to convert to 10 meters. The only piece of equipment that covered 10 meters was the main station HF transmitter, a filter-type SSB/CW exciter, a Hammarlund HX-50A. Turning to the "technical library" for some ideas yielded the distinct possibility of FMing a transmitter simply by hanging a variable-capacitance diode (varactor) in the oscillator tank circuit.[1-4] By applying a varying (audio) voltage to the varactor, it might just be possible to shift the oscillator's frequency at an audio rate—in other words, frequency modulation! Luckily, this method got me on FM in just a couple of hours, using only a few parts. Here's how.

Varactors are small diodes whose capacitance can be controlled by an externally applied voltage; they are used often these days to replace variable capacitors in tuning circuits. Most varactors are rated for their nominal capacitance at about 4 V dc and are typically operated from 2 to 30 volts. See Fig. 1 for a typical varactor operating curve.

A simple circuit using a varactor to supply a voltage-controlled capacitance is shown in Fig. 2. Here, the potentiometer, R, applies a dc control voltage to the varactor, VC, which determines its capacitance. Capacitors C1 and C2 provide rf bypassing and dc blocking, while the RFC keeps rf energy out of

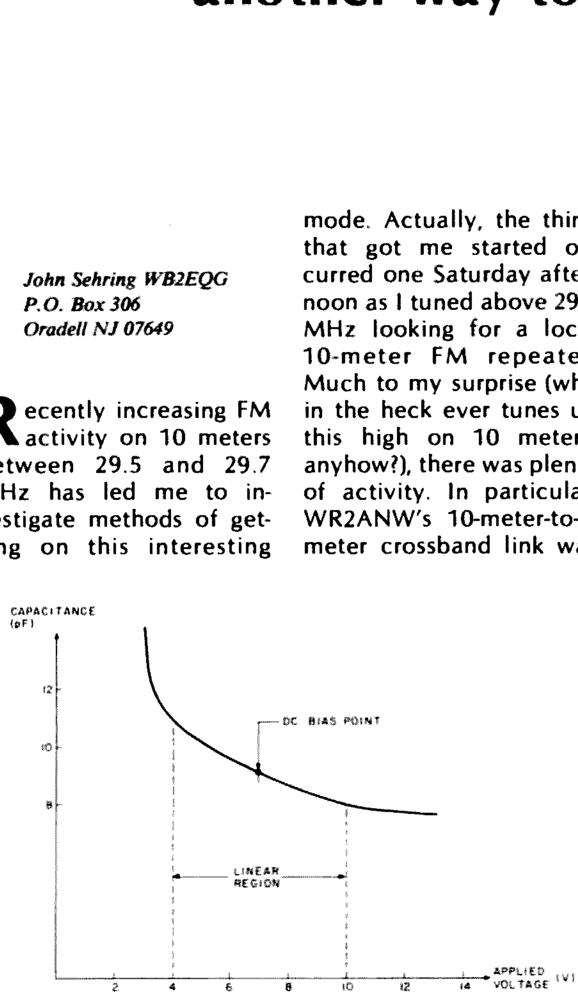

Fig. 1. Typical varactor characteristic curve.

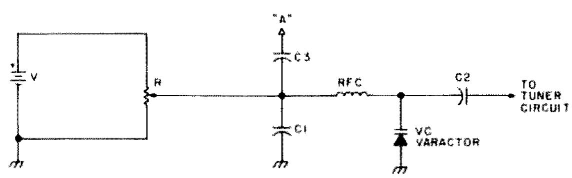

Fig. 2. Basic varactor circuit.

the power supply. Changing the applied dc voltage shifts the varactor's capacitance as per the curve in Fig. 1.

Now, if the varactor circuit were connected to the tuned LC circuit of an oscillator, then the varactor's changing capacitance would shift the oscillator's frequency a certain amount, by adding or subtracting from the total tank circuit capacitance. Let's take this idea one step further. Suppose that we now apply an audio (ac) voltage to the varactor circuit at point A of Fig. 2, through the coupling capacitor, C3. The varactor would then change its capacitance in step with the applied audio voltage. With the varactor connected to an oscillator's tank circuit, the oscillator's frequency would once again be shifted, but this time the frequency shift would be in step with the applied audio voltage. Hence, we would have frequency modulation of the oscillator.

You may wonder why we continue to apply dc voltage to the varactor along with the audio voltage. A look at Fig. 1 shows that the varactor's voltage-capacitance characteristic is linear (straight) only in the center of its curve. That's the part of the curve which we want to use for our frequency modulation scheme, swinging the varactor's capacitance upward and downward from the center of this linear region with our audio (modulating) voltage, to achieve linear frequency modulation. The adjustable dc bias is used to place us at the center of the linear portion of the curve.

My particular rig already has a varactor in its vfo tank circuit (as shown in Figs. 3 and 4), which is typical of vfo circuits. The varactor's purpose has nothing to do with modulation, though, and is used for shifting the vfo's frequency by about 3 kHz to offset SSB carrier-oscillator shift when switching from USB to LSB. The varactor already has some dc bias voltage on it, so let's see what happens when an audio voltage is also applied. Remember, though, that this technique is applicable to many different kinds of transmitters or transceivers, old or new, CW, AM, or SSB, since they all have oscillator(s) which can be frequency modulated. The basic idea is to get just a bit of audio-modulated capacitance into a suitable point of a variable or crystal-controlled oscillator tank circuit in order to frequency-modulate it. For example, since almost all SSB rigs use frequency heterodyning stages, conceivably any oscillator in the chain (vfo or crystal) could be FMed by the varactor circuit. (If you're a Yaesu FT-101 owner, see Reference 5.)

Fig. 4 shows the actual varactor frequency modulator circuit used. Point B is where the varactor circuit is connected to the vfo of Fig. 3. The audio signal is applied at point A of the varactor circuit, Fig. 4, as before. For a source of audio, I first used an inexpensive cassette tape recorder and microphone. The recorder's speaker output was connected to the varactor circuit at point A of Fig. 4. It worked! However, the first few QSOs revealed that the audio quality was bassy and muffled. The audio coupling capacitor, C3, then was made smaller until acceptable audio quality resulted; the final value of C3 in my particular application was 270 pF.

Actually, some of the bassy audio quality results from the fact that most FM receivers have "de-emphasis" circuits built in, which roll off the audio frequency response at the high end. Such a circuit is intended to complement (cancel out) the opposite kind of circuit built into FM transmitters, "pre-emphasis," which boosts the higher audio frequencies. This scheme is used to enhance the overall signal-to-noise ratio of an FM system by boosting the highs on transmit and cutting them on receive. I don't pretend that a sufficiently small value of coupling capacitor will produce exactly the right amount of pre-emphasis, but it does the job and produces pleasant audio quality on FM receivers.

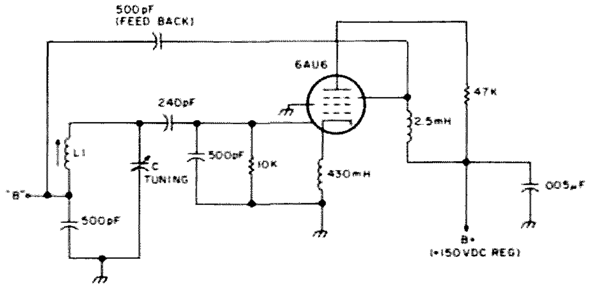

Fig. 3. Typical 6-MHz vfo.

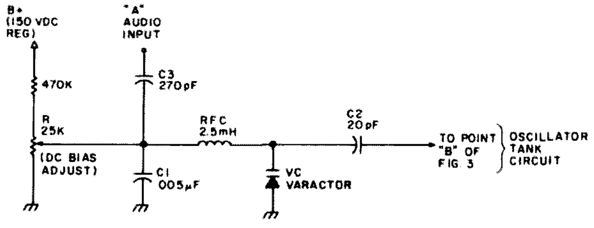

Fig. 4. Varactor frequency modulator circuit. Varactor part numbers: 1. Motorola HEP-R2503 (20-pF nominal capacitance); 2. Motorola MV2205 or MV2209 (swing 15 to 60 pF); 3. Motorola MV839; 4. Amperex H4A/1N4885.

You'll also have to decide what value to use for capacitor C2 in Fig. 4. If this capacitor is too small, you won't be able to get enough deviation; if it's too large, you'll have too much deviation, and it may throw your vfo way out of calibration and/or load it down excessively. I would suggest starting out with small values of capacitance at first and then increasing them if necessary. Examination of your particular vfo circuit should reveal where to attach the varactor circuit and roughly how big C2 should be.

References 1 through 4 show numerous different types of oscillators and similar methods of FMing them. As a rough guide in setting up your circuit, determine how much ±dc voltage is needed on the varactor to shift your oscillator by plus and minus 5 kHz; you can check the frequency shift using a receiver with a bfo and an accurately calibrated dial. The value of dc voltage thus determined will then be approximately the peak level of audio voltage you'll need. One of the nice things about FM is that practically no power (only voltage) is necessary for the frequency modulator. I wound up with plenty of deviation to spare.

Although this lash-up worked on the first try, who would want a tape recorder patch cord hanging out of the bottom of the rig permanently? So, a way of

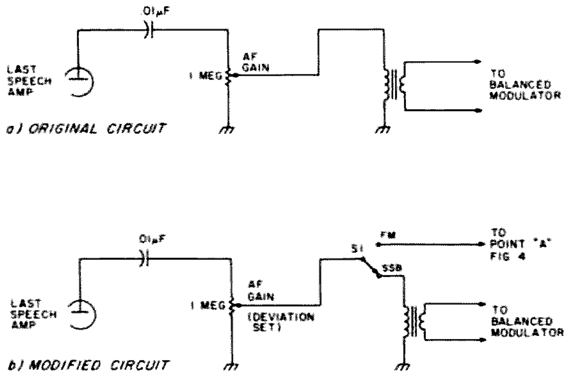

Fig. 5. Typical speech amplifier circuit.

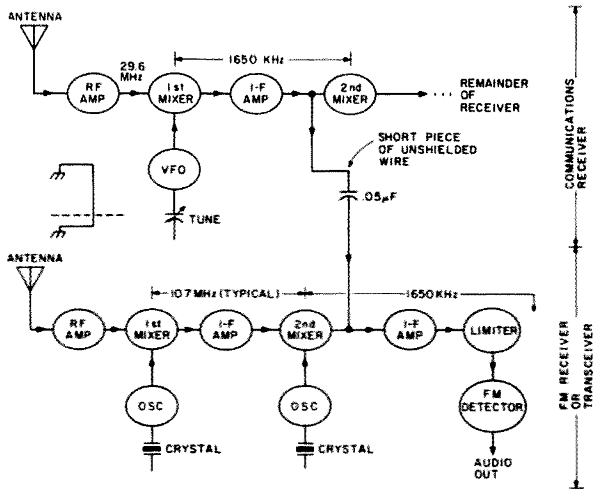

Fig. 6.

using the rig's own built-in speech amplifier was sought. A partial schematic of the Hammarlund's speech amplifier appears in Fig. 5 along with the very simple modification for FM. Once again, the speech amplifier circuit is quite typical; usually only a few volts of audio is needed. The SPDT switch, S1, removes the audio from the balanced modulator and applies it instead to the varactor circuit of Fig. 4. Shielded cable should be used for this modification, to avoid hum and rf pickup. The beauty of this change is that it in no way alters the other functions of the transmitter.

Operation on FM is simple: Tune up the rig in the CW mode, observing the maximum rated plate current limit for continuous, key-down operation. This is likely to be less than the rated CW input and equal to the RTTY or SSTV ratings, as we certainly don't want to overstress the final amplifier or power supply. After tune-up, flip S1 to FM and set the microphone gain for the desired amount of deviation. I happen to use an outboard speech processor (af compressor/clipper/lowpass filter combination) intended for SSB use on FM, too—it keeps the average deviation level (analogous to modulation percentage) high, prevents over-deviation, and crispens up the audio somewhat.

Some questions remain, though, about the operation of an FM transmitter: How much deviation is permissible, and how do you correctly adjust your FM transmitter for it? Well, most FM activity is limited to ±5 kHz deviation—so-called narrowband FM. First, you can roughly set your deviation based on signal reports from other FM operators. However, since each FM receiver will have somewhat different tolerances to over-deviated signals, you may get inconsistent observations. Generally speaking, your audio should sound about as "loud" (have as much deviation) as most other FM signals on the air, but no greater. Excessive deviation will sound grossly distorted and can cause splatter.

For deviation adjustment purposes, you also can use the following technique: Set FM deviation using an SSB receiver, by tuning the FM signal for zero beat, with no modulation applied. Then, while listening to the FM signal, modulate the FM transmitter normally and advance its deviation control (microphone gain) until the signal thus received becomes grossly distorted; back off on the deviation control until the signal becomes clean again. Use the widest available selectivity setting on the SSB receiver for making this adjustment. For example, a 5-kHz-wide receiver would indicate roughly the ±5 kHz deviation limit.

For practice, you might try listening to FM signals on the air, to get an idea of what a narrowband FM signal sounds like on your particular SSB receiver; a repeater output would probably be a good bet to be properly adjusted. Note, however, that an FM signal thus detected will obviously not be demodulated properly (it will probably sound garbled), but the onset of distortion caused by excessive deviation will be clearly audible.

The theory behind this technique is that the first pair of FM sidebands of an FM signal is indistinguishable from the sidebands of an AM signal. FM and AM signals thus considered differ only in that the FM sidebands and carrier are 90° out of phase with one another, whereas the AM sideband and carrier are in phase with each other. Further, for narrowband FM, both the first pair of FM sidebands and the AM sidebands occupy approximately the same bandwidth when using equal modulating signals. By receiving an FM signal on an SSB receiver with its bfo operating ("exalted-carrier" reception), you can replace the FM signal's 90° phase-shifted carrier with the bfo carrier (which is not 90° shifted). This provides an "equivalent" AM signal for our adjustment purposes.[4]

What about the reception of FM signals? Slope-detection in the AM mode works OK on most receivers by tuning off to one side of the FM signal; use the broadcast selectivity available. Ironically, the steeper the sides of the AM receiver's selectivity characteristics are, the harder it is to slope-detect an FM signal. Unfortunately, slope-detection doesn't provide any of the FM reception advantages—quieting and impulse noise rejection, for example. I presently use two different methods for true FM reception.

First method: The main station receiver here is a Hallicrafters SX-101A. This receiver has a double-conversion i-f strip, with a first i-f frequency of 1650 kHz. Also at hand is a Hammarlund FM-50A VHF-FM transceiver that has a 1650-kHz second i-f frequency. To use the SX-101A as a tuneable front end for the FM-50A's FM i-f strip, make these changes: First, remove the SX-101A's second mixer tube (V5, a 6BA6) and insert a short

piece of unshielded, insulated wire into pin 1 (grid circuit) of the now empty 6BA6 socket. Then, connect the other end of the wire to the grid circuit of the FM-50A's first 1650-kHz i-f amplifier via a .05-uF disc capacitor. Removing the FM-50A's receive crystal or mixer tube will disable its front end.[6] See Fig. 6.

Another such combination I've used consisted of a general coverage receiver having a single-conversion 455-kHz i-f strip, used to feed the latter half of a transistorized FM i-f strip, also at 455 kHz, from a Johnson "Monoscan" UHF scanner.* In addition, numerous FM adapter circuits and ideas may be found in References 1, 2, and 4. With a little experimentation, comparable hybrid arrangements with other sets may be found to be feasible.

Second method: Use a crystal-controlled converter (for example, a VHF Engineering Model RF-28** or Hamtronics Model C25-50***) to convert the 10-meter signals down to the i-f frequency of the FM i-f strip you want to use; for example, 10.7 MHz is a common i-f frequency. Just about any FM i-f strip is usable like this—all that you have to do is select a converter crystal to match the i-f frequency you need. See Fig. 7. The only trick is to select the right spot to inject the converter's output into the i-f strip. The best point seems to be just before the high i-f bandpass filter; most of these filters have relatively low input impedances (about 500 to 1000 Ohms), making connections relatively uncritical. Fig. 8 shows a common FM i-f strip configuration.

In case you're wondering, yes, Virginia, 10-meter FM operation is channelized. The frequencies are: national simplex—29.6 MHz (don't call CQ though; "QRZed" or "listening on the frequency" is better). Repeater pairs are—input/output, 29.52/29.62, 29.54/29.64, 29.56/29.66, and 29.58/29.68 MHz. Most are open machines. Caution: Don't go below 29.5 MHz using ±5 kHz FM because the Friendly Candy Company doesn't allow it—±2.5 kHz FM is the limit "down below." Lately, I've heard some simplex activity on frequencies between the repeater outputs, e.g., 29.61, 29.63 MHz, etc.

Results: Running 75 Watts output to a vertical antenna and using the first reception method has yielded fine results. I've worked mobiles all over the country with full quieting and some DX, too! Telling the guy at the other end that he's listening to a modified SSB exciter gives him something to think about, too.

Additional applications: There are some other important uses for FM or frequency-shift capability in an HF transmitter. You can achieve very clean frequency-shift keying (FSK) for radioteletype (RTTY) operation by feeding two discrete dc voltages to the varactor circuit (omit the coupling capacitor, C3), to give you the proper frequency shifts. Also, it would appear that better slow-scan television quality (SSTV, which uses frequency-modulated video signals) could be achieved by, once again, directly FMing the transmitter, using the varactor frequency modulator instead of feeding the SSTV (or RTTY) signals through the microphone input of the transmitter. In both the RTTY and SSTV modes, nonlinear operation, spurious products, and splatter may result unless: (a) your carrier and unwanted sideband suppression is very good, and (b) your speech amplifier, balanced modulator, filter, and amplifier stages are amplitude- and phase-linear and distortion-free (quite rare!). Direct frequency modulation of the carrier gets around the problem of avoiding the speech amplifier, balanced modulator, and filter stages entirely.

As a final thought, those of you with 10- to 6- or 2-meter transverters could easily get on VHF-FM. And, of course, the ideas in this article and in the references would be just fine for getting on FM that old VHF-AM/CW rig lying around the shack.

I would welcome your experiences and comments on 10-meter FM operation, and I'll answer questions if you include an SASE. CUL on 29.6 FM! ■

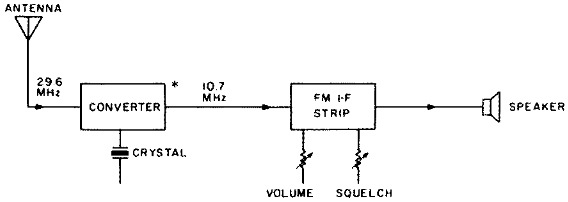

Fig. 7. 10-meter FM reception. (Can be any i-f frequency.)

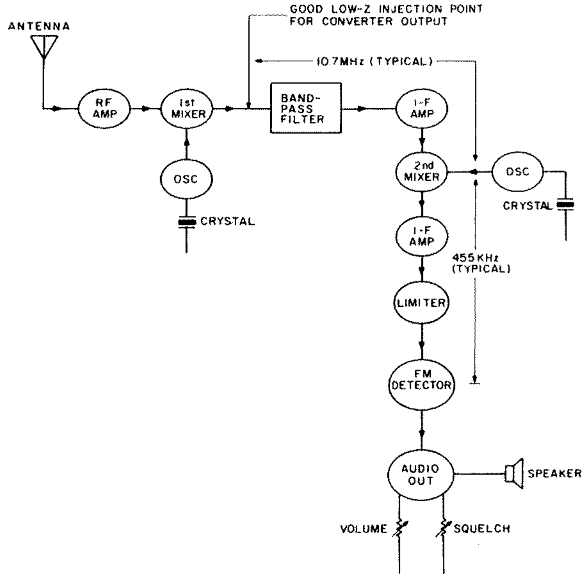

Fig. 8. Typical FM receiver block diagram.

*Available (used) without cabinet, power transformer, or crystals from: Science Workshop, Box 393, Bethpage NY 11714, for $14.95; a nice item for experimenters.

**Available from: VHF Engineering, 320 Water St., Binghamton NY 13901, in kit form, $13.95 plus postage.

***Available from: Hamtronics, Inc., 65A Moul Rd., Hilton NY 14468, in kit form, $25.50 plus postage.

References

1. *The Radio Amateur's Handbook*, American Radio Relay League, 1976.
2. *FM and Repeaters for the Radio Amateur*, ARRL, 1972.
3. *The Radio Amateur's VHF Manual*, ARRL, 1972.
4. *Amateur Radio Techniques*, Radio Society of Great Britain, 1978, p. 199, "Setting N.B.F.M. Deviation," originally from *QST*, December, 1972, article by D. Collins K4GGI/1.
5. "VHF Transverters and the FT-101," *73 Magazine*, July, 1978, p. 168.
6. *Hints & Kinks*, "Providing a Tunable VHF-FM Receiver," ARRL, 1978, p. 108.

Sunspot Predictions for 1980

—whither propagation?

Editor's Note: The sunspot forecast presented in this article does not agree with the one issued by our own propagation expert, John H. Nelson. In the March, 1977, issue of *73 Magazine*, Nelson predicted that Cycle 21 was going to be a moderate to low cycle. Nelson further predicted in *The Propagation Wizard's Handbook* that both Cycle 21 and 22 would be moderate to low. In the *Handbook*, Nelson explains his forecasting methods and gives us the reasons for his predictions. While we continue to believe that Nelson's is the more accurate forecast, we thought you would be interested in this, another view of the subject.

***The Propagation Wizard's Handbook* is available from the *73* Radio Bookshop, Peterborough NH 03458. Please include $6.95 plus $1.00 postage and handling. You'll find John Nelson's monthly propagation forecast near the back of each issue of *73*. ■**

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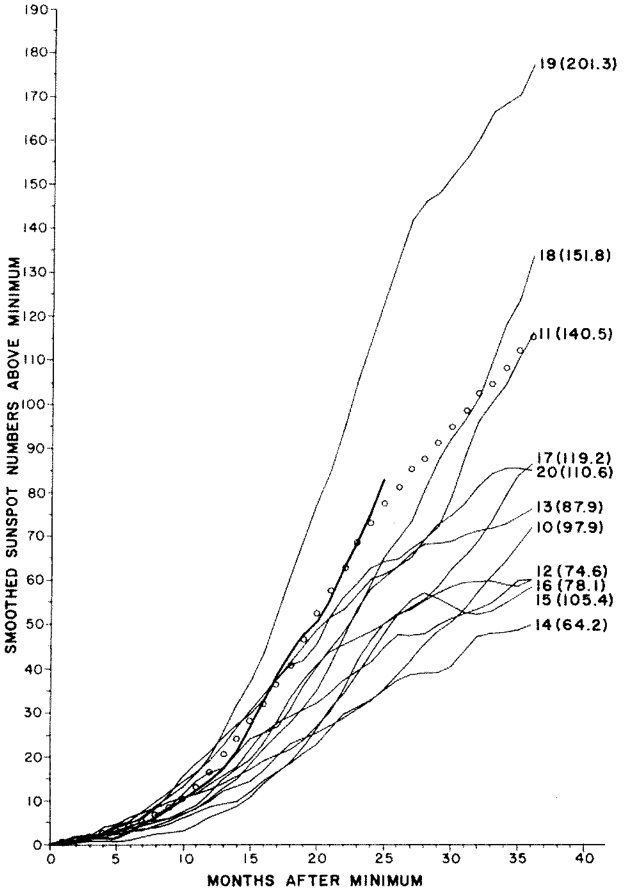

Fig. 1. Sunspot maxima for previous cycles.

The frequency of the occurrence of sunspots varies in cycles averaging around 11 years in length. Twenty cycles have been observed since 1755. We are now approaching maximum activity in Cycle 21, the minimum activity having occurred in 1976. The highest number (201) occurred in Cycle 19 in March, 1958. Radio communications, especially in the 3-to 30-megahertz (high-frequency) band, are vitally affected by sunspot activity, long-distance propagation increasing dramatically as the cycle approaches its maximum of activity.

Because of this significance, a number of investigators have made their predictions of sunspot maxima for Cycle 21 and the times of their occurrences. Predicted maxima range from as low as 60 to highs of up to 200, to occur in the years from 1979 to 1984. Published during the past two sunspot cycles, investigators used some type of time series or pattern analysis of the sunspot numbers alone to arrive at their predictions. Others

have included physical indications such as the tidal effects of the accurately-determined planetary alignments.[1,2,3,]

Measurements of the horizontal component of the Earth's magnetic field to predict subsequent maximum sunspot activity was such a departure.[4,5] A strong negative correlation between the number of "abnormal quiet days" of this horizontal component and the sunspot maximum reached during the next half-cycle of solar activity was used. A simpler relationship was employed whereby there was found a high correlation between the value of the geomagnetic sum of the Kps index (average of geomagnetic activity at a number of high latitude stations) during the years immediately preceding solar minimum and the solar maximum reached during the next cycle.[6]

A major limiting factor in the success or failure of predictions is the size of a reliable data base containing, at best, 11 sunspot cycles. Data prior to 1848 is considered to be unreliable. The first seven cycles (starting from about 1755) have been noted to differ statistically from the subsequent cycles, so that some investigators used only the later cycles in constructing an average solar cycle.[7]

Scientist H. H. Sargent III of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), has recently summarized a number of predictions of the time intensity of Solar Cycle 21.* Working in NOAA's Space Environment Laboratory in Boulder, Colorado, Sargent has an-

ILLUSTRATION OF MODIFIED OHL METHOD OF PREDICTION

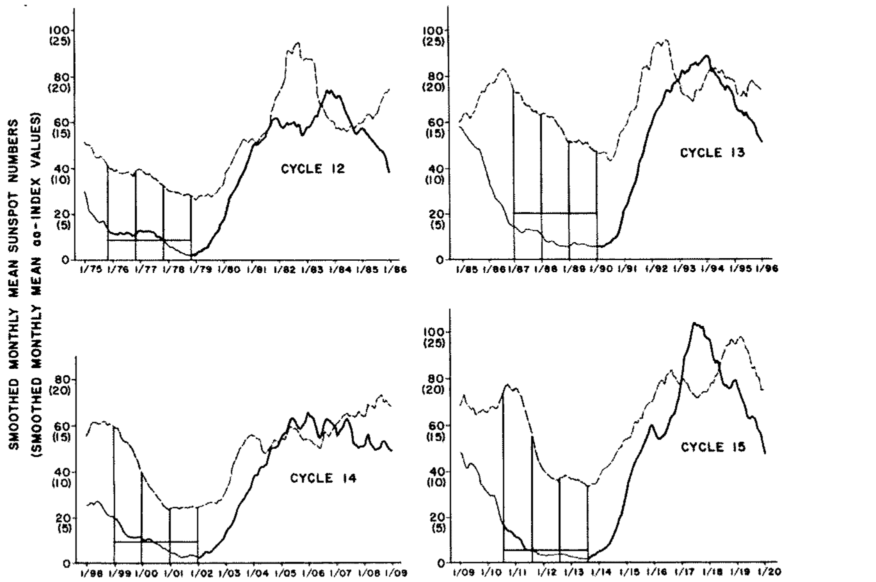

Fig. 2. Most predictions to date have indicated a low sunspot value (120 or less) for the present cycle, Cycle 21. One of these, however, predicts a smoothed sunspot maximum value of 154 to occur in early 1980 which is considerably higher, and earlier, than the others. A high correlation between the value of geomagnetic activity during the years immediately preceding solar minimum and solar maximum reached during the next half-cycle has been found. If accurate, Cycle 21 will be equivalent to, or greater than, the second largest observed in the past century. This would have a profound effect on radio communications, especially in the high-frequency range (3-30 megahertz). The illustration shows pairs of even- and odd-numbered sunspot cycles (solid lines) plotted with concurrent geomagnetic cycles (dashed lines). The shaded areas indicate the variables between the smoothed geomagnetic and sunspot cycles used in the computations.

alyzed the method of A. I. Ohl in predicting the maximum level of sunspot activity (154 in 1980).[6,8,9] This prediction is unique in that its value for Cycle 21 is considerably higher than most of those made in recent years by a number of investigators.

The method used to make the prediction was founded on a data base of only 11 sunspot cycles. This was done because geomagnetic data not available prior to 1868 was used. It was considered that the cycle of geomagnetic activity which accompanies each sunspot cycle may be separated into two components. One is a sporadic component associated with large solar flares, and one a recurrent component thought to be caused by high-speed solar wind streams. It was found that the size of the recurrent component is closely related to the maximum value of the succeeding sunspot cycle. Factors proportional to the sunspot numbers at solar minimum were subtracted from the magnetic indexes for similar periods, resulting in a corrected magnetic index which is highly correlated with the next smoothed sunspot maximum. A best predictive equation was determined using multiple regression to calculate the maximum smoothed value of the following sunspot cycle. This predicted value for Cycle 21 is 154.

The small data base that was used (11 cycles) resulted in large confidence intervals. The 95 percent confidence interval extends from 103 to 203, and the 90 percent interval from 113 to 193. The probability of exceeding a smoothed sunspot maximum value of 120 is 92.6 percent. There is less than one chance in a thousand that the relation developed is one of mere chance, convincing evidence that magnetic activity in the declining phase of one sunspot cycle is somehow physically related to the level of solar activity during the next cycle. Using this equation, the past 3 sunspot cycles would have been predicted within 5 percent, and several would have come within 1 percent of the observed values.

A careful examination of Cycles 10 through 20 showed that the even-numbered cycles were different in appearance from the odd-numbered cycles; as each cycle proceeded to its maximum value, even-numbered curves are more truncated while the odd-numbered ones rose rather deliberately to maximum. This suggested two dif-

*Sargent, H. H. III, 1978, "A Prediction for the Next Sunspot Cycle," *Conference Record*, 28th IEEE Vehicular Technology Conference, March 22-24, Denver, Colorado, pp. 490-496.

ferent families of cycles. An average odd-numbered cycle was constructed from the five odd-numbered cycles (Cycles 11-19) and rescaled between the last observed minimum (12.2) and the predicted maximum value for Cycle 21 (153.6). This made possible the prediction of the monthly values for Cycle 21; the predicted maximum value falls in early 1980.

Also, an analysis showed that the three largest cycles had the steepest emergencies while the smaller cycles proceeded less steeply from the minima. The predicted emergence slope for Cycle 21 correlated well with those of the largest cycles and follows closely the observed values through July of 1978. Each cycle settles down to a smooth and steady upward pace within about 18 months after solar minimum, and the upward slope of Cycle 21 had become well established in the first few months of 1978. This feature should make it possible to confidently predict the maximum value of Cycle 21.

The effects of high sunspot activity on radio communications, especially in the high-frequency part of the spectrum (3-30 megahertz) and the lower end of the very high frequency band (30-300 megahertz) would have both advantages and disadvantages. The more than 350,000 licensees of the Amateur Radio Service will find it possible to conduct extremely consistent, long-distance communications frequently and with relatively low power.

On the other hand, radio operators confined by law to specified frequencies may find them more heavily congested than at the present time, making them much less efficient as methods of intelligible communication. This is generally the case with increased solar activity.

There are ways such high activity can temporarily worsen propagation conditions, however. Solar-flare events and related geophysical aspects such as sudden ionospheric disturbances and geomagnetic and ionospheric storms can disrupt radio communications for periods of a few minutes to several days. If Cycle 21 is as large as predicted in this analysis, relatively more of such major disruptions can be expected.

Those charged with planning relative to the vital radio communications the world over (especially in the high-frequency range) may find of interest this prediction of sunspot activity in the present cycle, as well as its rationale. ■

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An End to Dials and Meters?

—nope . . . but discrete LEDs make an interesting substitute

73 Magazine *Staff*

One of the items that usually proves to be a bit of a chore in constructing any piece of equipment or accessory item is a dial (and dial scale). Multi-turn dials with an indicating scale can be expensive, and constructing various other forms of dials and scales can require considerable mechanical ability.

There is the alternative, today, of having a digital readout, but digital readouts can consume a significant amount of power for portable equipment. Also, in some cases the use of a digital readout is a far more elaborate option than is needed. A case in point might be a roller inductor in an antenna tuner. Usually, one just wants to know approximately where the roller inductor is set, since final tuning would be done using an swr meter or a wattmeter.

This article explores some simple alternatives to ordinary mechanical or digital-type readouts, using LEDs. Several LED circuits are described, to suit almost any requirement from indicating the approximate position of a roller inductor in an antenna tuner (just using several LEDs) to having a long string of LEDs arranged to form a frequency scale in which the LEDs light in turn as a receiver or a vfo is tuned. All of the circuits require, however, that a voltage be supplied to the circuit which is proportional to the shaft rotation of the inductor or capacitor being tuned (except for varactor diode-tuned vfos

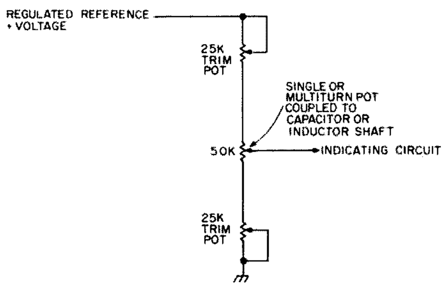


Fig. 1. Typical circuit for a potentiometer coupled to the shaft of a variable capacitor or inductor.

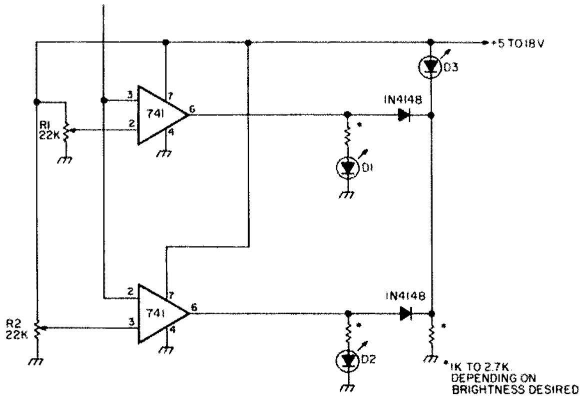


Fig. 2. LEDs D1, D2, and D3 can be set to light in turn according to the value of an applied tuning voltage. R1 and R2 are trim pots and set the voltages at which the LEDs light. The circuit can be easily constructed, especially if a dual 741 is used.

where the dc tuning voltage already is available).

How to do all this will vary from application to application, of course. Usually, one can find some way to couple a single- or multi-turn potentiometer to a tuning shaft. This is the only area in which some mechanical work is required to implement an LED scale. As shown in Fig. 1, it often is handy to add trim-type potentiometers in the circuit so that the voltage range covered by the potentiometer coupled to the tuning shaft can have both its upper and lower range adjusted.

The circuit in Fig. 2 provides only three LED indicators, but it uses readily-available 741 ICs and can still provide some useful tuning indications. For example, it can be used to indicate approximately which third of a roller inductor is active in a small antenna tuner. Also, it can be used as a warning indicator, with a vfo, that one is near the edge of a band, or it can be used to "bracket in" a small portion of a band so that it is readily apparent when one has tuned to the lower, middle, or upper part of the frequency range chosen.

The two 741s operate as comparators, and the potentiometers, R1 and R2, set the points at which either D1 or D2 will light. When the input voltage to the circuit exceeds the voltage set on pin 2 of IC1 to ground, D1 will light. When the input voltage is smaller than the voltage set on pin 3 of IC2, D2 will light. When the input voltage is in between (smaller than the D1 ignition voltage but larger than the D2 ignition voltage), D3 will light. There is nothing at all critical about using the circuit, but to avoid confusion when initially adjusting the potentiometers, be sure that the D1 ignition voltage is set higher in value than the D2 ignition voltage. Since the LEDs involved are switched separately, they need not have exactly the same characteristics. One can use different colored LEDs if desired, therefore, in each position.

The circuit in Fig. 3 uses a new, inexpensive (about $1.00) IC from Texas Instruments. Basically, it does the same thing as the circuit in Fig. 2 but contains everything in one IC, drives up to 5 LEDs, and contains a few extra features. At about 0.2 volts input on pin 8, pin 2 goes low and the first LED will light. As the input voltage increases in 0.2-volt steps, pins 3, 4, 5, and 6 will go low in turn and light the LED connected to them. At 1.0 volt input, all the LEDs will be lighted. Note that this is a slightly different action than in the circuit in Fig. 2 where only one LED at a time is active. Also, using this circuit, there is no way to change the 0.2-voltage steps needed to light successive LEDs. Further features of the IC are that when the input voltage goes below approximately 0.2 volts, the first LED will flash on and off periodically. Also, the IC contains a built-in voltage regulator so that the supply voltage need not be regulated. Although the circuit shown uses LEDs, the output terminals (pins 2-6) can actually switch currents up to 80 mA at a maximum voltage of 18 volts. One could, therefore, use small lamps for the indicators, or even set up a solid-state buzzer on one of the outputs to indicate aurally that some high or low limit had been reached.

The circuit in Fig. 4 moves into the "big time" with LED displays, in that a string of 10 LEDs is involved. This circuit uses an IC that was specifically designed to drive a string of LEDs in response to a variable input voltage. The LED action is like the circuit of Fig. 2 in that only one LED is active at a time, depending on the voltage level being sensed. The IC itself will take only a few milliamperes of current, so the main current drain using the circuit will be from the LED that is active. The circuit is suitable, therefore, for many types of portable equipment applications.

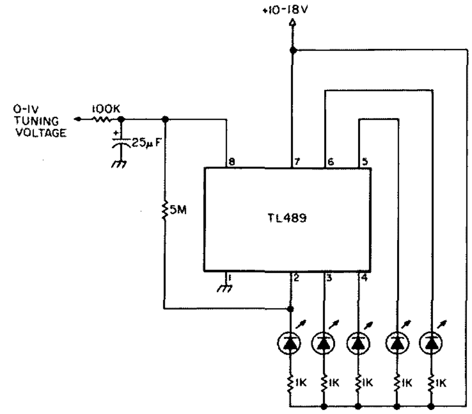
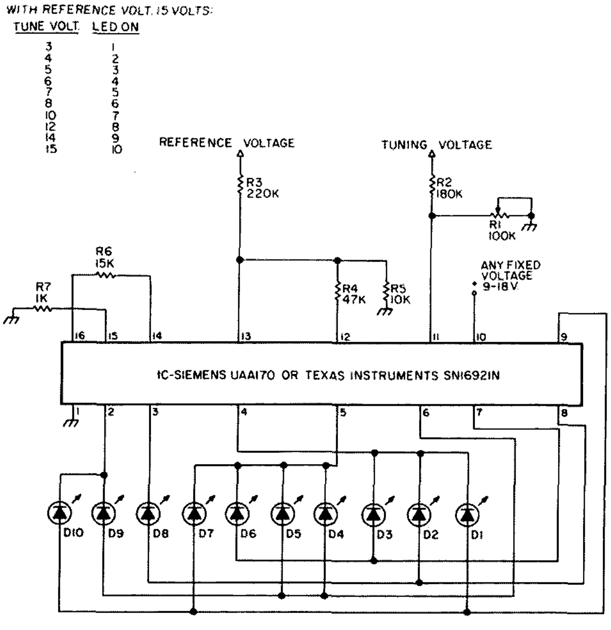


Fig. 3. In this circuit, as the input voltage varies from 0 to 1 volt, one LED will light (and stay lighted) for each 0.2-volt step in the input voltage.



D1-10-LED'S OF THE SAME TYPE

Fig. 4. The circuit of a 10-LED indicator. The size of the IC has been exaggerated for clarity; it is a normal 16-pin type and provides for very compact circuit construction.

This circuit is suited for construction of an electronic LED scale, since the 10 LEDs provide sufficient "spread." For instance, if a receiver had a tuning knob which covered 25-kHz/revolution, a string of 10 LEDs could be used to provide markers every 25 kHz across a 250-kHz portion of a band. If a linear vfo is used, therefore, the combination of having LEDs *and* the dial skirt divisions marked will provide readout to 1 kHz over a 250-kHz range.

The IC, although it is a small 16-pin type, packs

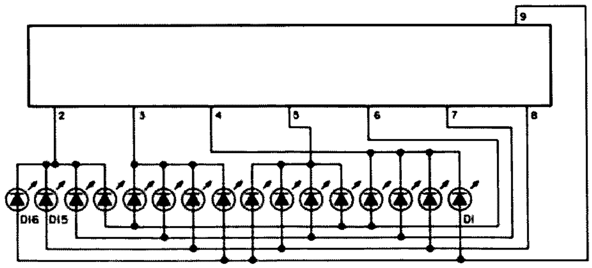


Fig. 5. The circuit of Fig. 4 can be expanded to control 16 LEDs as shown here. Pin connections not shown remain the same as in Fig. 4.

quite a bit inside. There are sixteen differential amplifiers and a resistive voltage-divider network, plus the driver circuits for the LEDs and a voltage regulator. The internal resistive voltage-divider network has equal value resistors, so that the device will function only to produce a linear LED scale.

There are three voltages that are important in the application of the IC. The voltage applied to pin 10 is the supply voltage for the IC and can be any regulated or unregulated voltage between 9 and 18 volts. The voltage on pin 13 is the maximum reference value of the variable-tuning voltage, and the voltage on pin 12 is the minimum reference value of the variable-tuning voltage. These voltages, as well as the actual tuning voltage on pin 11, cannot exceed 6 volts.

In many circuits, such as where varactor diodes are voltage-tuned in an oscillator, however, the maximum value of the tuning voltage will exceed 6 volts. Therefore, voltage dividers have to be employed, as in Fig. 4, where the tuning voltage varies between 4 and 15 volts. R1 and R2 form a voltage divider to limit the voltage on pin 11 to 6 volts maximum. R3, in conjunction with R4 and R5, set the high value of the tuning voltage on pin 13 and the low value on pin 12. The table in Fig. 4 shows which diodes will light for different tuning voltages.

Making R1 variable provides a slight adjustment similar to the mechanical analogy of centering the scale. The difference in voltage between pins 12 and 13 can be as low as 1.2 volts if a very restricted tuning voltage range is necessary. However, the LEDs will tend to present a mushy display at this voltage. That is, one LED will come on before the foregoing one is completely extinguished. If the voltage difference between pins 12 and 13 is at least 4 volts, the LEDs will light sharply one after the other.

The circuitry connected to pins 11, 12, and 13 will not load down any external circuitry because of the high resistances involved. So, the circuit is ideal for use with varactor diode-tuned vfos. There is a 5-volt regulated reference voltage available from pin 14 to ground. In some cases where only low current drain is involved (3 mA maximum), this voltage can be used as the reference voltage on pin 13 and the source of the variable-tuning voltage. Only one external voltage is needed then, to pin 10. R6 controls the brightness of the LED display and can be made variable, if desired, to keep the current drain at a minimum for portable applications or to vary the display brightness according to external lighting conditions. The LEDs used should all be of the same type for the circuit to function smoothly. Different colored LEDs can be used if their voltage/current characteristics are similar.

The circuit in Fig. 4 actually does not utilize the full capabilities of the IC, but is probably the most useful because of its 10-position scale. Actually, the IC will drive up to 16 LEDs, as shown in Fig. 5. All of the foregoing discussion about setting the voltage levels on various pins of the IC still applies. Again, however, it is worthwhile to emphasize that the LEDs must have the same electrical characteristics.

One may wonder if the circuits in Figs. 4 or 5 can be further expanded to create even longer LED scales. In most cases, this can be done easily if the tuning voltage range is not too small. If it is on the order of 1 to 14 volts, for example, one IC can be set up to respond to 1 to 7 volts and the other from 7 to 14 volts, with their inputs (pin 11) paralleled. The setting up of each IC to respond to a given voltage range is done, as explained previously, by putting the desired low- and high-reference voltages on pins 12 and 13 of each IC. Note that the high voltage of the first IC, which is a nominal 7 volts, should be a bit higher than the nominal low 7 volts of the second IC. The reason for this is to provide a smooth crossover between the LED displays associated with each IC. For instance, if two circuits of the type shown in Fig. 4 were used, when 7 volts or slightly over was reached, the last diode in the first IC (D10) would light simultaneously with the first diode (D1) associated with the second IC. These diodes would not be used in the scale display but must be left in the circuit.

By careful adjustment of the 7-volt overlap point, there will be a smooth step between diode D9 from the first IC and D2 from the second IC. This overlap adjustment can be achieved by making R7 in the circuit in Fig. 4 a trim pot instead of a fixed value resistor. If one used two circuits of the type shown in Fig. 4, therefore, 18 diodes actually will be available to form a scale; there will be 30 diodes available in the case of the circuit in Fig. 5.

Although the foregoing circuits were presented for use as LED tuning or logging scales, they can be applied to many other uses around the shack. The most obvious might be as battery voltage monitors. The circuits in Figs. 2 and 3 are particularly suited for this purpose. Also, the circuits can be used to replace or to augment analog meter readouts. The circuit in Fig. 4, with or without the additional LEDs shown in Fig. 5, is particularly well suited for this purpose. It has a high impedance input, and the response time is easily fast enough to follow speech peaks once the audio sample has been converted to dc by a suitable rectifier.

The Texas Instrument ICs are available from the usual supply sources, while local availability of the Siemens IC can be determined by writing to Siemens Components Division, 186 Wood Ave., S. Iselin NJ 08830. Siemens actually makes two ICs—the UAA170 and the UAA180. They are similar, except that the UAA180 provides a display such that the LEDs remain lighted once their voltage detection level is reached. The amount of current required with, say, 10 LEDs lighted would make this type of display unsuitable for most portable applications. However, where current availability is not a problem, the display is a very effective one in place of an analog meter display. ■

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The Paper, the Station, and the Man

—a brief history of the New York Times radio stations

The year was 1920, and the prestigious *New York Times* was in trouble. Communications from England and especially from occupied Germany were in bad shape after World War I. The Navy, still handling messages, had only one land line to NBD, Bar Harbor, Maine. News dispatches from Berlin that were being transmitted by the long-wave station, POZ, Nauen, Germany, were being received at the Bar Harbor installation, but would arrive at the *Times* newsroom 24 to 48 hours later. As everyone knows, nothing is deader than day-old press.

The *Times* had always been interested in wireless communication. Even back in December of 1901, when Marconi had been able to transmit the letter "S" to Newfoundland from the Poldhu station in southern England, the *Times* had not joined the rest of the world in doubting that wireless messages could ever be sent across the Atlantic. Instead, the paper had called the Marconi transmission a triumph and had written columns about the achievement.

Also, the *New York Times* had been the first to receive a message sent to the west from the newly-established wireless service between Clifden, Ireland, and Glace Bay, Nova Scotia. From that time, January, 1912, until the outbreak of World War I, nearly all *Times* dispatches from London and Paris had come by wireless to the Glace Bay station and then over special land lines leased by the paper.

When trouble came after the war in the form of unreliable communications, it was decided to establish a long-wave receiving station in the tower of the *Times* building at Times Square; this did not bring the success hoped for in receiving dispatches from POZ, Nauen, Germany, however. So, who better could they turn to for improving this situation

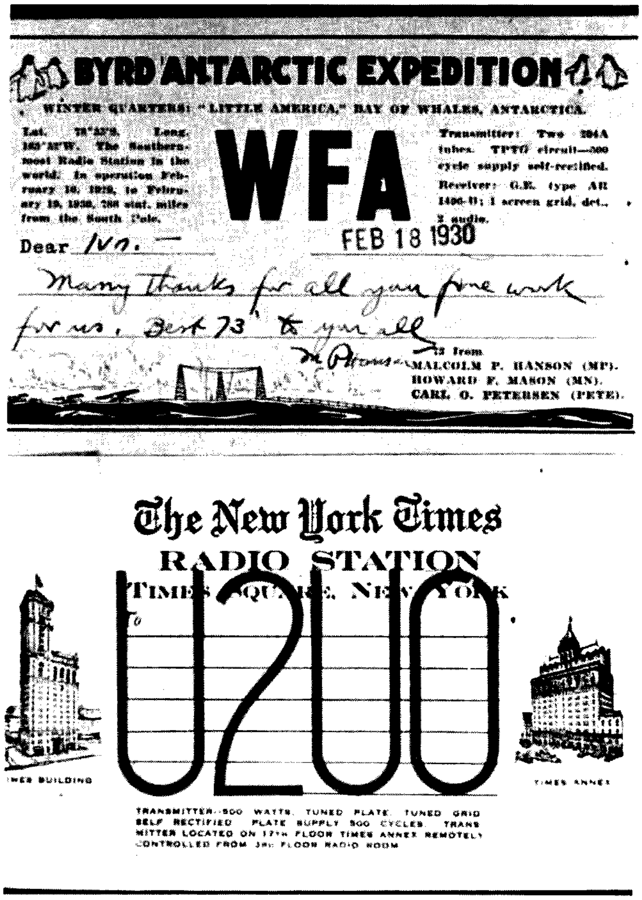
Times *receiving sets, 1925.*

Times *receiving sets, 1926. Note long-wave receiver and two-stage amplifier in background.*

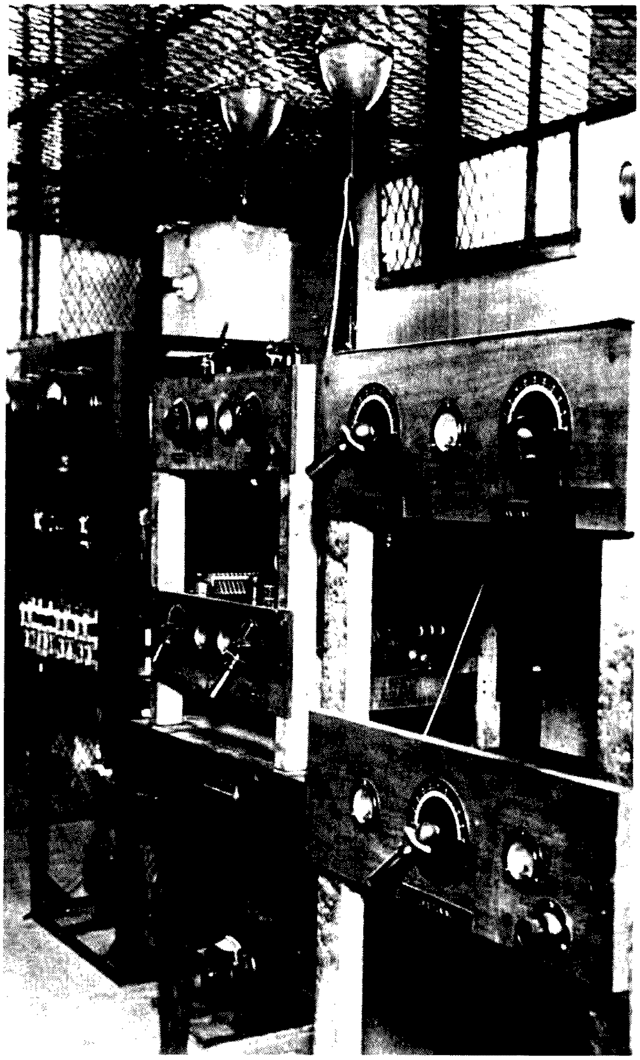
than Reginald J. Iverson, a former crack operator at transatlantic Navy receiving stations in Belmar, N.J., Chatham, Mass., and NBD, Bar Harbor, Maine?

Once employed at the *Times*, Iverson began assembling improved equipment for the new receiving station. An antenna was run from the top of the flagpole on the *Times* building down to the corner of the Flatiron Building at 43rd St., then along the third-floor offset and back up into the radio room. Another antenna went from the top of the tower down to the other side of the building.

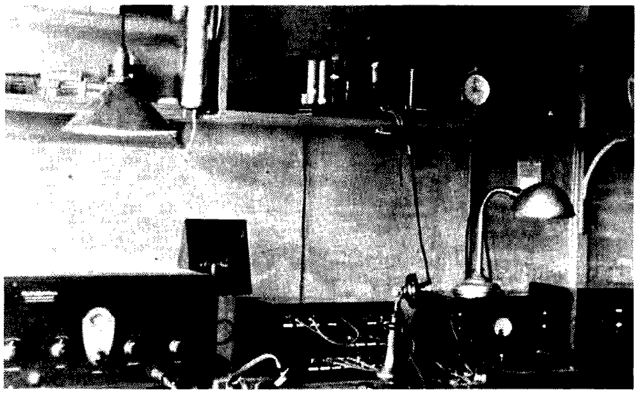
Early equipment consisted of a Kennedy long-wave receiver with a two-stage amplifier and Baldwin phones, later to be supplemented by receivers designed and built by Iverson. All of this finally brought better reception from Europe so that dis-



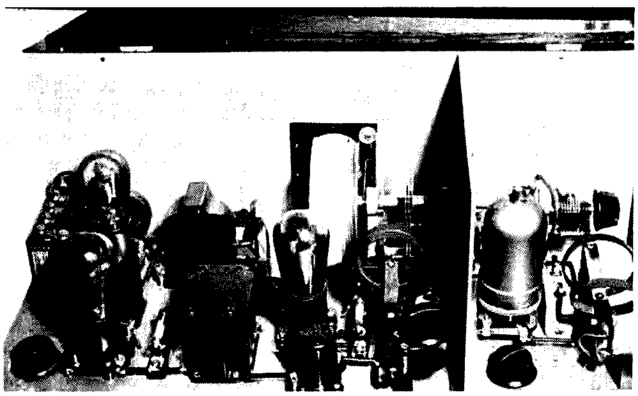
WFA and U2UO QSL cards.



Amateur transmitter using two 204 tubes with motor-generator under table. Note: This same transmitter was used in 1928 with slight modifications at WHD. Located in Times *Tower, Times Square, N.Y.*



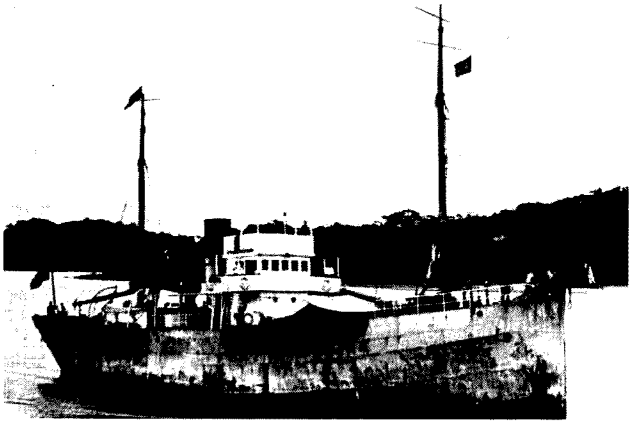
Front view of Byrd expedition receiver.



1928 shortwave receiver built by Iverson for reception from the Admiral Byrd 1928 expedition. Back view.

patches received during the day could be printed in the paper that night. Two years later, in 1922, this station was superseded by a completely new installation, and the radio room was moved from the tower to the new *Times* building on 43rd St. Radiotelephone had become popular, and several broadcast receivers were added at the new installation.

At this time, in order to further improve press reception, Iverson was sent on a lend-lease basis to Halifax, Nova Scotia, to establish another transatlantic receiving station. This project, to be known as *News Traffic Board, Ltd.*, was a joint venture of the *New York Times, Philadelphia Public Ledger, Chicago Tribune*, and a Canadian paper.



Byrd ship Eleanor Bolling, *1928 expedition.*

The New York Time

Copyright, 1929, by The New York Times Company.

NEW YORK, SATURDAY, JANUARY 26, 1929.

3YRD PLANE IN AIR OVER THE ANTARCTIC 'TALKS' TO NEW YORK

'wo-Way Messages by Radio Across 10,000 Miles Establishes a Record.

INKED FOR ENTIRE HOUR

imes Operator in Touch With the Craft From Take-Off at 3:15 A.M. Yesterday.

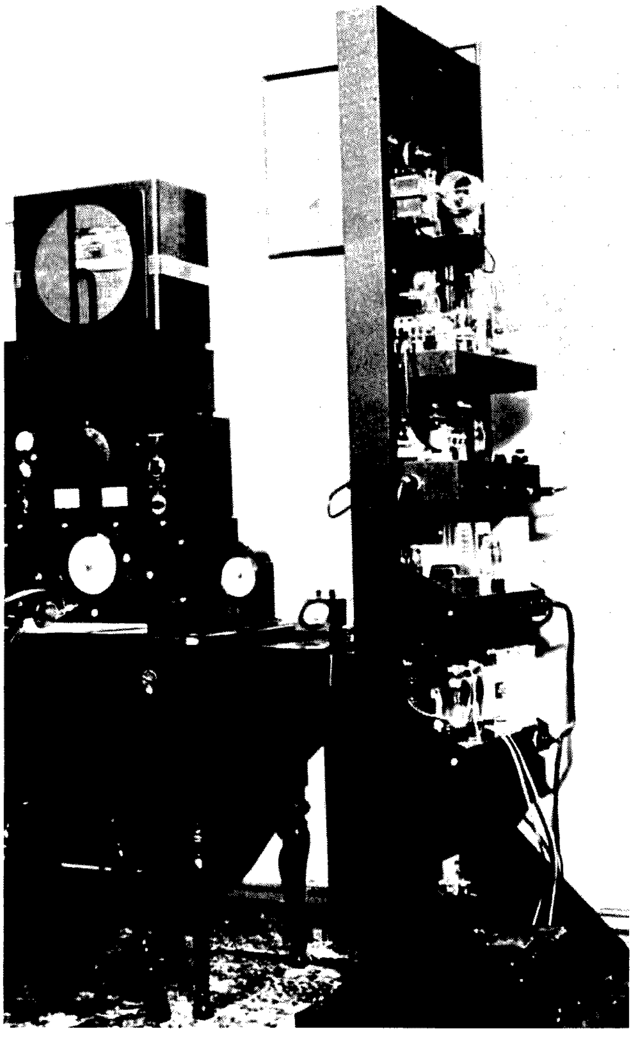
AN FRANCISCO ON CALL

BYRD PLANE IN AIR 'TALKS' TO NEW YORK

Continued from Page 1, Column 8

Continued on Page Two

New York Times *headlines, 1929 Byrd flight.*



R. J. Iverson W2LDR home station in Astoria, L.I., 1938.

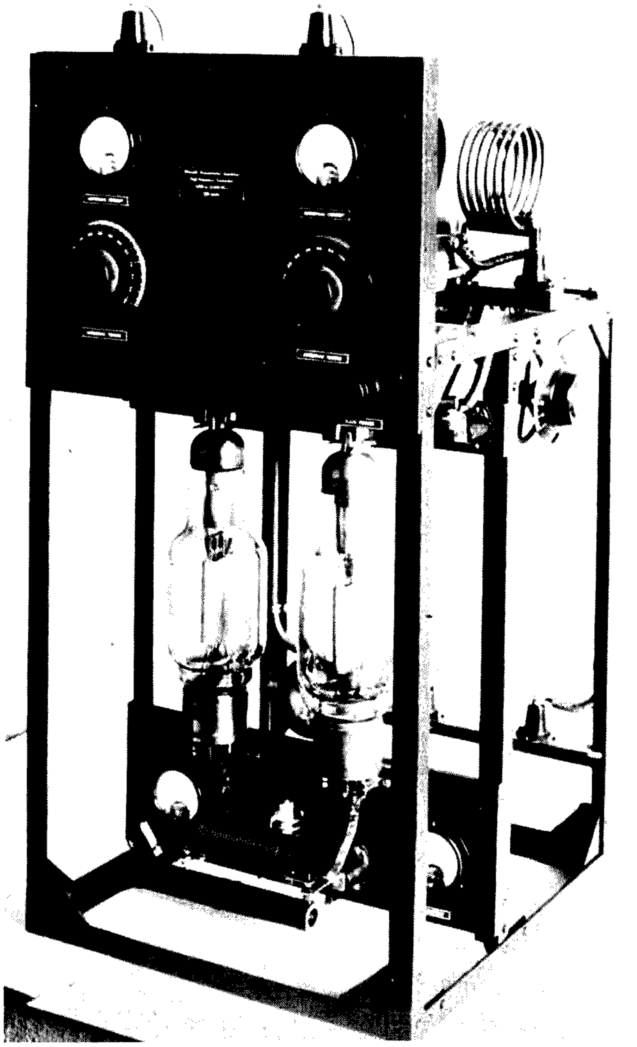
1935 flight: Thor Lothing, N.Y. to Norway, before takeoff. Picture of plane with note to R. J. Iverson of the Times. (Times installed his radio.)

Shortly after completion of the Halifax station, its efficiency and that of Iverson, its only engineer and operator, were sorely tried when Irish rebels cut the transatlantic cables at the repeater stations along the Irish coast. This left in operation only two very slow cables, one of them from France. Since this reduced the communication channels considerably, Iverson sat at the typewriter fifteen hours daily, from 10:00 am until 1:00 am, copying the London long-wave press transmissions until more operators could be recruited. His perseverance greatly expedited copy intended for the United States and Canadian newspapers, and this experience proved to the papers the value of wireless. They now poured more money into building a better station at Dartmouth, Nova Scotia, with a vastly improved antenna system. Balanced loops and towers were installed. Incidentally, this station was a forerunner of Press Wireless, founded in 1929.

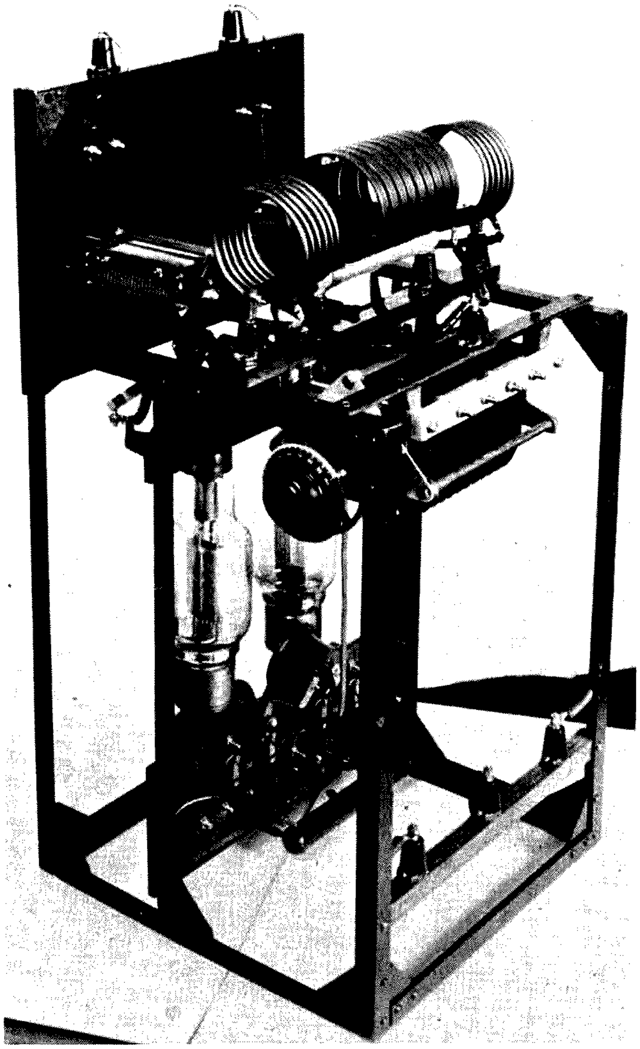
Iverson returned to the *Times* in 1924 as chief engineer. The receiving equipment was updated, long-wave receivers were built with audio bandpass in the outputs, and new antennas were erected. All of this resulted in excellent reception from Europe.

About the time that shortwave frequencies were coming into use, around 1926, a rash of explorers and fliers were making headlines. When Richard Byrd and Amundsen reached Spitzbergen Bay in their race to be first to fly over the North Pole, Byrd by plane and Amundsen by the dirigible, *Norge*, the commercial dispatches that came from there were

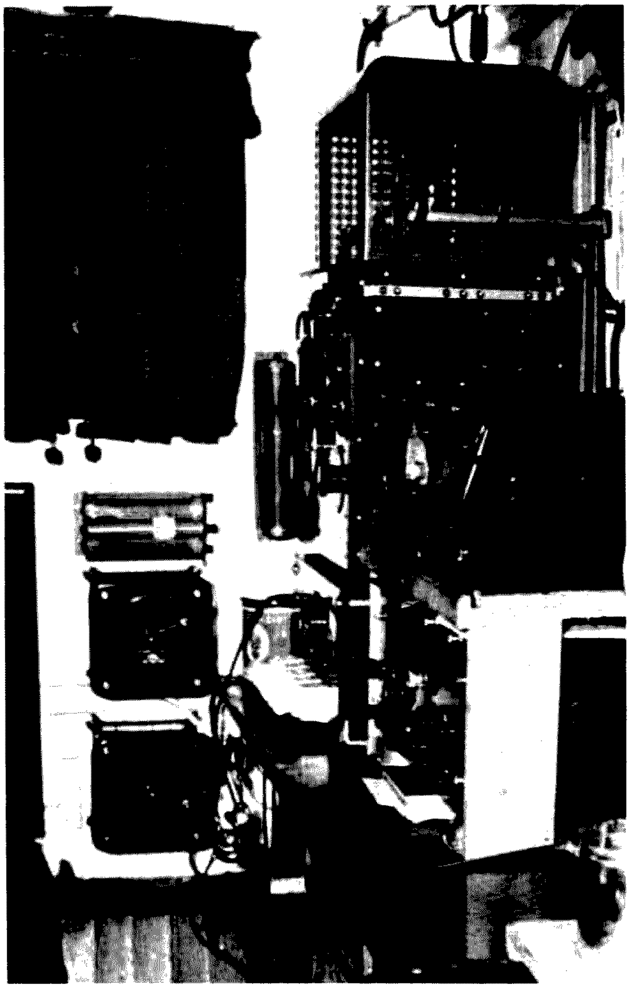
Press Wireless receiving room, Little Neck, L.I., 1929.



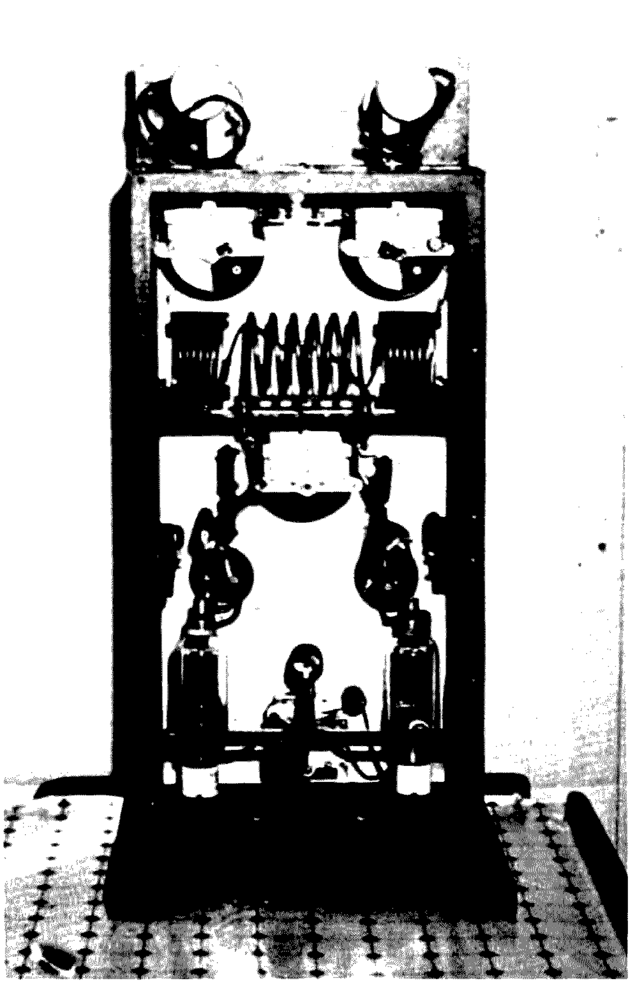
204 transmitter which the Times *built for the Ellsworth trans-Antarctic expedition. Front view.*



Back view of same transmitter.



Louise Boyd North Greenland expedition, 1938. Front view.



Back view of one of the transmitters. Times*-built by R. J. Iverson. Call letters of expedition: LAHR.*

unsatisfactory even when the *Times* had to pay over $1.00 a word for them. This prompted the engineering department to build immediately a 500-Watt short-wave transmitter using two 204 tubes in tuned-plate, tuned-grid, with the plate supply furnished by Crocker-Wheeler motor generators. Several high-frequency receivers also were constructed.

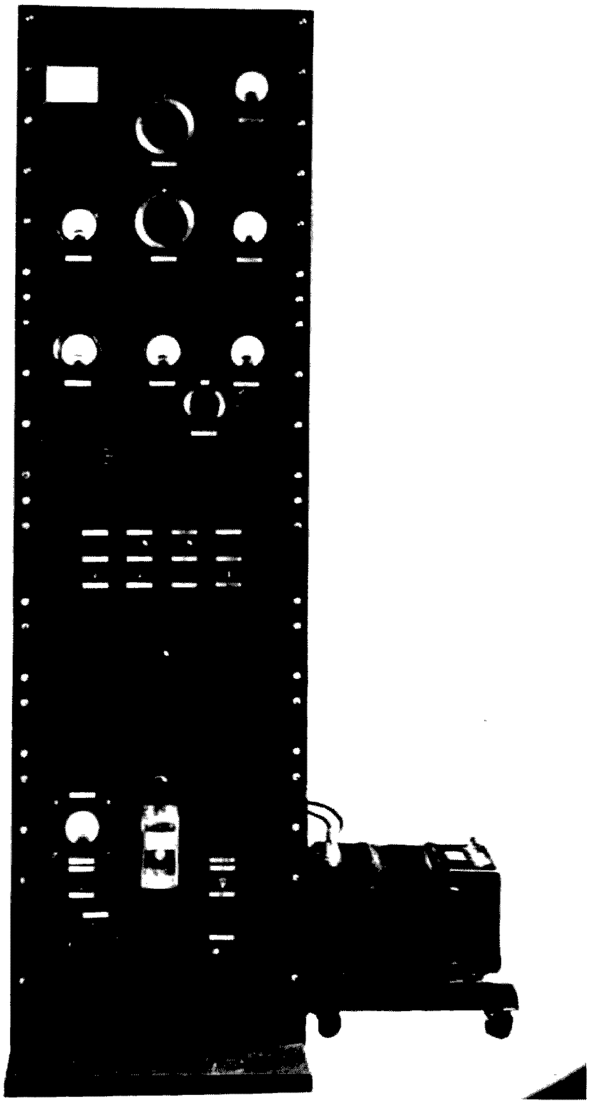
In 1926, the *Times* applied for and received an amateur license with the call letters U2UO. From then on, direct press communications were established with expeditions to all parts of the world. Thousands of words of front-page copy appeared under the slug, "By wireless to the *New York Times*." Two years later, at the insistence of the American Radio Relay League, station U2UO was phased out and a commercial license was issued with the call letters WHD. Frequencies were assigned in the press section of the marine bands.

A partial list of the noteworthy expeditions covered by the *Times* follows:

- The Richard Byrd and the Amundsen flights (already mentioned above).
- The Count Von Luckner 'round the world "Cruise of Good Will" on the yacht *Vaterland*, in 1927.
- Captain William Erwin's flight in the *Spirit of Dallas*, 1927. The *Times* operator in New York heard his last message as his plane fell into the Pacific and was lost.
- The Byrd Antarctic Expedition to Little America, 1928. Much of the equipment was supplied by the *Times* in exchange for exclusive newsbeats. More than two million words were handled by the stations of the expedition, and communication with Little America was so reliable that it was referred to as "the 9000-mile wire to the South Pole."
- The Hobbs University of Michigan Expedition to Greenland, 1928. An interesting sidelight here was that the Rockford (Illinois)-to-Sweden fliers, Haskell and Cramer, were lost after their last radio signals placed them at the northern tip of Labrador. No word of them was heard until they walked into Hobb's camp 100 miles from their landing site. The first edition of the *Times* that very night carried the story.

During the 1930s, the *Times* station worked closely with many other expeditions and fliers. Some of these were:

- War maneuvers in the far Pacific. The paper had its correspondent on the flagship, *Pennsylvania,* and WHD communicated directly with the fleet through a receiving station in Iverson's home in Astoria. The transmitter was controlled by land line.
- The Russian flier's Moscow-to-Los Angeles flight, lost in the Arctic without a trace. Iverson was commissioned to obtain a complete radio station to communicate with the search expedi-



One of WHD's postwar transmitters, 1947.

News receiving room with printers. Note National HRO in background.

tion headed by Wilkins and based in Point Barrow, Alaska. The plane was never found.

- The Lincoln Ellsworth trans-Antarctic expeditions under Sir Hubert Wilkins, 1938-9. Iverson built all of the transmitters and organized and secured communications equipment used for two years. At this time he became active in amateur radio as W2LDR to service the expeditions with an outlet for news and personal messages.
- The expedition of San Francisco socialite Louise Boyd to North Greenland. The same services were performed for communications as in the expeditions above. Her valuable surveys were used by the Navy in World War II.

With the coming of World War II, there were no more explorations. The world had become too small and there were more immediate concerns.

News broadcasts begun by station U2UO were now continued with WHD twice daily on marine frequencies and were heard regularly by Australia, South America, and ships at sea. The reputation of the *Times* was such that it was the only station allowed to transmit its hour-long newscasts without a censor sitting in the radio room. Also, half a dozen shortwave receivers were set up to constantly intercept broadcasts from London, France, Berlin, and Rome. This information was important to the reporters and correspondents, although much of the news from the Axis powers was exaggerated or untrue.

Soon after the war, the twenty-five-year-old transmitters of WHD were replaced by two modern crystal-controlled jobs with the increased output of 2 kW. They now had ac in the radio room in the tower where formerly there had been only dc. News summaries were broadcast until the mid-sixties, when it seemed that there was no further need for them.

After the armistice, the Reuters News Agency, London, wanted to establish itself in the United States and South America. The *Times* agreed to handle their east-to-west communications into the States. High-speed radio circuits were set up at the London end and receiving time was leased from Press Wireless and ITT. The signals then were piped into the *Times* radio room. Thirty to forty thousand words of press copy from Reuters were handled daily, received on Hellschreibers, facsimile-type printers. These were made in Germany and were capable of taking fifty words a minute.

In 1965, the license of WHD, which had seen such extraordinary service, was allowed to lapse and Iverson, after almost fifty years with the *Times*, retired. ■

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QRP from Canton Island

—proving all things are possible

Author's note: Since my April, 1979, visit, some changes have taken place which may have an important effect on Canton as a DX location. First, the area has been included in the newly-formed Republic of Kirabati and the military is no longer in charge of the island. Second, while the treaty is being finalized, the US representative on Canton is Larry KS6DV. He has been doing a fantastic DX job as KS6DV/KH1 and VR1PJ (just changed to T3PA). It's possible Canton may soon lose its place on the "rare DX" lists.

Call me naive. I honestly believed my trip to Canton Island would give me a chance to do some late night operating, something I rarely do at my home QTH just outside Honolulu. I thought I might even be able to work some rare DX stations, if I were lucky.

Little did I realize at the time that *I* was considered by some to be rare DX myself. I still consider myself to be a relative newcomer to amateur radio. My first Novice ticket was WN3CNX, obtained in 1954. I procrastinated a lot, never got on the air, and my unused license expired a year later. Finally, twenty-three years later, in 1977, I tested again and was given KH6JUO. In March, 1979, I upgraded to General and changed my call to KH6GB. As you can see, although I've known a bit about ham radio for quite a few years, my actual association has been very limited. Being basically economy-minded, I decided to try low power for a while and settled on the Ten-Tec Argonaut.

Officially, my Canton trip was Air Force business—not a DXpedition. The radio gear was an afterthought, really. I packed more clothes than necessary, a typical fault of mine, but carefully left space for the Argo and its power supply. I casually mentioned my pending journey to a close friend, Marv KH6DL, and he came unglued, asking, among a hundred other questions, if there was room in my luggage for him. He tried to warn me of something called "pileups," but I didn't get the picture. He asked which bands and frequencies I'd be working, and got rather panicky when I truthfully replied that I hadn't thought about it. The afternoon before I departed, Marv provided a hastily-built 20-meter dipole and suggested a frequency I might try. We set up a tentative time to meet on the following Saturday, April 7th. It was the earliest I felt I'd be able to set up, and so I was on my way.

Wednesday, April 4th, arrived and the four and one-half hour flight from Hickam Air Force Base to Canton was routine. We flew on a C-141 Military Airlift Command (MAC) plane. Accompanying me on the trip was Jim KH6HIT, also an active-duty Air Force member, who, although he chose not to operate, would later prove to be an outstanding engineer.

Around noon, we climbed down from the C-141 aircraft onto the sweltering ramp at Canton. Canton is one of eight small islands and the only inhabited one within the Phoenix Island group. There is a "British" side of Canton, but its only residents are sea birds and hermit crabs which thrive in the aging Pan American Airways clipper station ruins. During and after my trip, I was told I could have used a VR1 call in addition to the KH1. However, since I had very short notice of the journey, I hadn't had time to seek approval from the British government, so I could not and would not use the VR1.

Canton is a closed military installation, with a caretaker force of about thirty government contractor personnel. The temperature upon our arrival was 90° F, and the first order was to unpack and brief the site manager on our visit. This was accomplished quickly, and almost before we knew it, the day was ending. Jim and I were told that the night life on Canton is virtually nil, so we decided to begin hooking up the radio. Jim took my old, homemade 15-meter dipole and tied it about six feet off the ground, between two coconut palm trees. Orientation was no problem—we simply ran it the same way that the trees ran! We had no idea which direction was north until the setting sun gave us our first clue. Now, where were we in relation to the rest of the world?

Fifteen meters appeared to be a poor choice on my part, for after two hours of intermittent CQing, I had worked one VK and a ubiquitous Japanese station. Jim and I raised the antenna as high as possible, leaving one end dangling in a palm tree while securing the other end to a building eave, but there was no improvement. Jim then fabricated a 10-meter dipole, but a half-dozen QSOs proved it (or the band) to be as unreliable as my previous attempt on 15. Then Jim suggested we try Marv's prefab 20-meter dipole in the same

two trees. Why didn't I think of that?

By now it was totally dark (where did I put that flashlight?). We quickly learned why there wasn't much night life on Canton. It should rate as the sandbur capital of the world, or at least of the equatorial zone. Our stumbling around in the dark produced many ouches and groans and raised havoc with the many hermit crabs who had decided to investigate the disturbance. Finally, however, the new dipole was up, and a quick front-to-back check showed a nice, low swr; we did *something* right. A rapid CQ (or two) and success—an answer! During the next ninety minutes, I worked thirty-four stations, ranging from W4OOW in Georgia to one each P29, H4, UAØ, KC6, 5W1, and several VKs and ZLs. I was in heaven. Little did I know that this was merely the tip of the iceberg.

For the next several evenings, Jim and I (mostly Jim) experimented with different antenna directions and heights, finally settling on a 060° heading with a height of about fifteen feet. This precarious altitude was reached by taking two 2 × 4s found drifting in the nearby lagoon and lashing them to the trees. The dipole ends were then tied to the tops of the 2 × 4s. This arrangement worked fine until one 2 × 4 came tumbling down during a rain squall, taking the dipole with it. (So *that* was why the swr needle jumped to 5:1—funny it didn't affect the ongoing QSOs.)

Somewhere along the way, perhaps during the second evening of operation, I was asked by Bob AA4AR in Tennessee if I could use some help. Well, his offer was a real blessing, because up until this time I had been roughing it, trying to punch through the QRM alone. Bob and I worked together until QSB did him in, but then Larry W7IUV spoke up and took charge. He, along with several friends from the Central Arizona DX Association, assisted in setting up schedules and such. By the third night, it all began to make some sense to me. We could now move along with about two hundred contacts each evening, covering a three- to four-hour period. Larry, Ned AA7A, or Wayne W7QS would take a list up frequency, while the others maintained order down where I was. It worked perfectly, and we continued this method until my final evening on Canton. I'm firmly convinced that their help enabled many US and DX stations to contact me. Without them, we wouldn't have been able to make contact. Several other operators also were extremely helpful, doing what they could, when they could. Some of these were Walt AG5H, Bill WB7BFK, and Don WB7AQX. There were others whose names, unfortunately, got lost in the heat of the battle, but I'm sure their QSL cards will straighten that out!

Quite a few QRP stations came through with 5 by 7 to 5 by 9 reports from New York, New Jersey, and the Southeast. Their 5-, 8-, and 10-Watt rigs should certainly help prove that full legal power isn't everything. Don't get me wrong—there were times when I wished for more oomph, but when you don't have it, you do what you can with what you've got. Incidentally, my prime frequency was 14280, up or down a bit, depending on QRM.

The final totals, as yet unverified, show that for twenty-five hours of operation, I worked 1150 stations, all with the 5-Watt Argonaut and the 20-meter dipole. Miraculously, on the last evening, Craig WB7EUT checked in from Wyoming, giving me QRP WAS. I experienced considerable difficulty working into Europe and the Middle East, and it was frustrating to hear the 4X4s, OEs, OKs, and EAs calling, among others. Unfortunately, they couldn't read the Argo. Despite this, I managed to work all continents QRP, thirty-six countries (including G3RCA), several Italian stations, and F6EXV. South America was well represented, and solid contacts were made with JY3ZH and EA8BW.

Would I do it again? Absolutely, but with better preparation. I'd try for approval of a VR1 call. I'd still use the Argonaut, but would look for a small beam and tower to make life easier. An unresolved difficulty is the problem of access approval for Canton and the actual trip itself. Since Canton is still military, only those with a valid, official reason can visit there. Also, the only aircraft authorized to land are military types, and military passengers are limited to sixty-six pounds of luggage each. If and when these difficulties are ever resolved, Canton Island would truly be a DXer's paradise. ■

Photo by James K. Gilman KH6HIT

Harv KH6GB on Canton Island.

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In Search of Power Line Interference

—how to find it and get it stopped

Fortunately for all of us in the United States, there are no minimum limits established for radiation of interference from overhead power lines. Had there been a minimum limit established, we might have had to live with it, no matter how disruptive it was. The Federal Communications Commission is fully responsible for establishing limits of interference for any device that may be causing harmful interference, and at this time, the FCC considers overhead power lines to be "Incidental Radiation Devices." The radiation of interference is incidental to their primary function of transmitting 60-Hz electrical energy. The only requirement the FCC has for incidental radiation devices is contained in Section 15.25, Part 15, of the FCC Rules and Regulations, which reads as follows:

"An incidental radiation device shall be operated so that the radio frequency energy does not cause harmful interference. In the event that harmful interference is caused, the operator of the device shall promptly take steps to eliminate the harmful interference."

The definition of harmful interference is in Section 15.4 (b) of Part 15 of the FCC Rules and Regulations:

"Harmful Interference—Any emission, radiation or induction which endangers the functioning of a radionavigation service or of safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with this chapter."

Now that you have read the law concerning power line interference (and it amazes me, the number of utilities that profess to have no knowledge of this federal law), what can you do to eliminate RI and TVI caused by gap-type (sparking) sources from power lines and their associated apparatus?

My advice to you is not to sit back after making a phone call to the utility company, registering an interference complaint and expecting the interference to disappear. If you do, you may have a very long wait. There are some power companies which are spending over a hundred thousand dollars per year in their interference programs, but, unfortunately, there are many which are not meeting moral and legal responsibilities in this area.

I am served by one of only four investor-owned electric utilities in the nation with two million or more customers. It serves approximately 4.5 million people and is the second fastest-growing electric utility in the nation. I make mention of this as it was only two months ago that they purchased a receiver capable of covering all the frequencies between 540 kHz and 30 MHz. I was informed that this equipment was purchased so that they could verify the places I had located and informed them about which were causing low-frequency interference in my area. So don't expect many of the electric utilities to have an all-wave receiver, spectrum analyzer, ultrasonic detector, "Little Snoop" interference locator, yagi antenna interference equipment, loop antenna, etc.

Before going any further, I would like to mention that in many cases of gap-type RI or TVI, the electric company is not at fault.[1] The electric power companies generally are responsible for less than 50% of the sources that cause electrical interference. (This figure varies, based on the type of program the utility company has instigated for handling interference complaints and how they maintain their lines.) It has been estimated that more than 95% of these power-line sources of interference are due to gap-type discharges. The remaining 5%, or less, are due to corona discharge.

Gap discharges occur on power transmission equipment when metal parts become electrically isolated by corrosion. The parts will then be charged, by the action of the electric field, to different potentials until the gap insulation becomes overstressed, at which time a complete breakdown of the gap takes place. The resultant discharge is termed gap discharge. This gap is usually "operative" during fair weather. As soon as moisture appears, the gap is "shorted out." Consequently, interference caused by gap discharge usually is absent in wet weather. These sources can be located and completely eliminated.

Gap discharges can occur in insulators, at tie wires, in lightning arresters, between neutral or ground

wires and hardware, and in electrical equipment that is defective, damaged, or improperly designed or installed. Gap discharges can and do occur frequently in overhead power lines.

The majority of all interference caused by electric transmission lines, other than line corona, fall into three main categories: (1) improper hardware, (2) faulty apparatus, and (3) physical construction.

The manner and paths by which interference is transmitted to the receiver are the most important characteristics of interference. The interference energy can travel by one, or, simultaneously, by two or three of the following means of transmission: (1) by conductor, via the transformer or by the neutral wire into the receiver power supply, (2) by induction, when the power line carrying the interference energy is near enough to the receiver antenna to be coupled into the receiver, and (3) by radiation, when the energy is transmitted into space with the power line acting as a transmitting antenna. In this last instance, the energy can be radiated from a distant line and be reradiated from a nearby fence, power line, or metallic structure.

Low-frequency interference generally is carried by the first two methods. Conduction currents decrease more slowly with distance along the line as the frequency is decreased. Radiation is generally the cause at high frequencies. Power line interference is roughly in inverse proportion to the frequency. The higher the frequency, the lower the absolute interference level. Above a frequency of 100 MHz, conducted power line interference is quite likely to be only six to ten pole-line spans from your receiver. There have been cases of radiated power line interference originating from a source as far as 30 miles away. This is the exception and not the rule. Generally, the high-frequency power line noises which will bother you are located less than one mile from your location. If you can see the interference on the screen of your television set, on channel 2, 3, or up to channel 6, the interference source will usually be less than one thousand feet from your QTH.

Since we have touched now on the basic fundamentals of the way power line interference travels, let's see what you can do to track down the location of the source.

For high-frequency noise, you should have a beam antenna—and, preferably, one resonating at ten meters—plus a street map, a 6-pound sledgehammer, and a portable FM receiver. Yes, I said FM receiver, even though you may have been taught that FM discriminates against amplitude noise. On low-frequency noise (160-75 meters), I use a portable AM receiver with coverage from 540 kHz to 4 MHz. Your receiver in the shack must be capable of operating in the AM mode. Listening on a receiver in the SSB position, or with the bfo on, won't permit hearing what the noise sounds like. It is very important to hear the pitch of the noise so that you can distinguish between power line noise and other electrical noise.

Tune your receiver in the shack to a clear frequency, preferably on ten meters. Now turn your beam until the noise peaks (make sure you are not picking the noise up off the back of your beam). Now get your street map out and draw a line on it in the direction your beam is pointed. Get in your car and turn the FM car receiver on to a clear channel on the low end of the band. (If you do not have an FM receiver in your car, you are in for some walking.) Start driving to the streets you have marked on your map.

As you approach the source, you will start hearing the interference. As the amplitude increases, tune your receiver higher in frequency (again make sure you pick a clear frequency). When you think you have reached the peak noise level, stop your car. Now use your portable FM receiver to locate the pole with the highest noise level. Tap the suspected pole with the sledgehammer. This vibration should cause an intermittent noise in your portable receiver if this is the noisy pole. Report this pole location in writing to your electric utility company as the source of interference.

From experience, I cannot emphasize enough how important it is to reconfirm, in writing, every phone conversation you have with your utility company. Some employees have a very convenient way of not remembering what was discussed. Also, do not hesitate to call them to find out what progress they are making correcting the source of interference. Persistence will pay off.

Tracking down low-frequency noises is an entirely different ball game. I will not go into this method at this time, even though I have been extremely successful in locating these for the electric company. Unless you have a receiver *in your car* which covers 75 and 160 meters, you are in for a lot of walking. Don't think you can track it down with your AM car radio by itself. What you hear at 540 kHz may not be heard on 75 or 160 meters. Also, what you hear on 75 and 160 meters may not be heard on the broadcast band. Do not use an AM broadcast-band receiver to track down line noises unless you are well experienced in power line noise technique.

I would like to mention that noises which usually bother all frequencies are generally caused by loose connections, tie wires, lightning arresters, insulators, and hardware. Very seldom are they caused by a transformer. However, most noises generated by power lines that are heard only on 75 and 160 meters are usually from transformers.

Within the past 3 years, I have located 67 sources of power line noise with the above procedure. These locations were reported to the electric utility and 55 have been corrected. (I did have to send the utility company a copy of the FCC rules regarding incidental radiation devices.) The majority of our power line interference has been caused by loose clamps and connections, plus oxidized tie wires and dead-end insulators. A few cases were lightning arresters. 24 of the locations were noisy transformers (mainly caused by a capacity current discharge) that were causing only low-frequency interference. These the electric company replaced. As of this writing, the utility company has work orders written on 12 more noisy transformers that were causing only low-frequency interference.

Since I embarked on this project, my neighbors have a much better image of amateur radio. Many times the power line interference was being blamed on my amateur radio station. One of my neighbors cut my 160-meter antenna down twice, thinking this was causing his TVI when it actually was power line in-

terference. Many of the neighbors have thanked me for locating the source of the power line interference and for having the electric company eliminate the interference.

There have been some very informative articles published in *QST* and other publications concerning power line and electrical interference. I have listed them below. You should obtain and read them—particularly the first one. Since electrical noises are generated by many sources, one should have the information covered in this article before blaming the power company for the interference.

Although I have been active in amateur radio since the early 1930s, it has been only in the past two years that I have become knowledgeable about EMI. With study and experience, you also can become knowledgeable on the subject. You will experience the pleasure of clearing up not only your reception, but also the reception on your neighbor's TV set. Good hunting! ■

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Hard Copy from your Xitex Terminal

—when a video display isn't quite enough

Many hams and computer enthusiasts are turning to video terminals to get rid of the noise machines. There are times, however, when hard copy is desirable, and the purpose of this article is to describe how to obtain parallel ASCII data output from a popular video terminal, the Xitex SCT-100 (see *73*, December, 1978).

The SCT-100 accepts either ASCII or Baudot serial data, current loop or RS-232, at two selectable baud rates. Obviously, two different printers would be required if both ASCII and Baudot modes are used and if the printers are interfaced with the signal sources. Fortunately, the SCT-100 converts all signal inputs, either ASCII or Baudot, to parallel ASCII; thus, a single printer will suffice for both modes.

The Xitex SCT-100 video terminal board utilizes a single-chip dedicated microcomputer, the Mostek MK3870/14001A/79056, which identifies an MK3870 chip pre-programmed for video terminal use with either ASCII or Baudot serial data. The MK3870 is a complete 8-bit microcomputer on a single MOS integrated circuit. It executes the F8 instruction set and includes 2K bytes of ROM, 64 bytes of scratchpad RAM, and four 8-bit I/O ports. It requires a single +5-V power supply. All I/O lines are TTL compatible, but each is limited to one TTL load unit.

A partial schematic of how the MK3870 is used in the Xitex SCT-100 is shown in Fig. 1. Port 4 (pins 8-15) is an 8-bit bidirectional data bus used to output parallel ASCII data to the video-screen-refresh RAM and to input parallel ASCII data from the keyboard. Only seven data bits are used for character/control function definition, the eighth data bit being programmed for keyboard strobe input.

Buffers U7 and U15 both enable and buffer keyboard data when U10 pin 31 (KSTB) is scanned by the internal MK3870 firmware.

U10 pin 7 (STRB) is a port 4 strobe, active low when port 4 is used for output. Unfortunately, STRB is also active during other system functions, such as screen clearing, which use printable characters. For use as a printer strobe, STRB must be further qualified to indicate when ASCII data output on the bus is valid for printer input.

U10 pin 32 (K1) is a firmware-generated strobe which, when combined with STRB, will produce the desired output strobe.

With reference to Fig. 1, one IC1 gate inverts STRB to active high, which is then combined with K1 in another IC1 NAND gate. The resulting output strobe (STROBE) is active low and only about 4 μs wide. My printer will accept a strobe this short, but if yours requires a longer strobe, the optional single-shot IC2 may be added. The other two gates of IC1 invert the respective strobe signals to produce active-high or active-low signals as required by your printer.

Remembering that the I/O lines are limited to one TTL load unit each, I buffered the data lines to my printer with IC3 and IC4. I used 74LS08 AND gates for active-high output and 74LS00 NAND gates for active-low output. One CMOS CD4049 or CD4050 and one unused gate from IC1 or U15 also can be used.

I solved the problem of getting at the required eleven connections (Gnd, +5 V, U10 pins 7, 32, and 8-14) through use of the 16-pin DIP socket, J3, which I do not use otherwise. I had to remove the serial output connection from J3 pin 8. The choice of specific pin connections on socket J3 was arbitary and has no special significance. Alternately, you can jumper to unused lines on the S-100 edge connector, J4.

I mounted IC1, IC2, IC3, and IC4 on a small PC board near the SCT-100 board. All power is taken from the SCT-100 board.

If you are real fussy about making modifica-

tions on your SCT-100 board, you can escape with having to add only two jumpers. Jumper U10 pin 7 to U15 pin 6, and U10 pin 32 to U15 pin 10. Then, mount U7 and U15 external with IC1-IC4 and connect back to the SCT-100 board with 16-pin DIP plugs in the U7 and U15 sockets.

If your ASCII printer requires serial input, then the addition of a standard UART circuit will turn the trick.

I used the particular chips shown because they were handy at my local Radio Shack. Do not tempt fate with your thirty-five dollar microprocessor by using anything heavier than low-power Schottky chip loads. Bypass the +5-V bus with 0.1-uF discs at each chip. And last, keep the distance from the SCT-100 board to your off-board ICs short: six inches or less if possible.

Incidentally, the MK3870 is virtually a single-chip ASCII/Baudot serial/parallel converter by itself. Costwise, it is competitive with the multi-chip versions. You might wish to consider this if your only printer is a Model 15 or 19 Baudot machine and you need a parallel ASCII/serial Baudot conversion. I have an article in the planning stages on just such applications. I would be interested in hearing about any reader experiences or ideas.

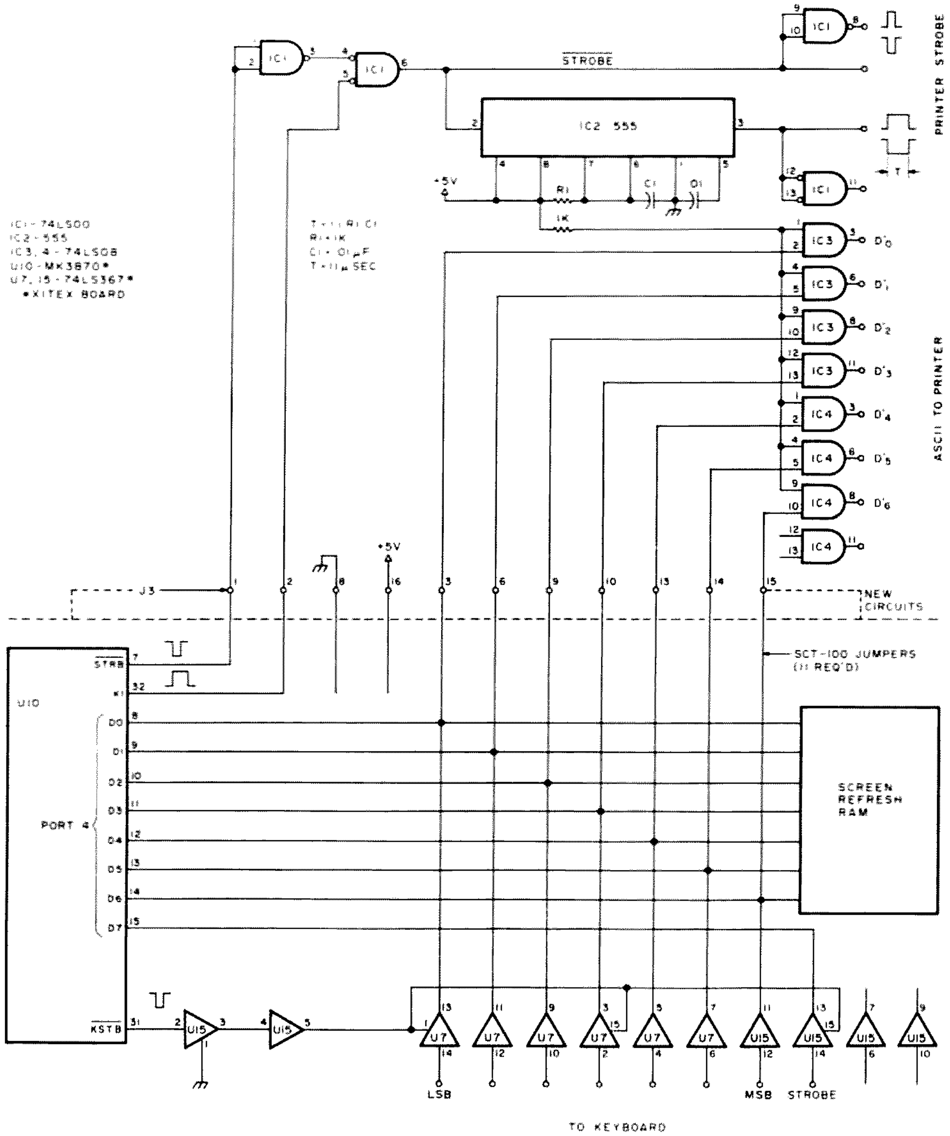

Fig. 1. Partial Xitex SCT-100 schematic showing additional circuits required to generate printer strobe and buffer printer data.

I wish to thank Bob Ferrier with Xitex and Mike Miller with Mostek for their technical assistance with this project.■

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Excavation Litigation

—don't dig a hole without your lawyer

To put up a good beam usually requires a good tower; to put up a good tower—especially if self-supporting—requires a good concrete base. To pour a good base requires that you dig a hole—and that sometimes causes a few legal problems.

There are probably other potential legal problems that I have not thought of that might arise when digging a hole near a property line, but here are four such problems which have been brought to my attention so far.

Error In Calculating the Property Line

This kind of error can come about in two ways. First, sometimes the property line is not where you think it is, especially on hillside properties. And you would be surprised how expensive it is to move a tower after your neighbor discovers it is on his property and will not let you keep it there! To avoid this problem, if there are no property-line survey marks you can rely on and if the tower is to be positioned anywhere near a property line, have the line surveyed before you dig.

Second, although I know it sounds dumb, some people forget that the antenna is wider than the tower. So, if the tower is right next to a property line, the antenna could stick out into the neighbor's air space. If that happens, the neighbor has the right to make you move it—and that is just as bad as if the tower itself were over the property line. So do not forget to calculate carefully the radius of the antenna over 360 degrees before planning the tower.

Blocking the Neighbor's View or Sunlight

This problem, too, seems to crop up mainly in hillside properties. It may seem to be the height of reasonableness for the valley dweller with a hillside near his house to place a tower on the hillside and capture a position above the surrounding hills, but to the dweller on top of the ridge, an antenna sticking up at the edge of his yard—so that he has to look between the director and the reflector to see the sun setting over the ocean—can be very frustrating.

The legal aspects of blocking a view (or sunlight) are now in a state of change and vary in different courts and different locales. The point to be aware of, however, is that the trend is toward recognition by courts of these rights and away from the absolute property rights characteristic of earlier times. The advent of solar power—even in theory, if not yet often in practice—has given an impetus to this trend, as judges, along with other people, have begun to recognize the importance of not allowing sunlight to be blocked or "hoarded" by anyone.

From the radio operator's point of view, the thing to do is recognize the potential problem and try to position the tower and antenna where it will not interfere with any often-used view, particularly some unusual or spectacular view, nor block light to an important area. If there is some problem in avoiding this result, consider other alternatives, such as:

(a) A motorized, or hand-crank tower, to lower the antenna when it is not in use;

(b) A smaller-sized antenna; or

(c) Meeting with the potentially-offended neighbor and obtaining permission to erect the tower on some less offending spot owned by the neighbor. I know of one case where a hillside dweller offered to allow an amateur operator below to put the beam antenna right on the hilltop dweller's house, just to get it out of the beautiful ocean view from his backyard.

Interference With Underground or Property Line Easements

Many property titles are legally "burdened" by deeds to telephone companies, electric companies, cable television operators, and other utilities which give these services various rights. Usually these rights are to install—either under or over the ground—various cables and pipes and often to enter onto the property to replace, ser-

vice, and check these installations. These easements are often so broad that although you "own" the property—and the right to have it included in your property taxes!—you or your predecessor have given up the use of these (usually five-foot) strips.

If you install anything which blocks utility company rights or prevents exercise of the rights granted, you may be required to move your tower. Even if the utility is not using the easement now, it might wish to do so a few weeks after you install the tower, or it might just make difficulties because it is run by people intent on enforcing their rights.

In the western states, you probably can check these easements on a title insurance policy, which often has a map attached to it showing the easement. In the eastern states, easements are more complicated, and you may have to check with a lawyer to have a basic title search done.

Another aspect of the same problem is the danger of cutting or otherwise damaging cables or pipes when digging the hole. By checking in advance to be sure you are not digging into an easement, you can eliminate your risk of legal liability here. It is not uncommon, however, to find utilities which have run their lines outside of designated easements, so you still may dig up something unexpected.

Causing Damage to the Neighbor's Structure

There are three general ways I have known this to happen:

(a) Mechanical drilling, such as by jackhammer, can cause shock waves potentially damaging to nearby structures.

(b) Loss of lateral support can cause unexpected (and sometimes almost inexplicable) land movement resulting in damage to nearby structures. In California, there are special statutory duties created which require a person digging near a property line to give advance notice to the neighbor and which create special liabilities for damages which result from taking away lateral support from a neighbor's ground.

(c) By far the most common major problems I have seen resulting from property line excavation are water drainage problems. In an area where there is a rainy season, particular care should be taken not to change any drainage pattern, as the slightest change can cause thousands of pounds of water to accumulate in unexpected places.

It goes without saying that an equally damaging result can occur from accidentally cutting or blocking a water line or sprinkler feed, as water can build up underground for a long period before discovery.

Have I talked you out of putting up that tower? I have not even mentioned deed restrictions, height limitations, airport clearance and lighting regulations, city permits, covenants running with the land, neighbors running after you with a shotgun, or a host of other problems. I stopped with digging the hole.

Please do not let this discourage you. My only point has been that if you are going to dig a hole, do not dig it very near a property line unless you take special care to avoid the special problems that can arise in that situation. ■

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Noise Rejector II

—an exciting sequel

The name of the game (particularly on 160 meters for about nine months of the year) is to achieve QSOs through various QRN types and levels—atmospherics, line buzzes, TV and industrial radiations, etc. It is only October through February that nature-made and man-made noises are not the chief deterrent to ham operation on the lower frequency bands, though even on higher bands noises can be a nuisance at times. It has long been easier to QSY upward during the QRN season to escape the problem. And how often—on all bands—are QSOs interrupted by some sort of QRN? To combat the problem successfully, rather than run upward in frequency in dismay and frustration, I was forced to devise a means of coping with the noise.

QSY-up has not been my favorite tactic in over forty years of hamming. Various loops and low-noise receiving antennas were tried with some success, but there were always drawbacks, such as solid-state circuitry, preamps, etc., getting zapped because of malfunctioning antenna relays or just forgetting to flip the relay switch while gassing away at length on the air. Round tables and DXers just love this sort of thing. Then, too, depending on the time of day, loops often pick up only sky-wave propagation or vice versa. There also have to be adjustments made, such as tuning, turning, switching, etc. This happens often in the frenzy of a DX pileup. So I tried approaching the problem from the other end, trying many varied devices. Many were built, but I seldom produced a unit which would not materially disturb signal intelligence while overcoming QRN of various sorts. Eventually, I was able to work out circuitry that performed in the manner desired with a minimum of drawbacks. Fig. 1 is the circuit which has proved adequate.

73 Magazine printed my first article on this noise-coping-modifying system in their September, '77, issue. Since that time, several refinements and additions have been made in the circuitry. This improved circuit has proved most helpful on all bands, and the 3″ × 6″ × 2½″ utility box of the older circuit will take the changes.

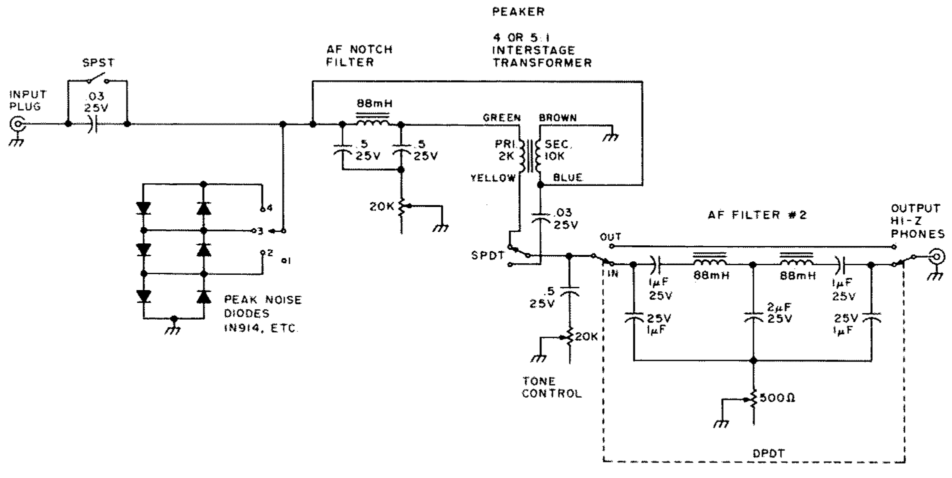

Fig. 1. Circuit diagram.

As the circuit diagram (Fig. 1) shows, the unit is a succession of af clipper, limiter, filter, and peaking circuits coupled in a simple easy-to-build device. Pleasantly, the circuit layout is uncritical, with common parts used throughout. New parts may be obtained from the catalogs of the big electronics parts supply houses. (I have found all the parts I've needed at neighborhood TV servicemen's supply stores.)

It may be best to begin the project on a 10″ piece of 1″ × 6″ breadboard. This can be fronted by a piece of 3″ × 10″ aluminum paneling, in order to mount jacks and controls. Breadboarding will give one the opportunity to test the circuit, making adjustments, substitutions, evaluations, and generally improving the project prior to final construction. The circuit values shown in the diagram have suited my particular needs over the years and may serve as an equally good starting point for you. When these values were finally determined and circuit performance was approved, the unit was finalized and made electronical-

ly attractive by mounting it in the utility box. A small chassis would do just as well.

Circuit Description

The unit's input phone plug fits into the phone jack of a receiver/transceiver. Hi-Z phones plug into the unit's output jack. The af input feeds into the .03 input capacitor, which is shorted by an SPST toggle switch. This varies the amount of signal/garbage to be passed. When clear atmospheric conditions exist, the switch is put in the closed position so more af can pass any signals and noise. This is particularly useful when copying the weak ones. Other noise can be modified in later circuitry, either by the two filters or by the tone-control, depending on the type of noise. Because signals are just one form of atmospheric disturbance, such filtering devices are designed to overcome noise at the same time that they raise signals to a copyable level. Some circuits accomplish this better than others. This process can be tricky, as the suppression of unwanted noise usually interferes with "good" signals. A slight attenuation is normal, depending on the circuitry. A signal/noise-discriminating circuit is what is needed. There is only slight signal attenuation with this circuit. It doesn't "ring." The signals are lifted above the remaining background noise to a copyable level. Sometimes—under some conditions—the unit effects only a slight improvement. However, the improvement is *usually* dramatic, making a QSO possible under otherwise impossible conditions. This logic and unit have proved very successful over the years, dealing with almost all noise types and conditions. As low-noise antennas are often inconvenient, this approach is simplest and most adequate . . . for this ham.

Cascaded diodes form the clipper-limiter. It clips high-noise pulses in addition to peaks and buzzes at the initial part of the circuit. The clipper-limiter deals with these before signal distortion can get into later circuitry, thus freeing the later circuitry to deal with other types of noises. A four-position rotary switch successively selects the required rejection depth. Next comes af filter #1, an af notch-type filter, which narrows the af passband and exalts and clarifies signals. It is varied by the 20k pot. Like all elements of this unit, this one is also noise-modifying. Then the peaker circuit raises the af level that had been lowered somewhat by previous circuitry. Its transformer primary can be switched in/out, adjusting to still other noise conditions. The tone control handles atmospherics most effectively and is probably the most used control in the unit. The final section starts with a DPDT toggle switch which selects or bypasses filter #2. This filter is noise-eliminating as it sharply narrows the af passband, which also contributes to further receiver selectivity. In combination, these circuits increase the range and effectiveness of the unit.

Should you require more audio or desire to get more volume from a speaker, a solid-state op amp could be used, but a larger housing box will be required. I use this unit barefoot, as is, getting completely adequate earphone gain.

While I am sure that this unit is not the final answer to our noise problems, it still is a valuable step in that direction. At any rate, this is an interesting and helpful approach to our problem. Why not throw these parts on the workbench some evening, and, if you can, improve it. You may be very pleased with its considerable utility, as I have been. See you on 160. ■

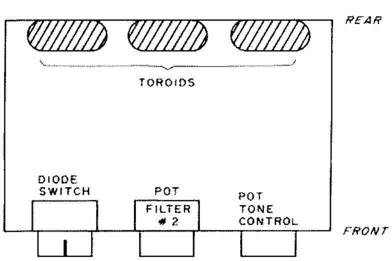

Fig. 2.

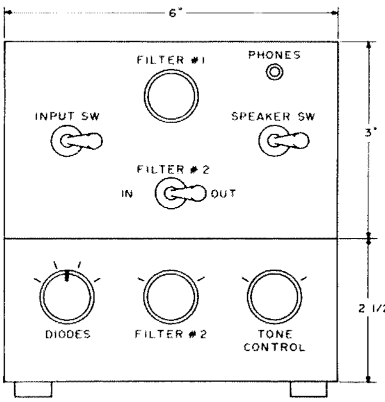

Fig. 3.

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Trouble-Free ID Timer

—for repeaters

Does your repeater suffer from an identity crisis? Does it over-identify? If it does, this project is just what you need.

The circuit for this timer evolved from many disappointing experiences with other long-time delay methods used over the years, all of which suffered from glitches on the power or signal lines causing extraneous identifications.

Although the circuit described was designed for a ten-minute timing interval, other intervals can be obtained by changing resistor and capacitor values. In addition, if a microprocessor is used for control, it can test the timer to ascertain the status and effect an interrupt if desired.

Design Goals

The timer circuit was designed with the following requirements in mind (see schematic in Fig. 1):

1. The timer must be set by a TTL high-to-low transition supplied by the carrier-operated switch.

2. The timer must provide a TTL active-high pulse to initiate the identification generator circuit.

3. An identification sequence must occur immediately when the repeater is accessed if it has been dormant for longer than ten minutes.

4. An identification sequence must occur once, and only once, during any ten-minute interval while the repeater is in use.

5. The timer circuit must use readily available parts.

Clock

A free-running (astable) multivibrator is used as the clock. It consists of an NE555 integrated circuit and an RC timing network. Values for Ra, Rb, and C were calculated from the following formulas (T denotes the period of the clock):

$T = 600\ \text{seconds}/100$
$T = 0.693\,(Ra + 2Rb)C$

The output of the clock can be monitored by connecting an oscilloscope between TP-1 and ground. Operation of the clock is not affected by the control latch; therefore, a square wave should be observed at TP-1 whenever power is applied.

If you need some other period, the calculated values will probably not work out to be standard EIA resistor values. In this case, use the next higher EIA values. Precision resistors are not required, since satisfactory stability will be achieved with 5% tolerance components.

Divider

Two decade counters are connected in cascade to achieve a divide-by-100 counter. The clock drives the input of the divider

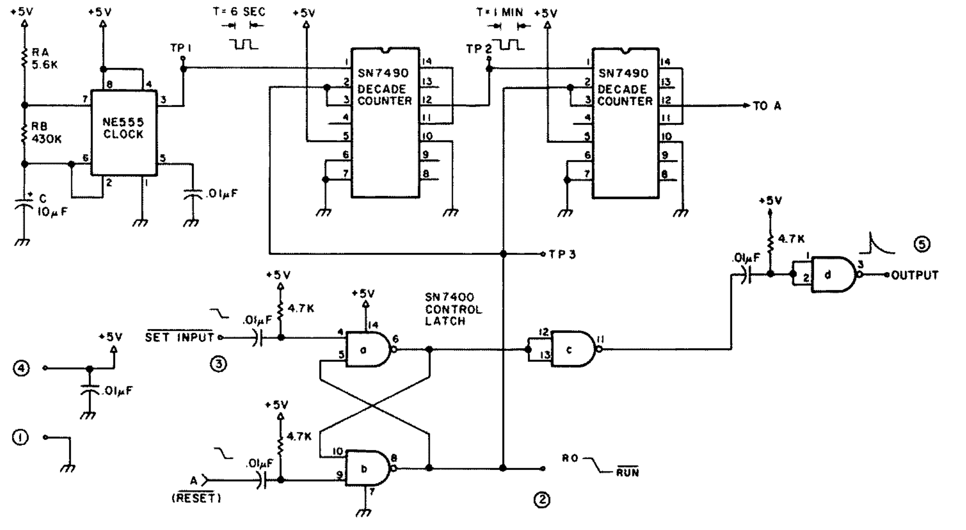

Fig. 1. Schematic of the timer circuit. Encircled numbers are PC board terminal designations. All resistors are ¼ Watt, 5%. All capacitors are disc ceramic except the timing network capacitor, which is a dipped tantalum type.

chain, and the divider output is used to drive the reset input of the control latch.

Whether or not the divider is allowed to function depends on the status of the control latch. When the control latch is in the reset state, a logic-high condition will be present at pin 2 of each counter. This is a reset-to-zero (R0) state which prevents the counter from incrementing, even though clock pulses are present. When the control latch is placed in the set state, a logic zero is placed on pin 2 of each counter. This permits the counters to increment in response to clock pulses.

Operation of the first counter can be verified by connecting an oscilloscope between TP-2 and ground. A square wave having a period of one minute will be observed when the divider is running.

Control Latch

The control latch consists of an RS latch formed by cross-connecting NAND gates A and B. When an active-low pulse is applied to the set input, the latch is placed in the set state. This causes two events to occur. The output of gate B becomes logic low, which is the run signal for the divider. The output of gate A is inverted by gate C which, in turn, causes gate D to output an active-high pulse which is used to initiate the identification sequence.

Once the latch is set, subsequent pulses at the set input will have no effect on the timer. After the timing interval elapses, which in this case is ten minutes, the divider provides a high-to-low transition to the reset input of the control latch. This causes the control latch to revert to the reset state and, consequently, the divider is reset to zero. The latch will remain in the reset state until the next set pulse is received; then, the cycle will repeat.

Construction

The circuit was built on a PC board measuring 3-5/8" by 1-1/2" from the artwork shown in Fig. 2. For those of you unable to roll your own, arrangements have been made with Firston Electronics, PO Box 151, Streetsboro OH 44240, to supply etched and drilled boards at a nominal cost. Prices are available for an SASE.

Assembly should proceed quickly by following the component location drawing, Fig. 3. The usual precautions should be observed, such as double-checking the polarity of electrolytic capacitors, inspecting for solder bridges, etc.

Testing

Connect a 5-volt power supply to terminals 1 and 4 while observing proper polarity. Check to verify that the clock is running by verifying the square-wave signal at TP-1.

Apply an active-low pulse to the set input (terminal 3). In order to achieve proper operation, the set input must be nearly +5 volts prior to application of the pulse. Refer to Fig. 4 for suggested methods of accomplishing this. Verify that the latch was set by observing the logic level at TP-3. A logic-high state indicates reset and logic low indicates set.

Connect the oscilloscope to TP-2 to verify that the divider chain is counting when the latch is set.

To verify that an output pulse occurs when the latch is set, connect an oscilloscope between terminal 5 and ground. Apply a set pulse and observe a very fast, active-high pulse at terminal 5. Unless you have experience with digital circuits, you may have some difficulty seeing this pulse because of the short duration.

During the testing phase, you may find it annoying to have to wait the full ten minutes for the latch to be reset. You can shorten the timer to one minute by shutting off the power supply and removing one of the counter integrated circuits. In its place, install a jumper wire between pins 1 and 12. Now, the timer interval will be reduced to one minute.

Conclusion

The timer described has been in operation for over a year with excellent results. Elimination of extraneous identifications sure makes the repeater more pleasant to listen to. ■

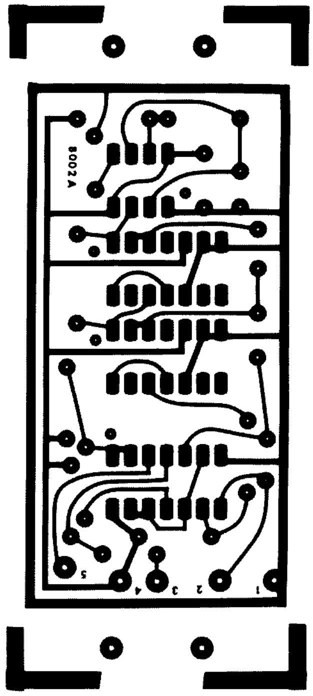

Fig. 2. Actual-size artwork showing the foil side of the PC board.

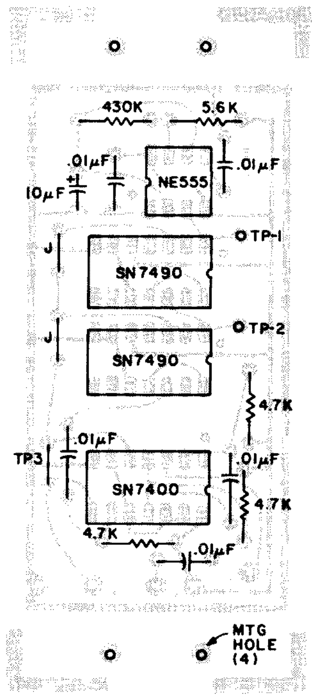

Fig. 3. Component location drawing. A dot is placed near pin 1 of each integrated circuit for identification. TP-1 and TP-2 are made from cutoff resistor leads and have an "eye" formed at one end. TP-3 is a jumper with an "eye" formed in the middle.

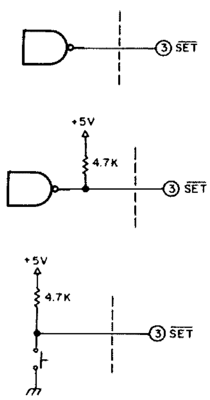

Fig. 4. Totem pole TTL gate, top; open collector, center; hardware switch, bottom. The set input must be held near +5 volts when set pulses are not present. This may require the use of a pull-up resistor if an open collector gate is used to drive this input or if it is driven by a switch.

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So You Want to Build a Beacon?

—here's how

This project was started as a club activity to help the two-meter enthusiasts in the Midwest to determine how two-meter propagation varied from day to day. The goal was to set up a 24-hour beacon, battery powered, and vertically and horizontally polarized. This was to be accomplished with very easy-to-get parts so that the project could be duplicated widely—so that many clubs around the country could follow suit and, perhaps, start a series of beacon systems on the low end of two meters.

The frequency that the Marissa Amateur Radio Club (MARC) set up for the beacon was 144.050. Since many two-meter operators have only FM equipment, a method was devised so that the signal could be copied with the conventional CW receiver as well as an FM receiver.

Transmitting Strip

The transmitting strip used was one of the one-Watt VHF Engineering strips. One of their kit versions was used and it was found very easy to assemble and align. Since it would be used to transmit a regular broken-carrier, A1 CW signal, the oscillator and tripler were wired to run all the time while the driver and final were keyed from the identification board. This was done by

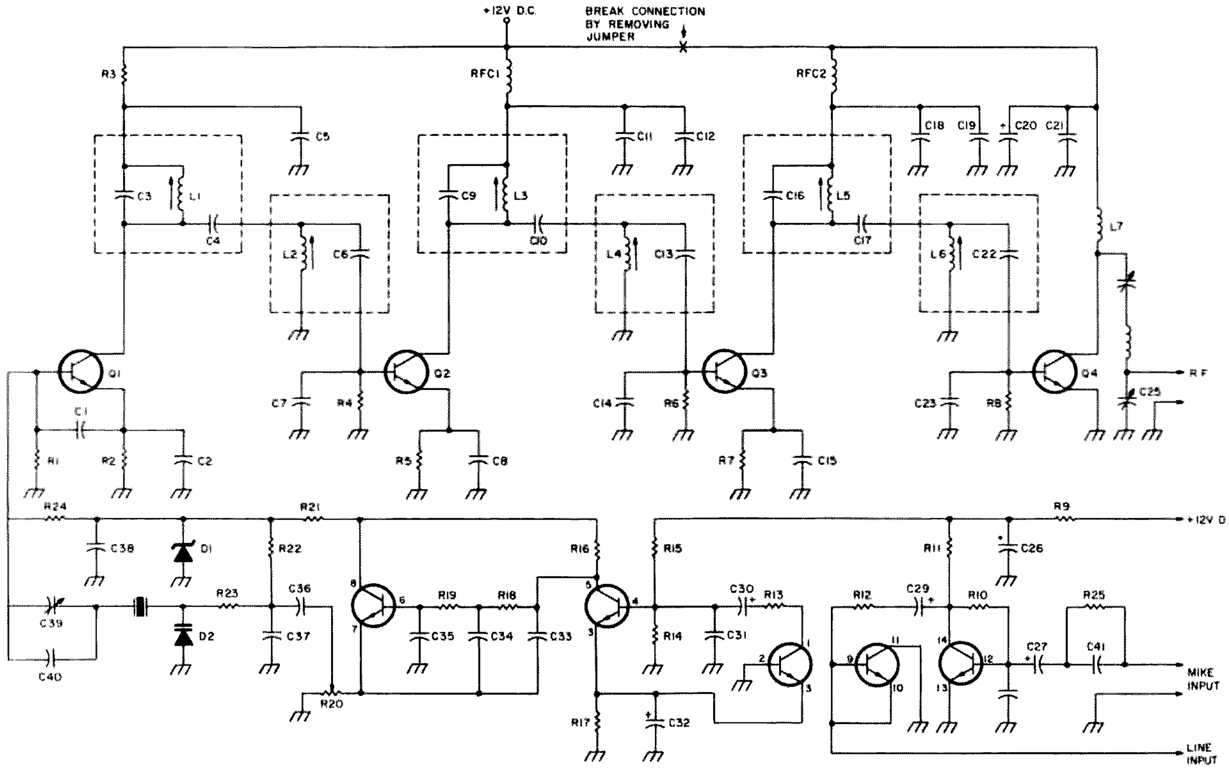

Fig. 1. VHF Engineering TX 144 transmitter.

simply breaking the B+ lead that feeds the driver and final transistors. No problems were encountered. Fig. 1 shows this modification to the regular VHF strip. Fig. 2 shows component location.

CW Ident Board

A system to program the beacon very easily was developed by using one of the CW identification boards from VHF Engineering. This board has a RTTY output which actually is a logic high with each character that the circuit sends. The board is mainly for FM repeater use, and the audio tone from the 555 tone oscillator is used to drive the audio section of repeater transmitters. The system used for the beacon uses *both* outputs. A simple 2N2222 transistor circuit uses the RTTY logic output to drive an electronic switching network that keys the driver and final transistors of the transmitter. This gives us the CW A1 signal for receivers that will be listening in the SSB or CW mode. At the same time this is happening, a very small amount of audio is taken from the normal tone oscillator circuit of the CW ident board to drive the microphone input of the transmitter strip. Adjustment of this audio tone is kept very low so as not to FM the CW signal too much. It takes only a very slight amount of level to make a tone audible when listening to the signal through a regular FM receiver. (See Fig. 3.)

Power Supply

Since we wanted the beacon to run continuously without any failure, it was decided to use a car battery with a charging system so that there would be no need to rely upon the ac line at all times. A small 3-Amp, 12.6-volt regulated dc supply was tapped across the sealed-type car battery, keeping the battery trickle-charged. The entire transmitter and identification board draw only around 500 mA, so that the battery will run the system for several days should ac power fail. (See Fig. 4.)

An accessory circuit that may be of use is shown in Fig. 5. This circuit senses any 110-volt ac failure, and should the power drop, the battery takes over automatically. When this happens, a low-level beep tone is generated every 3 seconds. This tone is fed to the audio input of the transmitting strip and warns any control operators that the ac power has dropped and the beacon is running on battery power.

This circuit is not necessary but is a nice addition for groups which may have problems with ac power losses. It has been our experience that many operators become dependent on the beacon for checking nightly (or daily) band conditions on two meters; it is best, therefore, that all systems should be made so that power failure will not affect beacon operation.

Control Access

If you remote your beacon, you should have some form of link control to shut the transmitter down should any problems occur. An easy approach to this is to use a Midland 13-509, 220-MHz rig. This is a natural for link use. It takes about one hour to get the unit split up and ready for action. The receiver board is mounted with four screws. Remove the squelch and volume pots and cut out all of the crystal wires from the 12-channel switch. Since you will use it only on one frequency, the 12-channel switch and socket assembly also can be removed.

The transmitter board is left in the original case and chassis. Simply remount

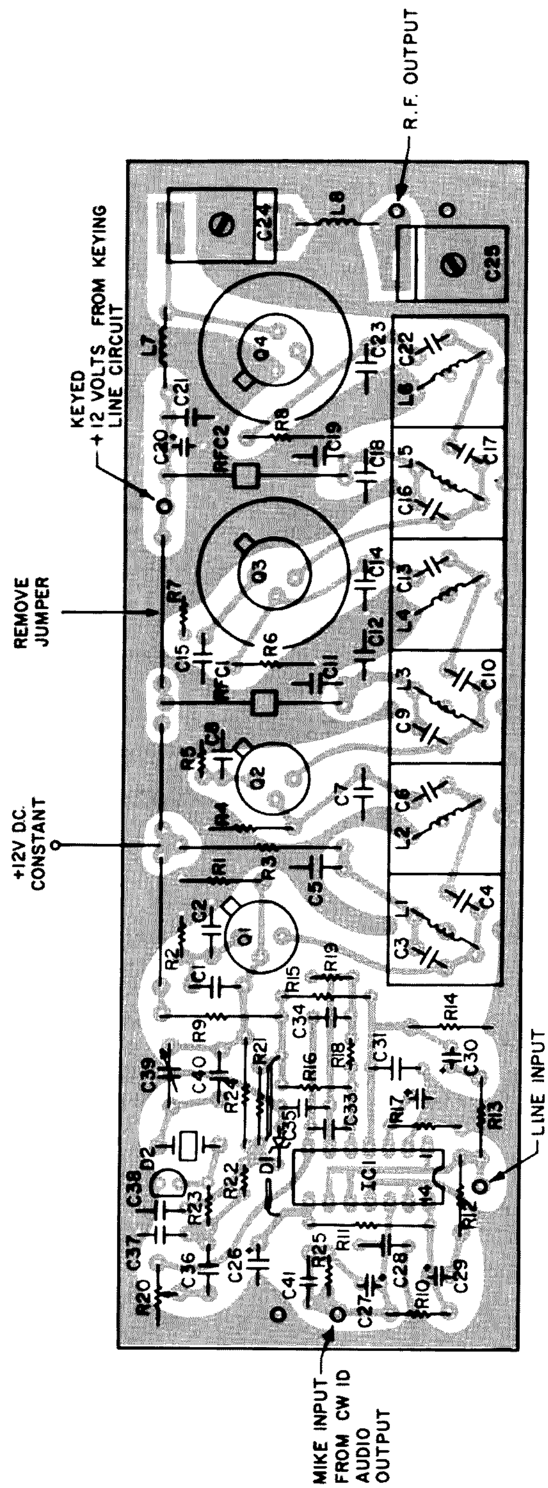

Fig. 2. Component location (component side).

the receiver board along with the beacon equipment and connect the logic system that you choose to do your controlling. This should take care of any link control situations that you might need for this or any other project. There have been numerous articles in *73 Magazine* describing various logic control systems that can be used over the 220-MHz link, so there is no need to cover that subject here.

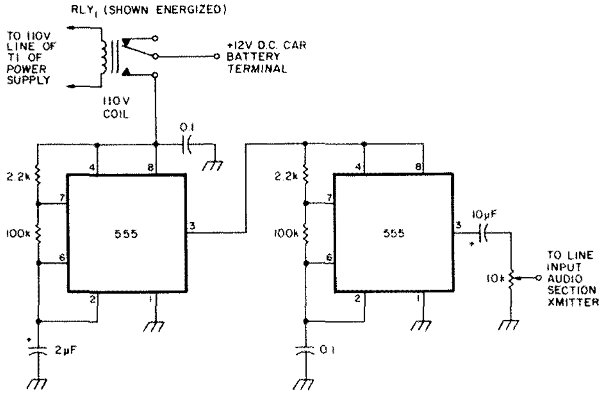

Fig. 5. Power failure beeper.

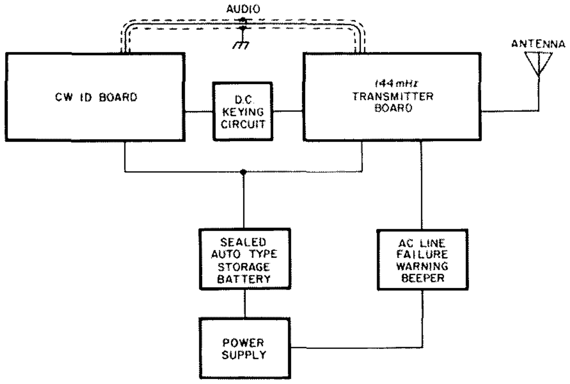

Fig. 6. Block diagram, WD9GOE beacon.

Antenna System

It was decided that both horizontal and vertical polarization must be used to give maximum coverage with the beacon. Several systems were tried, but the simplest and most effective was obtained with a Cushcraft four-pole AFM-4D antenna system. Two of the dipoles were turned to the horizontal plane and two to the vertical plane. The regular phasing harness was used, and the antenna seemed to work beautifully. It gave us the necessary pattern with ease in connecting and mounting.

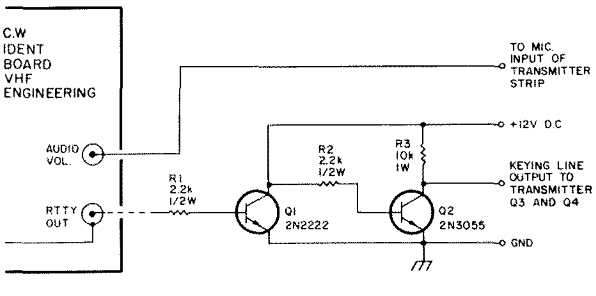

Fig. 3. Transmitter keying circuit.

Results

The MARC beacon group has programmed the identification CW board with a long, three-second steady tone followed by the club call, WD9GOE, and the word "beacon." This then repeats after a two-second stand-by. The VHF Engineering CW ident board has just the correct number of bauds for all of this. The diode matrix *could* be expanded, but this would be quite involved and really is not necessary since all of the necessary information can be programmed on the regular board.

The beacon committee of MARC asked that all stations receiving the beacon QSL to WD9GOE; they were going to send a report to the FCC at the end of December. Several of the reports received to date are from 300 miles out, and many of the SWOT group (Side Winders On Two) have done a great job in passing the word of the beacon's existence. Many of these serious two-meter operators rely on the Marissa beacon to plot a propagation each day. Some of them are even using a time recorder coupled to a tape recorder and are monitoring the beacon on a 24-hour basis so that they can chart the paths. ■

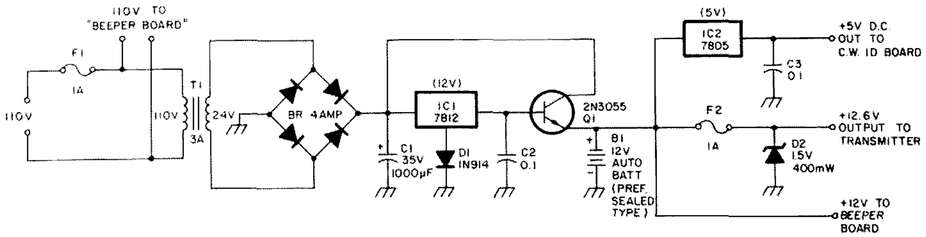

Fig. 4. Power supply for the beacon.

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Working with FETs

—part III: the source follower

In part II of this article, I continued a discussion of audio amplifiers which use the FET, the transistor that thinks it's a tube. Let's finish up by examining more of the functions these devices can be made to perform.

Let's look at the output signal from our basic FET amplifier (Fig. 1). Usually it

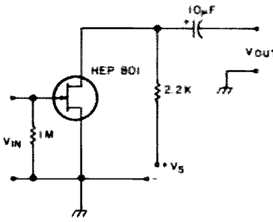

Fig. 1. FET triode circuit.

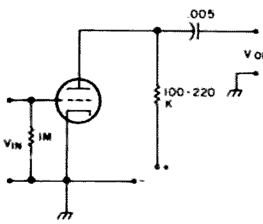

Fig. 2. Triode tube voltage amplifier stage.

is coupled through a medium-value electrolytic, such as 10 uF. This is higher than the tube circuit of Fig. 2. A word about why: While the input impedance of the FET is high, even close to a tube, the circuit resistances are often lower, such as in the drain circuit. The coupling circuit in an RC (resistance-capacitance) coupled circuit is frequency-sensitive. The resistance and capacitance values form a tuned circuit at audio frequencies.

This is related to the time constant of the R and C combination. As a practical matter, it usually is a factor at low frequencies in interstage coupling. The effect is used in tone controls to form circuits to pass or reject frequencies. It is usually the low-frequency cutoff, however, that is the main factor. This is not so critical for communications use, but you may want to make circuits for other uses.

If the tube circuit uses 220k and 0.05 uF as its circuit, then obviously your 10k or 20k, or even less, drain resistance will require more capacitance to do the frequency-coupling job. 10 uF is easy, but there are circuits where you might want 100 uF or more for low-frequency use. The output from the FET drain is still considered high impedance, however. There is a low-impedance output stage. In tubes, this is the common cathode follower. In FETs, it's called a source follower. It is so simple you can't miss.

The basic circuit is shown in Fig. 3. The major difference here is that there is no load resistance in the drain circuit and the drain is bypassed to ground. I used 10 uF for test purposes, but it probably should be more. The input circuit is the same as for the other amplifier, only the output is taken from the source resistor instead of the drain circuit. The coupling capacitor was another 10 uF. I have lots of them, but here, too, it could be larger in value for best low-frequency response.

Now then, the resistance value is shown as 2.2k. This is very commonly the same value as for a tube circuit, and it is the same as in the standard FET amp circuit.

A few things about the source follower. The gain is unity. Come again? That means the gain is one, or more accurately, there is no gain at all. In fact, the gain is less than that. You don't ever get as much out as you put in. It usually can run about 95% of the input, though. Now why would anyone go to the trouble of building an amplifier that doesn't amplify? Oddly enough, the circuit is popular because it doesn't amplify. It has other uses. Let's start with its ability to non-amplify.

There are circumstances where you want a circuit to perform a function, but you don't want gain. The source follower is often used as a mixer circuit. In-

puts of various levels are given to the circuit and the output is a smaller signal, but all the inputs come out at the same level. Here gain is not needed, but the ability to control varying signal levels is. This is not the real reason for the follower circuit, however. Its real claim to fame is as an impedance transformer. Here we gain some pragmatic advantage with the circuit.

The normal triode gain-type circuit had a high output impedance. It also had a high signal-output voltage compared to the input. Let's look at what happens to that output when it goes any distance.

The best way to send a signal any distance from the amplifier is with shielded cable of some sort. Right away, we have a problem. Over any appreciable distance, that cable will have a certain amount of distributed capacitance. This will form a trap circuit that will affect the high frequencies. You will start to cut off your audio high frequencies if you use a long cable at the output of the amplifier.

You also will attenuate the signal strength. Sure, your regular amplifier has a higher output voltage than input, but at high impedance, the loss is more as the distance increases. A high-impedance line is also more susceptible to hum and other noise pickup, even though it is shielded.

So, you lose high frequencies, you lose more signal, and you get more hum and noise using a high-impedance output and shielded cable.

That's why you need an impedance-transforming circuit. It takes a high-impedance signal in the gate circuit and turns it into a low-impedance signal at the source. But what does this do for us?

Well, at the lower impedance, you don't have the problem of high-frequency loss that you do with the other circuit. At the lower impedance, you do not have as much signal loss. At low impedance, you stop thinking in voltage terms and start thinking in current terms. You are trying to put some audio power through the cable; even though it is low power, it is not just a matter of signal voltage. Still, your losses will be much less at the lower impedance than the same power at high impedance would be. Also, the lower impedance is less susceptible to stray hum and noise pickup. That is one of the major reasons for using low impedance and why so much fancy audio equipment is geared to a 600-Ohm line or even lower impedances.

What does it mean? Well, if you have a tuner and made the output to the amplifier a high-impedance triode stage, it wouldn't work well when you hooked it up by cable to your amplifier. If you made it a cathode follower or FET or transistor equivalent, you would be able to run a cable of reasonable length and avoid a number of problems. You also may have had trouble when you ran a long cable from a high-impedance microphone to your tape recorder. It picked up hum and noise. That's why many modern recorders use low-impedance mikes. There are some ham rigs that are sporting low-impedance mikes, too. Same reason.

Start with the 2.2k value shown, but play around with a few values to see how the circuit works. You might monitor the current with a VOM so you don't hurt the FET. For most uses, if you go much less in value, you will cut down on the output voltage; you will get much less than the input. Past a certain value, you will not get any more output from the circuit, so you don't get anything using too big a value, either.

While this circuit is good to work with to learn, I really don't recommend a small-signal FET for this particular application. It's a matter of power. At low impedance, you need more current to drive the line and the FET is not designed for current, or at least this one isn't. From a practical viewpoint, a bipolar transistor would be the choice here, but the operation is much the same.

You might have a finished circuit that has two transistors. Your first stage would be a gain stage, as was described. This would build up your signal voltage. The next stage would be the follower stage. You already have your gain, so its job is to change the signal to a low impedance for the cable. This stage may have a gain control to adjust the actual output. This would allow you to set the output to a specific value.

Apart from cable use or where a long run has to be made, there is one other common use such a stage might have. This would be to change a high-impedance signal to a low-impedance signal to go with a transistor. A bipolar transistor is comparatively low impedance, and you might have too much loss trying to ram some signals right into the transistor.

A FET is sometimes used between the signal and transistor stages to make a better match. The same condition can happen with ICs, too. The follower circuit is a handy circuit to keep in mind. It's so easy to make and work with, and when you need it, you have it.

One other effect was noted during experimentation with the regular amplifier. At a certain point, the output signal exceeded the supply voltage and the signal peaks cut off. Under ordinary circumstances, this is just plain garden-variety distortion, but it does have some useful applications. If you increase the input, the peaks get flatter and flatter. With the best-gain circuit (bypassed resistor), you can adjust the output waveform so that you get a fairly symmetrical square-wave pattern with about 4 volts peak-to-peak input. This is well within the allowable input for the FET, and you get something very close to a square-wave output.

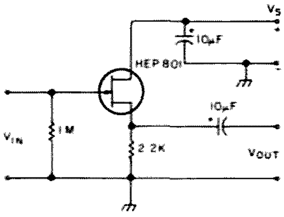

Fig. 3. Source-follower circuit.

So who needs a circuit that clips the peaks? Well, sometimes it's nice to have square waves, but if you're going to get critical, there are better ways to do that job. There are some applications where this type of circuit is used. It is very similar to the input circuit of many frequency counters. This is often two-stage, the first to give gain, and a clipper stage to precondition the ac input signal so that it looks like a square wave to the ICs to follow.

The FET is high impedance and won't be as much of a load to a sensitive input signal as would a low-impedance IC. There's our impedance match again. This is also similar to the circuits used in musical-instrument amplifiers to get fuzz sounds and long, sustained distortion effects. The square wave will have a fuzzy sound to start with, and, if you really clip hard, the note will decay as the signal decreases. But

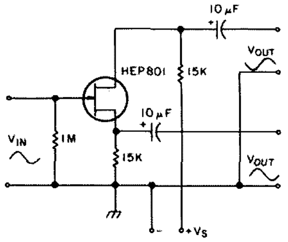

Fig. 4. Basic phase-inverter circuit.

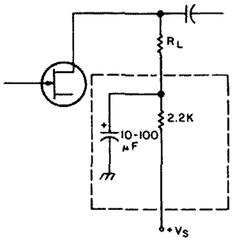

Fig. 5. Decoupling circuit.

because only a tiny input is needed to get the square-wave output, the same output can continue for quite some time before the note will die out.

Since the square-wave output will remain about the same amplitude for most of the time, it seems like the note just hangs in there forever. Normally, the note would decay rapidly to the ear as the amplitude died down. It's a handy little circuit for some purposes and not too hard to get running. Another one to keep in the back of your mind.

There is one tricky little application of the follower circuit which often has been used in audio work. This is the phase inverter. The output signal of your standard triode amplifier is 180 degrees out of phase with the input signal. The output signal of the follower circuit is in phase with the input signal. Thus you can get two signals that are 180 degrees out of phase with each other. The trick is in how you do it. I played around with adjusting back and forth until it suddenly fell into place and was obvious.

Start with your high-gain circuit values. Make the source resistor the same value as your load resistor and take off the two outputs. You now should be in business—see Fig. 4. I found that the circuit would work with values of less than these, but as you go down, the output voltage goes down, too.

It should be mentioned that this is another non-gain circuit. It has the characteristics of the ordinary source-follower circuit. The outputs from both points will be slightly less—or more than slightly less depending upon resistance values—than the input. Its function is to split phase, not provide gain. You either get the gain beforehand, or you get it back after the two channels split up.

Still, you have to admit that it is an easy circuit to try. When you are done, you will have a circuit that will give you two outputs that are 180 degrees out of phase with each other. It is the key circuit for feeding a push-pull amplifier stage. There is also a tube and a bipolar equivalent for power amplifier use. If you have a dual-trace scope or an electronic switch for your scope, you can see both signals at once and see the phase difference. With a simple scope, you may not be able to see the inversion, and it will look like something is wrong as you go back and forth between the outputs.

My scope wouldn't show it, so here is an easy test for use with a basic scope. Feed your audio input signal to both the vertical and horizontal inputs. Adjust the controls for a convenient trace size at your normal amplifier input level. This should yield a straight line slanting diagonally across the face of the CRT. If there is more than a little bend, you may have scope trouble. This will show you what two in-phase inputs will look like.

Now connect the signal to both the input of the amplifier and the vertical input of the scope, and connect the source output to the horizontal input. It should look just like your first test—in phase. Now switch the horizontal scope lead from the source to the drain output. The line should now slant diagonally across the CRT from the other two corners. If both were on at the same time, it would look like the letter X, each output forming one stroke of the letter. If you remember your geometry, the two lines are at right angles to each other and, therefore, 180 degrees out of phase.

You will get the out-of-phase single line also if you connect the two outputs to the two scope inputs, so keep in mind which slant represents in-phase and which represents out-of-phase.

There are other uses for such an inverter besides a class B amplifier stage. Often you will see an input stage for gain feeding this type of circuit.

There is one other common circuit feature which may be most helpful in many applications. This comes under the heading of power-supply filtering, but is usually referred to as a decoupling filter. It serves two purposes: It does the final job you can do on power-supply hum, and it prevents the signal from the circuit from trying to sneak in somewhere else through the supply wiring.

Remember that most of these circuits are used at extremely low levels. This is where any hum or feedback getting in is going to be amplified by later stages and cause all kinds of trouble. Even though the follower circuit is not a gain circuit, it can carry the false signal through just as well.

The circuit is simple—just one additional resistor and a bypass capacitor, as shown in Fig. 5. The resistor is usually a fairly low value. The most popular value is 2.2k, with a bypass capacitance of the same value as the others in the circuit. I used 10 uF because that's what I had a handful of, but I would recommend more than that. 100-uF capacitors are almost as cheap at these power levels.

The filter serves as the final filter in the power-supply lead and also doesn't like to let anything come back the other way from the circuit. At the low current the FET draws, the 2.2k has only slight voltage drop, not enough to bother circuit operation, but it does a great deal to handle hum. If you are having a hum problem, you may even get some benefit from a higher resistance value, but don't just do that as a precaution.

You will be surprised what decoupling can do to some of the crud you will pick up bench-testing. I have a habit of using multi-foot test leads and can't abide a circuit lead less than a foot long, so if the circuit is tame that way, it may work great done right. Then again, it may not, but that's another story. Even a good supply can give you some trouble at that distance, and I found that batteries can be a headache. When they get weak, they are not the steady hum-free power source they are cracked up to be. I have gotten some really inspired feedback and oscillation with the same circuit using batteries, and yet it worked well with the supply.

Ordinarily, I don't recommend putting in parts just in case they might be useful, but there is a strong case to be made for decoupling circuits in

any finished audio circuit you might want to build. That's a decision you will have to make for yourself. I would probably put it into any test gear circuits I made, but I might skimp on some other gear I made.

I found working with the FET circuits one of the easiest transitions to make with solid state. You get the advantage of working with familiar tube concepts, but you also are working with solid state. That can give you the confidence you need while getting hands-on experience with solid state work. While you may not apply these circuits exactly as shown or with this FET, the experience you get working with them will help you with all triode designs, tube, FET, or bipolar. I would recommend playing around with these circuits or breadboarding with a different FET, if you have one, until you become comfortable working with them.

Your scope and the VOM (for safety) are the key test gear items. Then you can really see what is happening inside the circuit. Almost any available input signal can be adapted for use, but a mike and an audio sine wave (even 60 Hz through a potentiometer) will make it easier.

A few weeks of work with these circuits will give you a feel for operation that no amount of book theory can equal. You will see the effects of troubles and of proper operation, and your impressions will carry over when you work on any gear.

I hope that this has given you a solid, pragmatic tour of circuit operation that will take away a lot of the theoretical mystery about what goes on inside of these standard circuits.■

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Microcomputers and Your Satellite Station

—part II: ground station antenna bearings

In the first article in this mini-series (January, '80), I described a program for the TRS-80 microcomputer from Radio Shack that takes the drudgery out of computing polar orbit satellite crossings. One of the nice things about cozying up to your own personal computer is that the machine soon loses its exotic aura and you begin to appreciate it for what it really is—a very versatile, general-purpose, problem-solving machine. As far as the satellite station is concerned, there are lots of other jobs that can be handled quite nicely by a microcomputer. In this second of three articles, we will discuss one of these—the job of computing ground station antenna bearings for receiving signals for geostationary satellites.

Geostationary orbit is a phrase used to define a special category of orbit in which the satellite remains permanently in position over a given point on the Earth's surface (known as the satellite subpoint). Since the satellite does not appear to move in relation to the Earth below, the position of the satellite as seen by a ground observer does not shift. The satellite appears to remain fixed in the sky, making antenna alignment quite simple. If the proper bearings are known, the antenna can simply be fixed in place. This makes such spacecraft highly useful for relays to ground-based stations since one doesn't have to worry about tracking large directional arrays.

The trick of achieving a "fixed" orbit is possible because of the fact that distance from Earth determines the time required by a satellite to complete an orbit. It follows that there is an altitude at which a circular orbit would require precisely 24 hours (1440 minutes). This magic altitude turns out to be about 35,900 km (22,300 miles). If we have a circular orbit (located over the equator) with a period of 24 hours and a direction of rotation that matches that of the Earth, we have a situation where the satellite's movement in space matches precisely the rotation of the Earth below, making the satellite geostationary.

Unfortunately for amateurs, we have no geostationary communications satellites now, nor will we have any in our immediate future. The polar orbiting NOAA communications satellites are in orbits with a mean altitude of around

Given:
A (station latitude; + for ° N, − for ° S).
L_O (station longitude; + for ° W, − for ° E).
L_S (satellite subpoint longitude; + for ° W, − for ° E).
(1) $L = L_O - L_S$.
(2) D = arc cos (cos L x cos A).
(3) IF D = 0, then E (elevation) = 90° and no azimuth bearing is required; if D≠0, then go to step 4.
(4) Elevation = arc tan [(sin(90 − D) − 0.1513)/cos(90 − D)]
(5) C = arc cos [− (tanA/tanD)].
(6) IF L = 0, then azimuth = C.
IF L≠0, then go to step 7.
(7) Azimuth = 360 − C.

Fig. 1. Given the geographic coordinates of the ground station (A and L_O) and the longitude of the satellite subpoint (L_S), it is possible to calculate the antenna bearings with a maximum of seven steps as shown above. The reason for the D = 0 option in step 3 is that if D = 0, you will be right under the satellite and the antenna must be pointed straight up (elevation = 90°). The reason that no unique azimuth bearing exists in this situation will be obvious if you point your arm straight up and then try to determine what its compass bearing is. It's anything or nothing—take your pick!

1400 km (840 miles), and they have orbital periods of about 115 minutes. (In contrast, the moon, which is located almost a quarter of a million miles away, requires a period of 28 *days* to complete one Earth orbit.)

Weather Satellites and OSCAR

If you would like a taste of what the future holds, simply listen in with an FM receiver on 135.6 MHz while the ATS-1 satellite is doing its thing out over the equator at 140° W. If you think your local repeater is hot stuff, you have yet to hear low-powered stations scattered all over the Pacific Basin communicating with all the advantages of noise-free FM! Virtually all commercial communications satellites (telephone, Telex, TV, etc.) utilize geostationary orbits, as do the GOES weather satellites which transmit their pictures at a frequency of 1691 MHz. (See "Be A Weather Genius," *73 Magazine*, November, 1978.)

The problem, of course, is to know where to point the antenna. The *Weather Satellite Handbook* (a *73* publication) presents a simplified graphics approach to determining antenna bearings, and while this approach is adequate for the relatively wide beamwidth yagis used in the VHF range, it is not precise enough for use with the high-gain dishes used for GOES weather satellites or for those never-say-die experimenters who are even higher in frequency who want to snatch first-run movies and other interesting TV fare from the commercial satellites.

The solution to finding precise antenna bearings involves some spherical trig exercises. A most lucid discussion of the mathematics involved is included in an article by Shuch (*HR*, May, '78), which also includes a program for implementing the equations on the HP-25 calculator. An ordinary scientific calculator can be used to solve the equations, but you do have to watch the mathematical progression quite carefully, lest you get lost! Programmable calculators are a big advantage, but they require loading the program prior to execution, and you do have to follow the associated instructions carefully as to loading data and registers.

A microcomputer is an ideal tool for these calculations because its programming can be made interactive. All you have to do is supply data for some very specific questions, with any special notes actually incorporated in the program. Since the program can be loaded from cassette, you eliminate the time and possible errors associated with manual program entry in a programmable calculator.

See the box accompanying this text, which deals with the mathematical approach taken in bearing calculations. All this is derived from Shuch's article.

The Computer Program

Since one of my aims is to interest you in the applications of consumer microcomputers (without requiring a second mortgage), the program is such that it will run on a machine with only the minimal 4K memory and the bottom-line Level I BASIC. As we shall see, it can be done quite easily, although I had my doubts at first. If you have a TRS-80 with Level II BASIC, there will be little problem with this series of calculations, as the Level II dialect incorporates the various trig functions directly. My goal in this series, however, is to show how to get the best possible use out of the less expensive Level I BASIC.

The problem is that since Level I does not have integral trig functions, you must use subroutines which Radio Shack kindly supplies in the back of the Level I user's manual. The required trig subroutines used up almost half the available memory, so some work was needed to fit a completely interactive program into the remaining memory. The resulting program just fits (only 577 bytes are left over); it is

---

Calculating Antenna Bearings

The calculation of the antenna bearings has been organized into a series of seven steps in Fig. 1. I won't go through an explanation of the exercise in trigonometry because it is explained very well in Shuch's paper. Although it may look difficult at first glance, you can run off a demonstration exercise on any pocket calculator equipped for trig functions. Let's run through a sample, using the following set of data referenced to GOES E (Fig. 3).

Station latitude (A) = 45° N.
Station longitude (L_O) = 85° W.
Satellite subpoint longitude (L_S) = 75° W.

Following through with the steps of Fig. 1, we would proceed as follows:

(1) L = (85) − (75) = 10.
(2) D = arc cos [(cos 10) (cos 45)].
= arc cos [(.9848) (.7071)].
= arc cos (.6964).
D = 45.864°.

D is not really so mysterious for the non-math types—it is simply the hypotenuse of a spherical triangle and happens to represent the angular distance between the ground station and the satellite subpoint. With a few more operations (and the use of a constant), we can use this distance to compute the elevation angle for a spacecraft at geostationary altitude.

(3) If D should happen to be 0, it would mean that you were living under the satellite and would require a 90° elevation angle with no worries about azimuth. Obviously, our D is not equal to 0, so we must plug on to step 4.

(4) Elevation = arc tan [((sin(90 − 45.864)) − .1513)/cos(90 − 45.864)].
= arc tan [(sin(44.136) − .1513)/cos(44.136)].
= arc tan .6963 − .1513/cos(44.136).
= arc tan .5451/.71769.
= arc tan .7595.
Elevation = 37.22°.

After that expression, moving on to the azimuth calculation is a piece of cake.

(5) C = arc cos[− ((tan 45)/(tan 45.864))]
= arc cos[− (1/1.0306)]
= arc cos − .9703.
= arc cos − .9703.
C = 166.01°.

(6) If L is equal to or greater than 0, then C is our azimuth. Since 10 (L) satisfies this condition, then azimuth = 166.01° (true).

Now, if all you want is one or two bearing sets, you can go right ahead and use the manual technique, or even adapt it to a programmable calculator. If you want to be able to snap the calculations off for other operators, or need the convenience of being able to run a set of bearings off quickly (as I do), then the computer is the answer. In my case, I run a small business, building satellite ground station hardware. Finding antenna bearings for geostationary satellites is a service that I provide for customers who purchase antenna hardware. It was simply getting to be too much trouble to program the HP-25, and I decided to put the TRS-80 computer to work.

shown in Fig. 2. I will not attempt to go through the program step by step, but I will make a few observations.

First, although the general program structure parallels the manual problem-solving procedure, a more extensive array of variables is used to adequately slide in and out of the various subroutines. On occasion, other dodges are used to get around limitations in the trig subroutines.

Second, be sure to type it exactly as printed—particularly with the 30XXX subroutines. If you don't, you will run out of line in some cases. Also, there is a bug at some point in the arc sin subroutine that is required to run the arc cos subroutine. I never could determine where it was, but it affects the calculation of all *negative* arc cos operations for numbers larger than .707—resulting in a situation where the resulting value is the same as if the number were positive—not so good. In any case, a small addition was made to take care of this problem, so be sure to type it as shown.

Hopefully, Radio Shack will remove the problem in future editions.

Using the Program

After the drudgery of pounding out numbers on a calculator, the computer run is a breeze. Once in RAM, the program actually executes as quickly as the HP-25 version. With the computer, however, you have no instructions to consult, nor need you double check to make sure that the correct number is loaded into a specific register. All you have to do is answer some simple questions for the first run, with even simpler entries into later runs, if desired.

When you hit RUN for the first time, the computer will print out the heading data (I love bylines and wouldn't dream of burying the brag lines in REM statements) and then ask for the name of the spacecraft. Once you enter this, it will ask for the station longitude, satellite subpoint longitude, and, finally, the station latitude. The machine then rapidly computes the bearings and prints them as shown in Fig. 3. Fig. 3 is, in fact, what you should get if you plug in the data used for our sample calculation.

Note that following the data printout, you are presented with three options, terminate program, get data for another spacecraft, or get data for a new station.

If you enter Ø, the program ends. If you hit 1, the computer retains the station location data and asks for the name and subpoint longitude of the new spacecraft and then goes on to display the data. If 2 is entered, the computer retains the spacecraft name and location, requests the new station longitude and latitude, and then displays the bearing data. If the requested spacecraft is out of range, the computer will announce that fact and give you the three options.

Summary

Despite the fact that it occupies most of the 4K memory, the program can be loaded fairly quickly. Once on line, it is as fast or perhaps faster then a programmable calculator. The

Fig. 2. Interactive program, written in Level I BASIC for the TRS-80 microcomputer, for the computation of antenna bearings for reception of signals from geostationary spacecraft. Data required to run the program are the satellite subpoint longitude and the longitude and latitude of the ground receiving station.

```
1Ø   CLS
2Ø   P."GEOSTATIONARY SPACECRAFT ANTENNA"
21   P."BEARING PROGRAM"
22   P.
23   P."BY DR. RALPH E. TAGGART"
24   P.
25   IN."WHAT IS THE NAME OF THE SPACECRAFT";A$:CLS
3Ø   P."LONGITUDE AND LATITUDE ENTRY NOTES"
31   P.
32   P.TAB(1Ø);"W LONG. IS ENTERED AS A POSITIVE NUMBER"
33   P.TAB(1Ø);"E LONG. IS ENTERED AS A NEGATIVE NUMBER"
34   P.
35   P.TAB(1Ø);"N LAT. IS ENTERED AS A POSITIVE NUMBER"
36   P.TAB(1Ø);"S LAT. IS ENTERED AS A NEGATIVE NUMBER"
37   P.
38   IN."ENTER STATION LONGITUDE";M
39   IN."ENTER SPACECRAFT SUBPOINT LONGITUDE";N
4Ø   IN."ENTER STATION LATITUDE";K
1ØØ  L=M-N:P=.1513
11Ø  X=L:GOSUB 3Ø36Ø:Q=Y
12Ø  X=K:GOSUB 3Ø36Ø:R=Y
13Ø  IF (L=Ø)*(K=Ø) THEN E=9Ø:GOTO 18Ø
14Ø  D=Q*R:GOSUB 3Ø52Ø:D=Y
15Ø  X=9Ø-D:GOSUB 3Ø376:F=Y-P
16Ø  X=9Ø-D:GOSUB 3Ø36Ø
17Ø  X=9Ø-D:GOSUB 3Ø69Ø:E=C
18Ø  E=E+.Ø5:E=INT(E*1Ø)/1Ø
2ØØ  X=K:GOSUB 3Ø32Ø:Q=Y
21Ø  X=D:GOSUB 3Ø32Ø:R=Y
211  IF (L=Ø)*(K>Ø) THEN I=18Ø:GOTO 5ØØ
212  IF (L=Ø)*(K<Ø) THEN I=Ø:GOTO 5ØØ
213  IF (K=Ø)*(L>Ø) THEN I=9Ø:GOTO 5ØØ
214  IF (K=Ø)*(L<Ø) THEN I=27Ø:GOTO 5ØØ
22Ø  S=Q/R:S=-S:J=S:GOSUB 3Ø52Ø
225  IF (J Ø)*(ABS(J)>.7Ø71Ø7) T. I=18Ø-Y:GOTO 25Ø
25Ø  IF L Ø T. 27Ø
26Ø  I=36Ø-I
27Ø  I=I+.Ø5:I=INT(I*1Ø)/1Ø
5ØØ  CLS
51Ø  P.TAB(25);A$
52Ø  P.
525  IF E<Ø T.P.TAB(25);"OUT OF RANGE":GOTO 55Ø
53Ø  P.TAB(10);"ANTENNA ELEVATION = ";E;" DEGREES"
535  IF E=90 T.P.TAB(1Ø);"NO UNIQUE AZIMUTH":G.55Ø
54Ø  P.TAB(1Ø);"AZIMUTH = ";I;" DEGREES TRUE"
55Ø  P.
56Ø  P.TAB(2Ø);"STATION LOCATION:"
57Ø  IF K>=Ø THEN P.TAB(25);K;" N":GOTO 58Ø
575  IF K<Ø THEN P:TAB(25);ABS(K);" S"
58Ø  IF M>=Ø THEN P.TAB(25);M;" W"
585  P.TAB(25);ABS(M);" E"
61Ø  P."FURTHER OPTIONS:"
62Ø  P.TAB(1Ø);"TERMINATE PROGRAM - Ø"
63Ø  P.TAB(1Ø);"ANOTHER SPACECRAFT - 1"
64Ø  P.TAB(1Ø);"NEW STATION - 2"
65Ø  IN."OPTION #";Q
66Ø  CLS:IF Q=Ø THEN 8ØØ
67Ø  IF Q=1 THEN 71Ø
68Ø  IN."STATION LONGITUDE";M
69Ø  IN."STATION LATITUDE";K
7ØØ  GOTO 1ØØ
71Ø  IN."WHAT IS THE NAME OF THE SPACECRAFT";A$
72Ø  IN."WHAT IS THE SUBPOINT LONGITUDE";N
73Ø  GOTO 1ØØ
8ØØ  END
```

```
To this listing must be added the subroutines on p.218,219, and 220
of the Radio Shack Level I BASIC manual:
   TANGENT: enter lines 3Ø32Ø-3Ø34Ø
   COSINE:  enter lines 3Ø36Ø-3Ø365
   SINE:    enter lines 3Ø376-3Ø455
   ARCCOSINE: enter  line 3Ø52Ø
   ARCSINE:   enter lines 3Ø55Ø-3Ø63Ø
   ARCTANGENT:enter lines 3Ø69Ø-3Ø76Ø
   SIGN:      enter lines 3Ø81Ø-3Ø84Ø
```

```
              GOES E

    ANTENNA ELEVATION= 37.2 DEGREES.
    AZIMUTH= 165.7 DEGREES TRUE.
              STATION LOCATION:
                   45 N.
                   85 W.
FURTHER OPTIONS:
    TERMINATE PROGRAM - Ø
    ANOTHER SPACECRAFT - 1
    NEW STATION - 2
OPTION#?_
```

Fig. 3. Sample printout, given the following input data: Name of spacecraft: GOES E; Station longitude: 85; Satellite subpoint longitude: 75; and Station latitude: 45.

trig subroutines are certainly more involved than having the functions directly available in the BASIC dialect, but you will notice this only for your first run prior to storing the program on tape. Once the program is in RAM, it runs so fast that you will find it hard to believe that it is actually using the involved subroutines. The results are accurate and fast, becoming another useful tool for the active satellite station.

My third and final article will outline an antenna tracking program for polar orbiters. ■

Design Practical PLL and Timer Circuits

—program generates standard R and C values for 567s and 555s

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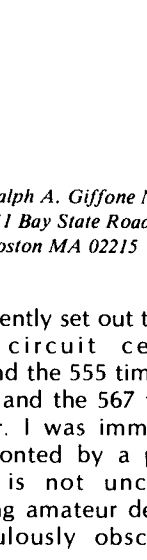
I recently set out to design a circuit centered around the 555 timer-oscillator and the 567 tone decoder. I was immediately confronted by a problem that is not uncommon among amateur designers: ridiculously obscure capacitance values (or resistance values) calculated from standard design formulas. To obtain these capacitances, one must then hook up two or more capacitors in various series-parallel combinations. This is often tedious and impractical. I therefore went to my newfound friend, the computer, and sought a program that would give me a practical solution to this problem.

Fig. 1 is the schematic diagram and frequency design formula for the 567 tone decoder. The frequency of the decoder is determined by the formula, $f=1/RC$. It is obvious that for a given frequency there are an infinite number of possible RC combinations. We do not, however, have access to all values of R and C, but only to those standard values that are



$f = \frac{1}{RC}$

$C = \frac{1}{Rf}$

f = HERTZ

```
list

05 dim a(25), R(77)
10 print "This program is designed to select the"
15 print "proper values of resistance and capa-"
20 print "citance for the proper operation of the"
25 print "567 tone decoder."
30 print
35 print "Enter the desired frequency of operation"
40 input f
45 print
50 print
60 let s=1
65 for I=1 to 13
70 read a(I)
75 next I
76 print
77 print "The following values of resistance"
78 print "and capacitance determine the fre-"
79 print "quency of";f;"Hz"
80 let A=1
85 for J=2 to 7
90 for I=3 to 13
95 let R(A)=a(I)*10^J
100 let A=A+1
105 next I
110 next J
115 for A=1 to 66
120let C=1/(R(A)*f)
125 if C<10^(-9) then 175
130 for H= 1 to 9
135 let d=C/10^(-H)
140 if 1>d then 150
145 if d<10 then 155
150 next H
155 for I=1to6
160 if .95*a(I)>d then 170
165 if d<1.05*a(I) then 190
170 next I
175 next A
180 goto 350
190 print
195 print
200 print "Set";s;":"
205 print "R1 =";R(A);"ohms"
210 print "C1 =";1000000*C;"uf"
215 let s=s+1
```

resistance and, at a given frequency, calculate C for all those values. The computer would then select those values of C which were within 5% (or any given tolerance) of standard capacitance values. Thus, the aforementioned pains of design could be alleviated!

In Fig. 2, the program I used for the 567 is listed. The program is in BASIC and essentially performs three very basic tasks:

1. Input:
   (a) The computer receives the design frequency specified by user.
   (b) The computer internally determines all standard values of resistance.
2. Calculation:
   (a) The computer takes the first resistance and calculates C at the given frequency.
   (b) If C is a *standard value* of capacitance greater than .001 uF (why mess with low-value capacitors?), then C is sent to the output section.
   (c) If C is less than .001 uF or not a standard value, the computer takes the next value of resistance and performs instruction 2.(a) with this resistance.
3. Output:
   (a) The computer receives value of R and prints R.
   (b) The computer receives value of C and prints C.

Now let's get to the meat of the program.

Lines 10-30 are merely the introductory print statements. At 40, the user inputs the frequency "f". At 65, the values of a(1) through a(13) are read from the data statement at line 230 (see Fig. 3). Note that the values of a(1) through a(6) are the significant digits of the more common standard values of capacitance and that a(3) through a(13) are the significant digits of the common standard value of resistance. These values of a(1) through a(13) will be used first to obtain all the standard resistance values, and then to determine whether the calculated capacitance is indeed a standard value.

Lines 80-110 take the subscripted variable R(A) and make it equal to the significant digit a(I) multiplied by a power of 10 (10^J). Essentially, it does *this* (starting from 80):

A = 1
J = 2
I = 3
$R(1) = a(3) \times 10^2 = 1.0 \times 100 = 100$ (Ohms)
A = 2
I = 4
$R(2) = a(4) \times 10^2 = 2.2 \times 100 = 220$ (Ohms)
A = 3
I = 5
$R(3) = a(5) \times 10^2 = 3.3 \times 100 = 330$ (Ohms)

You can see that we will be able to store up to 66 values of resistance in R(A), ranging from 1.0×10^2 to 8.2×10^7 Ohm. (Note that for my purposes, I didn't want values of R less than 100 Ohms. This is up to the designer and can be altered according to his needs.)

At line 115, we get a little more complex. Within a "for-to-next" loop, we have two more "for-to-next" loops! We begin with the first of 66 values of resistance and at line 120 we calculate C. If C is less than 10^{-9} (.001 uF), then it is bypassed and the next value of resistance is used to calculate yet another value of capacitance. If C is greater than .001 uF, then we must determine the significant digits of that capacitance and see if they are close to the standard values we desire.

At 130, we start dividing C by the various powers of 10 until we get to the power of ten corresponding to the one of the capacitance. This will be when d is greater than 1, yet less than 10. For example, if C is 5.0×10^{-8} (.05 uF), when it is divided by a power other than 10^{-8}, it will yield a quotient less than 1. However, when H = 8, $C/10^{-H}$ will be equal to 5.0. Thus, d will be equal to

a(1), a(2) . . . . , a(13)

$\overbrace{\quad}^{\text{SIGNIFICANT DIGITS OF STANDARD RESISTANCE VALUES}}$ (a(3) through a(13))

$\underbrace{5.0, 10.0, 1.0, 2.2, 3.3, 4.7}_{\text{SIGNIFICANT DIGITS OF STANDARD CAPACITANCE VALUES}}$, 1.2, 1.5, 1.8, 3.9, 5.6, 6.2, 8.2

Fig. 3.

```
This program is designed to select the
proper values of resistance and capa-
citance for the proper operation of the
567 tone decoder.

Enter the desired frequency of operation
? 10000


The following values of resistance
and capacitance determine the fre-
quency of 10000 Hz


Set 1 :
R1 = 100 ohms
C1 = 1 uf


Set 2 :
R1 = 220 ohms
C1 = 0.454545 uf


Set 3 :
R1 = 470 ohms
C1 = 0.212766 uf


Set 4 :
R1 = 1000 ohms
C1 = 0.1 uf


Set 5 :
R1 = 2200 ohms
C1 = 4.54545 E-2 uf


Set 6 :
R1 = 4700 ohms
C1 = 2.12766 E-2 uf


Set 7 :
R1 = 10000 ohms
C1 = 0.01 uf


Set 8 :
R1 = 22000 ohms
C1 = 4.54545 E-3 uf


Set 9 :
R1 = 47000 ohms
C1 = 2.12766 E-3 uf


Set 10 :
R1 = 100000 ohms
C1 = 0.001 uf

Edit.
```

Fig. 4. 567 sample run.

```
list

05 dim a(25),R(77)
10 print "This program is designed to select the "
15 print "proper values of resistance and capa-"
20 print "citance for the proper operation of the"
25 print "555 timer-oscillator."
30 print
35 print "Enter the desired frequency of oscillation"
40 input f
45 print
50 print
60 let s=1
65 for I=1 to 13
70 read a(I)
75 next I
76 print
77 print"The following values of resistance "
78 print "and capacitance determine the fre-"
79 print "quency of ";f;"Hz."
80 let A=1
85 let B=1
90 for J=2 to 7
95 for I=3 to 13
100 let R(A)=a(I)*10^J
105 let R(B)= R(A)
110 let A=A+1
115 let B=B+1
120 next I
125 next J
130 for A=1 to 66
135 for B=1 to 66
140 let C=1.44/((R(A)+2*R(B))*f)
145 if C<10^(-9) then 195
150 for H= 1 to 9
155 let d=C/10^(-H)
160 if 1>d then 170
165 if d<10 then 175
170 next H
175 for I= 1 to 6
180 if .995*a(I)>d then 190
185 if d<1.005*a(I) then 210
190 next I
195 next B
200 next A
205 goto 350
210 print
215 print
220 print "Set";s;":"
225 print "R(A)=";R(A);"ohms"
230 print "R(B)=";R(B);"ohms"
235 print "C=";1000000*C;"uf"
240 let s=s+1
245 print
250 goto 195
260 data 5.0,10.0,1.0,2.2,3.3,4.7,1.2,1.5,1.8,3.9,5.6,6.2,8.2
350 end
```

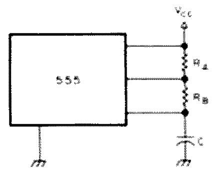
Fig. 6. 555 program listing.

the significant digits of capacitor C.

Next we go to 155 and begin a process which will determine whether d (the significant digits of C) is within 5% of the significant digits of any of the common standard capacitance values. These, as explained previously, are stored in variables a(1) through a(6).

Let's see how it runs.

When I=1, the first value of a(I), or a(1), will be 5.0. The instructions in 160 and 165 are such that if d is 5% above or below the standard value (5.0 in this case), C will be transferred to the output section beginning in 190. If it is not, the computer will see if d is within 5% of the next standard value, and so on. If it is not within 5% of *any* standard values, C is bypassed, the next value of R(A) is selected, and the whole process begins once more. Please note that one may select capacitors that are even closer to the standard values if he makes the tolerance less than 5%. You'll note that in the program for the 555 timer, the capacitance selected is within .5% of the standard values. However, if you make the tolerance too precise, you may find that there are *no* capacitors that close to the standard values and thus there will be no output from the computer.



$$f = \frac{1.44}{(R_A + 2R_B)C}$$

$$C = \frac{1.44}{(R_A + 2R_B)f}$$

Fig. 5. 555 oscillator circuit.

The program ends with some print statements, giving us the results of the computer's long, hard work. (It takes a few seconds!) All we need to do is enjoy the fruit of its labor!

Fig. 4 shows the printout as the program is run.

In Fig. 5, we have a more complex design formula. For the oscillation frequency of the 555 timer, we need to use *two* resistors and a capacitor. Fig. 6 shows the program for this circuit. Note that the program is identical except for some additional lines. What I've done is generate *two* sets of standard resistance values, R(A) and R(B), and calculated C for the 66^2 possible combinations between them.

One thing that might be confusing is the logic used in selecting the order of the data in a(1) through a(13). Studying Fig. 3 may clarify it for you. Some values are needed only for the capacitors, some only for the resistors, and some for both. Thus, it was necessary to order the data statement that way. If you wish to write your own program, consider these things. (Also be certain to make one of the values of a(I) equal to 10.0. Even though you have the digits 1.0 for the lower values of capacitance, the program will not work for significant digits of 9.99, etc., unless you have a data of 10.0 included.)

As you can see, the program is flexible and the reasoning can be applied to more complex formulas. So, next time you have a design problem, put away your scratch pad and take out your computer! ■

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DUPECALL . . . for Your Next Contest

—let your SWTP do the duping

"CQ contest, CQ contest. This is K4TSY calling . . . K4TSY, this is K4HTU, over . . . Err, uh . . ., K . . . 4 . . . H . . . T . . . U. Um, let me see now, have we worked before? (Much scrambling follows.) Just a minute, OM, I'm checking to see if we have worked earlier in the contest (more fumbling). Gee, I can't seem to . . . oh yeh, looks like we already worked earlier. Do you agree? Over. This is K4HTU . . . well, if you say so . . . but I'm not sure either . . ."

Does this sound familiar? For me, it was all too often the case. I do keep a dupe sheet, but I find it very hard to keep up during a rapidly moving contest. (For the uninitiated, a dupe sheet is a list of the stations worked, organized to facilitate the checking of station calls during the contest.) This sheet is normally arranged by call area, or simply alphabetically for DX.

I never found a good way to do it by hand, so I thought of using my microcomputer (an SWTPC 6800 machine) to help the cause. The result is the program that is presented in this article. I call it DUPECALL (Listing 1).

How To Use It

The program has two start-up modes, cold and soft. The cold start is like starting with a clean piece of paper; it clears memory and starts you at the beginning. The soft start just lets you jump back in where you left off (more about that later).

When loaded and started at $0100 "cold start," DUPECALL will respond with a prompt, a "greater than" sign, ">". This tells you that the program is waiting for an input. You type in the call to be recorded (up to 6 characters long) and end the field with a carriage return (CR). The CR tells the program that you have completed that particular call. Then, upon receipt of the CR, a check is made through all preceding memory. If no dupe is found, the prompt is changed to a plus, "+". If you want to add it to the list, type another CR; if not, type a minus, "—". The program will delete the last entry from the file and return the prompt ">" to indicate that it is ready for the next entry.

The input field is limited to 6 characters, so if you try to type 7 characters, the program will respond with "ERROR." Erase that entry from the file and return the prompt. This is also the way to correct a mistake. Just fill the field to "overflow," accept the "error" message, and try again after the prompt. You are forgiven.

The program's reponse to a dupe is a message to that effect, but the last call is left on the screen and the dupe message is typed under it for later reference. The duplicate call is erased from the file, as with the error mode above.

If you want to exit the program, just respond to the prompt with a "less than," "<", character. The LT will cause the program to make a clean exit. The top of file address is recorded at the beginning of the file and control is returned to MIKBUG.

The idea of a clean program exit is useful for more than just the soft start. The memory, loaded with calls (your file), can then be recorded on cassette tape. Then, with another program, like TYPECALL (Listing 2), the same data can be printed out. Actually, it's a good idea to stop once in a while to record the data file on tape, just to protect it. Use MIKBUG PUNCH and save DUPECALL and its file together. Put $00B3 into locations $A002-3, the contents of $0200 into locations $A004-5, and type P.

The soft start point allows you to get back into DUPECALL wherever you left off. Just type "G", and when the prompt is returned, you are back in DUPECALL, ready to continue entering calls for more duplicate checks. If you have used TYPECALL, be sure to reset the restart vector to $0113 before typing "G" Start TYPECALL at $0030.

The program as presented runs in 4K of memory and holds just under 600 calls in that much memory. If you have more memory avail-

able, change location $0109 to suit your needs.

Overview

A first look at the assembly listing may scare you, with all those jumps and branches. Bear with me and I'll show you how it works.

The program is divided into two parts. The first simply writes the inputted ASCII characters into memory. The second checks the preceding memory for a duplicate string of characters.

The input, as written into memory, is organized into fields of 6 characters. This means that calls up to 6 characters long are stored together. The calls are packed serially every 6 memory locations. The second half of the program compares the trail field, character by character, with the characters in the table of fields before it. If no duplicate is found, the prompt is replaced by a "+", as mentioned above. The program recognizes another CR as the go ahead to leave the last call in memory alone and return a prompt. A minus is recognized as the indication to delete it. After doing so, the prompt is returned. TYPECALL just prints the file out in columns. The printout will stop after each 15 ($0034) lines for viewing on a CRT. But a CR will cause the printout to continue. I have placed the origin of TYPECALL so that it resides just under DUPECALL for convenience in recording.

Functional Description

Here is a functional blow-by-blow description of the program itself: Begin DUPECALL at $0100 for the cold start. This will load $0200 through $0FFF with spaces ($20). The restart vector ($A048) is set for soft start ($0113). A prompt is written to the terminal by PDATA1 from the string starting at $00BD, which leads into INEEE, where characters are entered into memory sequentially, 6 ($0139) at a time. If more than 6 are entered, then PDATA1 at $0142 prints the error string ($00C1) and backspaces to the start of the field ($015F).

With the trial entry field complete with a CR, DUPECALL jumps to "TEST" ($0178) and backsteps to find the start of this trial field. The start of the table is superficially set to $01FC, and this location is compared ($0190) with the data in the first field location. If a match is found, each location is checked until: 1. the field is a complete match and DUPE is printed ($01B0); or 2. there is no match ($0196) and the table field pointer is stepped to the start of the next field ($01A2) and tried again.

```
E07E            PDATA1  EQU     $E07E
E1AC            INEEE   EQU     $E1AC
E0E3            CONTRL  EQU     $E0E3
0200            FILBEG  EQU     $0200
0FFF            MEMEND  EQU     $0FFF
                        OPT     PAG
00B3                    ORG     $B3
00B3            BUF0    RMB     2
00B5            BUF1    RMB     2
00B7            BUF2    RMB     2
00B9            BUF3    RMB     2
00BB            BUF4    RMB     2
                        OPT     PAG
00BD 0D 0A      PROMPT  FDB     $0D0A
00BF 3E 04              FDB     $3E04
00C1 2E         EOR     FCC     /...ERROR.../
00C2 2E 2E
00C4 45 52
00C6 52 4F
00C8 52 2E
00CA 2E 2E
00CC 04                 FCB     $04
00CD 0A         DUPE    FCB     $0A
00CE 2A                 FCC     /**************** DUPE *****************
00CF 2A 2A
00D1 2A 2A
00D3 2A 2A
00D5 2A 2A
00D7 2A 2A
00D9 2A 2A
00DB 2A 2A
00DD 2A 2A
00DF 20 44
00E1 55 50
00E3 45 20
00E5 2A 2A
00E7 2A 2A
00E9 2A 2A
00EB 2A 2A
00ED 2A 2A
00EF 2A 2A
00F1 2A 2A
00F3 2A 2A
00F5 2A 2A
00F7 2A 2A
00F9 2A 2A
00FB 04                 FCB     $04
00FC 0D 2B      PLUS    FDB     $0D2B
00FE 0D 04              FDB     $0D04
                *
                **************************************************
                *
                *   THIS IS THE COLO START POINT
                *
                **************************************************
                *
0100 CE 02 00   CSTART  LDX     #FILBEG
0103 86 20              LDAA    #$20     SPACES
0105 A7 00      NFIN    STAA    X        THIS LOADS RAM WITH SPACES
0107 08                 INX              UNTIL MEMEND IS REACHED
0108 8C 0F FF           CPX     #MEMEND
010B 26 F8              BNE     NFIN
010D CE 02 02           LDX     #FILBEG+2
0110 FF 02 00           STX     FILBEG   THEN SETS POINTER TO FILE START
                *
                **************************************************
                *
                *   THIS IS THE SOFT START POINT
                *
                **************************************************
0113 CE 01 13   SSTART  LDX     #SSTART
0116 FF A0 48           STX     $A048
0119 8E A0 7F           LDS     #$A07F
011C FE 02 00           LDX     FILBEG   PICK UP END OF FILE POINTER
011F DF B5      BEG     STX     BUF1
0121 CE 00 BD           LDX     #PROMPT
0124 BD E0 7E           JSR     PDATA1
0127 DE B5              LDX     BUF1
0129 5F                 CLRB
012A BD E1 AC   NCH     JSR     INEEE    NEXT CHARACTER
012D 81 3C              CMPA    #'<      EXIT CHARACTER
012F 26 04              BNE     NOEXIT
0131 C1 00              CMPB    #0
0133 27 24              BEQ     GETOUT   < CH IN FIRST SPACE
0135 81 0D      NOEXIT  CMPA    #$0D
0137 27 16              BEQ     BEE
0139 C1 06              CMPB    #6
013B 2D 0C              BLT     AGN      BUFFER NOT FULL YET
013D DF B3              STX     BUF0
013F CE 00 C1           LDX     #EOR
0142 BD E0 7E           JSR     PDATA1   ERROR MESSAGE
0145 DE B3              LDX     BUF0
0147 20 16              BRA     ERASE    ERASE ROUTINE
0149 A7 00      AGN     STAA    X
014B 08                 INX
014C 5C                 INCB
014D 20 DB              BRA     NCH      TO NEXT CHARACTER
014F C1 06      BEE     CMPB    #6
0151 27 04              BEQ     TEST1    FULL..CONTINUE
0153 08                 INX
0154 5C                 INCB
0155 20 F8              BRA     BEE      ANOTHER?
0157 20 1F      TEST1   BRA     TEST     PROCEED WITH COMPARISON
0159 FF 02 00   GETOUT  STX     FILBEG
015C 7E E0 E3           JMP     CONTRL   RETURN TO MIKBUG (EXIT)
015F 86 20      ERASE   LDAA    #$20     ERASE ROUTINE
0161 A7 00              STAA    X
0163 09                 DEX
0164 A7 00              STAA    X        STEP POINTER BACKWARDS
0166 09                 DEX              AND REPLACE SPACES
0167 A7 00              STAA    X
0169 09                 DEX
016A A7 00              STAA    X
016C 09                 DEX
016D A7 00              STAA    X
016F 09                 DEX
0170 A7 00              STAA    X
0172 09                 DEX
0173 A7 00              STAA    X
0175 5F                 CLRB
0176 20 A7      BEGI    BRA     BEG      THIS IS A BRANCH ISLAND
0178 DF B5      TEST    STX     BUF1
017A 09                 DEX
017B 09                 DEX              STEP POINTER BACK 6
017C 09                 DEX
017D 09                 DEX
017E 09                 DEX
017F 09                 DEX
0180 DF B9              STX     BUF3
0182 DF BB              STX     BUF4
0184 CE 01 FC           LDX     #FILBEG-4 THIS SETS UP THE TEST POINTER
0187 DF B7              STX     BUF2      TO A DUMMY START POSITION
0189 C6 06      CHK     LDAB    #6
018B DE B9              LDX     BUF3
018D A6 00      CONT    LDAA    X        CONTINUE CHECK
018F 08                 INX
0190 DF BB              STX     BUF4     CHECK EACH FIELD
0192 DE B7              LDX     BUF2
0194 A1 00              CMPA    X
0196 26 0A              BNE     NXC      NO MATCH
0198 08                 INX
0199 DF B7              STX     BUF2
019B DE BB              LDX     BUF4
019D 5A                 DECB
019E 2E ED              BGT     CONT
01A0 20 0E              BRA     FDP
01A2 08         NXC     INX
01A3 5A                 DECB             MOVE AHEAD TO NEXT FIELD
01A4 2F 02              BLE     OUT
01A6 20 FA              BRA     NXC
01A8 DF B7      OUT     STX     BUF2
01AA 9C B9              CPX     BUF3
01AC 27 0C              BEQ     PRMT     GOT TO LAST LOC IN FILE
01AE 20 D9              BRA     CHK      AND NO MATCH
01B0 CE 00 CD   FDP     LDX     #DUPE
01B3 BD E0 7E           JSR     PDATA1   DUPE MESSAGE
01B6 DE BB              LDX     BUF4
01B8 20 11              BRA     ERS
01BA CE 00 FC   PRMT    LDX     #PLUS    NO MATCH FOUND SO REPLACE
01BD BD E0 7E           JSR     PDATA1   PROMPT WITH +
01C0 DE B5              LDX     BUF1
01C2 BD E1 AC           JSR     INEEE
01C5 81 2D              CMPA    #'-      DELETE CHARACTER (-)
01C7 27 02              BEQ     ERS
01C9 20 AB              BRA     BEGI
01CB 86 20      ERS     LDAA    #$20     LOAD SPACES BACK
01CD 09                 DEX
01CE A7 00              STAA    X        IF DELETE CH OR DUPE,
01D0 09                 DEX              MUST STEP POINTER BACK AND
01D1 A7 00              STAA    X        RELOAD SPACES INTO MEMORY
01D3 09                 DEX
01D4 A7 00              STAA    X
01D6 09                 DEX
01D7 A7 00              STAA    X
01D9 09                 DEX
01DA A7 00              STAA    X
01DC 09                 DEX
01DD A7 00              STAA    X
01DF 20 95              BRA     BEGI     GO TO START AGAIN VIA ISLAND
                        END
      NO ERROR(S) DETECTED

    SYMBOL TABLE:
AGN     0149    BEE     014F    BEG     011F    BEGI    0176
BUF0    00B3    BUF1    00B5    BUF2    00B7    BUF3    00B9
BUF4    00BB    CHK     0189    CONT    018D    CONTRL  E0E3
CSTART  0100    DUPE    00CD    EOR     00C1    ERASE   015F
ERS     01CB    FDP     01B0    FILBEG  0200    GETOUT  0159
INEEE   E1AC    MEMEND  0FFF    NCH     012A    NFIN    0105
NOEXIT  0135    NXC     01A2    OUT     01A8    PDATA1  E07E
PLUS    00FC    PRMT    01BA    PROMPT  00BD    SSTART  0113
TEST    0178    TEST1   0157
```

Listing 1.

```
E1AC                 INEEE   EQU    $E1AC
E101                 OUTEEE  EQU    $E101
E0E3                 CONTRL  EQU    $E0E3
0200                 FILBEG  EQU    $0200
                             OPT    PAG
0020                         ORG    $20
0020                 FLDCNT  RMB    1
0021                 LINCNT  RMB    1
0022                 CHRCNT  RMB    1
0023                 COLCNT  RMB    1
                     *
                     *
0030                         ORG    $30
0030 CE 02 02        STRT    LDX    #FILBEG+2  START OF FILE
0033 C6 0F           NXP     LDAB   #15        LINES PER PAGE
0035 D7 21                   STAB   LINCNT     LINE COUNT
0037 C6 04                   LDAB   #4         START FIELD COUNT
0039 D7 23                   STAB   COLCNT     COLUMN COUNT ON LINE
003B 86 0D                   LDAA   #$0D       DO CR
003D BD E1 D1                JSR    OUTEEE     OUTPUT IT
0040 26 17           NLIN    BNE    OUS        NEW LINE?
0042 86 0A                   LDAA   #$0A
0044 BD E1 D1                JSR    OUTEEE     OUTPUT LF
0047 86 0D                   LDAA   #$0D
0049 BD E1 D1                JSR    OUTEEE     OUTPUT CR
004C D6 23                   LDAB   COLCNT     START FIELD COUNT
004E D7 20                   STAB   FLDCNT     FIELD ON LINE
0050 D6 21                   LDAB   LINCNT     LINE COUNT ON PAGE
0052 5A                      DECB
0053 27 20                   BEQ    INP
0055 D7 21                   STAB   LINCNT     LINE COUNT
0057 D6 20                   LDAB   FLDCNT     FIELD CNT  ON LINE
0059 86 20           OUS     LDAA   #$20       SPACE
005B BD E1 D1                JSR    OUTEEE     OUTPUT IT
005E 86 06                   LDAA   #6         CHAR PER FIELD
0060 97 22           CHCO    STAA   CHRCNT     CHARACTER COUNT
0062 A6 00                   LDAA   X
0064 BD E1 D1                JSR    OUTEEE     OUTPUT THE CHARACTER
0067 96 22                   LDAA   CHRCNT     CHAR COUNT
0069 08                      INX
006A 8C 02 00                CPX    FILBEG     END OF FILE?
006D 27 0F                   BEQ    GETOUT     DONE
006F 4A                      DECA              CHARACTER COUNT
0070 2E EE                   BGT    CHCO       NEXT CHARACTER
0072 5A                      DECB              FIELD ON LINE
0073 20 CB                   BRA    NLIN       TO NEXT FIELD
0075 BD E1 AC        INP     JSR    INEEE
0078 81 0D                   CMPA   #$0D       INPUT=CR ?
007A 26 02                   BNE    GETOUT     NO, THEN OUT
007C 20 B5                   BRA    NXP        YES, NEXT PAGE
007E 7E E0 E3        GETOUT  JMP    CONTRL     EXIT TO MONITOR
                     *
                     *
                             END
      NO ERROR(S) DETECTED

   SYMBOL TABLE:
CHCO    0060     CHRCNT  0022     COLCNT  0023     CONTRL  E0E3
FILBEG  0200     FLDCNT  0020     GETOUT  007E     INEEE   E1AC
INP     0075     LINCNT  0021     NLIN    0040     NXP     0033
OUS     0059     OUTEEE  E101     STRT    0030

S1130030CE0202C60FD721C604D723860DBDE1D157
S113004026178 60ABDE1D1860DBDE1D1D623D7207E
S1130050D6215A2720D721D6208620BDE1D1860675
S113006097 22A600BDE1D196220 88C0200270F4ACD
S11300702EEE5A20CBBDE1AC810D260220B57EE0F8
S1040080E398S9
```

Listing 2.

The test is complete when the table pointer equals the first location of the trial entry field ($01AC). A plus will replace the prompt, and the location counter (pointer) is set to the start for a new entry. DUPECALL then waits for disposition (keep it or not) of the last entry.

If a dupe is found (#1 above) and so indicated, the trial field is erased (ERS), starting at $01CB. Control is returned to BEG ($011F) for the prompt, and so on . . .

To exit, type a "<" in response to the prompt ($012D). The pointer to the end of the file is stored in location $0200 for use in soft start, and then control is returned to the monitor. If you type a "<" in a location other than directly after the prompt, the program will ignore the exit request and treat it as just another character in the field.

Soft starting at $0113 simply reloads the index counter (pointer) with the contents of $0200, the location of the end of the data file, and you are cleanly back to "BEG" for a prompt then to INEEE as before.

It really works nicely and is fairly fast. With my 4K machine, it takes about 2 seconds to check from $0202 to $0FFF. I can wait that long! Further, my 4K of memory will hold 4096 − 512/6 = 597 calls. That's not a bad weekend of contesting for one guy. I can hardly talk after 500 contacts!

So, there you have it, a program to keep your check log for you and check for duplicates with each entry. I have used it often and found it very useful. I hope you do, too.■

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Add 'Em Up: An IC-22S Programmer

—select a frequency by adding the settings of three switches

Like many other IC-22S owners, I soon tired of the diode matrix rat race. It began to look as though I was just going to have to live with about twelve programmed frequencies. A dozen channel frequencies is about all that I can commit to memory, and I don't like fumbling for a cross-reference table when amnesia strikes. However, I couldn't sit still for this limitation, since I'd just replaced a twelve-channel rock rig.

Photos by N4ZM

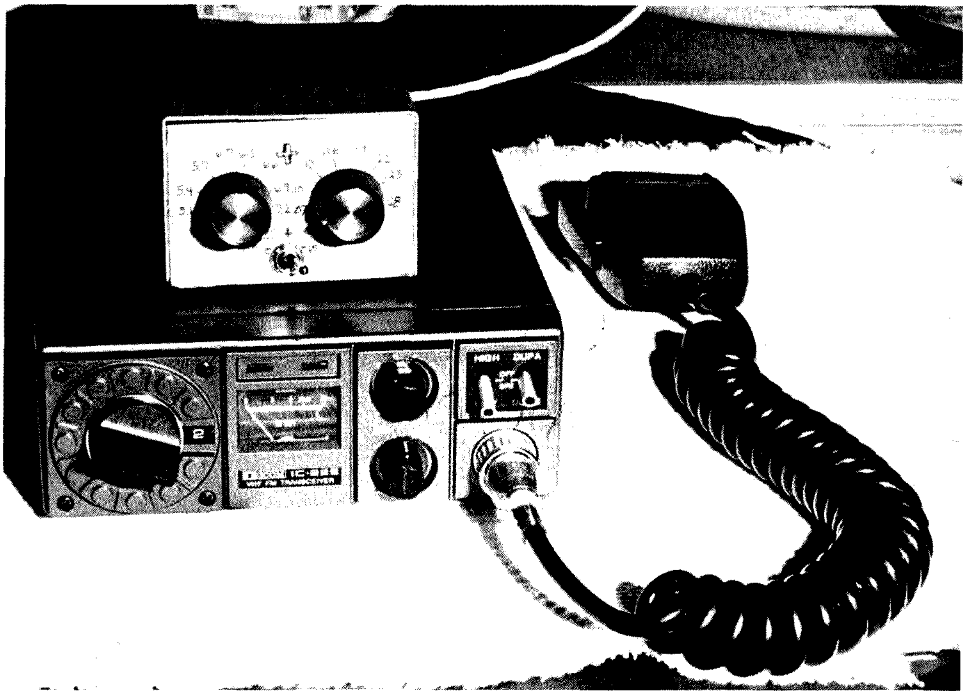

Photo A. The IC-22S at AA4RM.

At the suggestion of friends, a literature search for alternatives was begun. The hunt disclosed what are essentially two schemes. The first was to install a switch calibrated for 50 or 100 common splits. The other was any of a family of external programmers that used a switch register employing binary toggle or DIP switches, BCD, or octal thumbwheel switches, etc. Option 1 was slick, but I wanted as near to all 256 frequencies available as possible. Option 2 returns us to the translate-table arena and, to me, was as unsatisfactory as ever.

I went back to head-scratching, but not for long, because—Eureka!—an appealing symmetry quickly appeared. Here's what I saw: Take the programming number, N, which is made up of 8 binary digits set with your diodes. Note that if N is 108, the synthesizer fre-

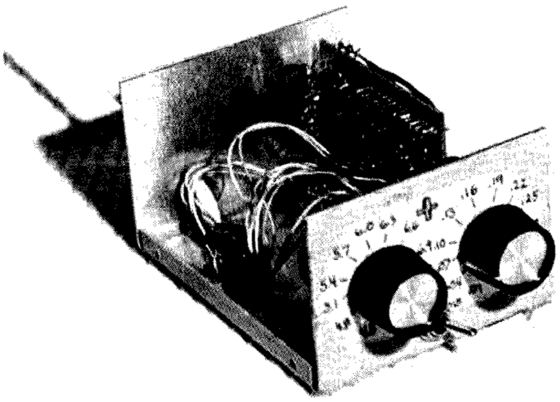

Photo B. Option one.

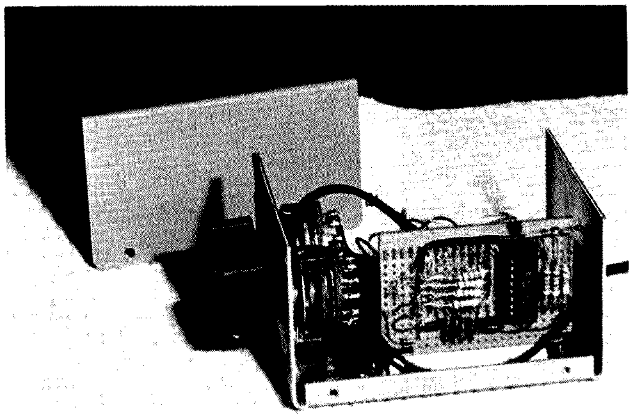

Photo C. Option two.

quency is 146.01 MHz. Check that if 20 is added to N, we go up 300 kHz to 146.31 MHz. And a scheme then emerged. What if I built a system using two diode matrices? One would select 300-kHz steps and the other would fill in the intermediate twenty 15-kHz intervals. Somehow I could then add them together and send the result to the IC-22S. I'd have but two simple switch readings calibrated directly in frequency to mentally add together to determine where I was operating. (Example: 146.31 MHz + .06 MHz = 146.37 MHz.) Bliss would reign.

What I actually built works this way: The 22S gets an N made up of the sum N1 + N2 + N3 (instead of N1 + N2 as above). I have a single-pole, 12-position rotary switch calibrated from 144.51 MHz (N1 = 8) through 147.81 MHz (N1 interval = 20). There is a second rotary switch with 10 positions starting at .00 MHz (N2 = 0) through .27 MHz (N2 = 18), with 30-kHz intervals (N2 interval = 2). 15-kHz settings are made with a toggle switch setting N3 equal to 0 or 1. This setup allows selecting 240 of the 256 possible frequencies.

I admit that doing the addition initially sounded like a job for a bagful of logic. However, it turns out that only one chip is needed to do the deed. It's called a four-bit full adder and has two names: 74C83 or 4008. Before going further, you may note that these are the very low-current CMOS numbers. Well, the 22S already uses CMOS logic and has 9 volts regulated to match. One more chip on that line seems to bother no one.

Back to the operational aspects. It takes eight bits or binary digits to represent any number in the range 0-255. Icom uses a notation wherein D0 is the least significant bit (coefficient of 1) and D7 the most significant (coefficient of 128). Refer now to Fig. 1. Generally, to add a selection from the N1 matrix to a selection from the N2 matrix requires operations on all bit positions from the first which is common to both, D2, up through D7. Note here that the N3/15-kHz bit, D0, is common to neither N1 nor N2 and doesn't enter into these adding considerations.

Regardless, working with D2 through D7 is working with 6 bits, not 4. However, by picking 128 as one of the "stops" for N1, we get around the need for having bits D7 and D6 added. Stated another way, D6 will never be simultaneously "on" in any pair of N1 and N2 matrix selections. Hence there will be no "overflow" or "carry" out of the summed D6 values into D7. The resultant D6 (that sent to the 22S) is formed from a

DIODE SETTINGS [VALUE / NAME]

SWITCH	FREQ (MHz)		128	64	32	16	8	4
		N1	D7	D6	D5	D4	D3	D2
1	144.51	8					X	
2	144.81	28				X	X	X
3	145.11	48			X	X		
4	145.41	68		X				X
5	145.71	88		X		X	X	
6	146.01	108		X	X		X	X
7	146.31	128	X					
8	146.61	148	X			X		X
9	146.91	168	X		X		X	
10	147.21	188	X		X	X	X	X
11	147.51	208	X	X		X		
12	147.81	228	X	X	X			X

a) N1 MATRIX

DIODE SETTINGS [VALUE / NAME]

SWITCH	FREQ (MHz)		16	8	4	2
		N2	D4	D3	D2	D1
1	.00	0				
2	.03	2				X
3	.06	4			X	
4	.09	6			X	X
5	.12	8		X		
6	.15	10		X		X
7	.18	12		X	X	
8	.21	14		X	X	X
9	.24	16	X			
10	.27	18	X			X

b) N2 MATRIX

Fig. 1. Diode matrix layouts.

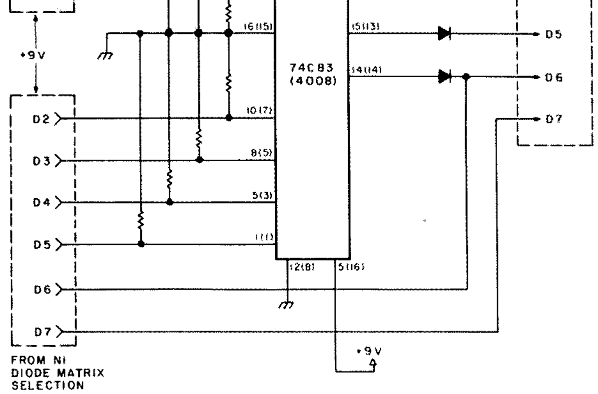

Fig. 2. Programmer schematic. All diodes are 1N918, 1N4148, etc. All resistors (pull-downs) are 27k, ¼ W. +9 V is taken from diode supply voltage in the 22S at board position 23 (channel "0").

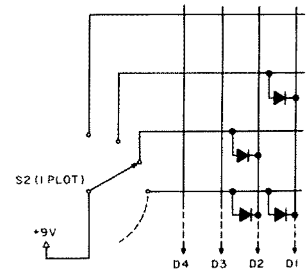

Fig. 3. First four elements of the N2 diode matrix. Refer to Fig. 1 for the remainder of N2 and all of N1 diode placements. All diodes are 1N918, 1N4148, etc.

"wired diode OR" of the carry out line of the 4-bit adder with the D6 line from the N1 matrix. The four-bit adder has lines D2 to D5 input from the N1 matrix, and lines D2 to D4 from the N2 matrix (N2's D5 is "made" zero since it doesn't exist).

Fig. 2 shows the electrical connections for the programmer. Pin connections in parentheses are for the 4008 chip; the others are for the electrically interchangeable 74C83. Fig. 3 is a schematic excerpt of the smaller diode matrix and switch.

I built the programmer into a small 3-3/8" x 3" x 2-1/8" utility box (LMB CR332). The photos show the construction used. All electronics are on a little piece of perfboard. The diode matrices are fabricated by pushing a "row" of cathodes through the board and tying them together with one strand of a piece of 7 x 22 hookup wire. The column anodes are similarly terminated. The connections to the IC-22S internal diode matrix board are made through a 10-conductor cable (8 logic lines, +9 volts, and ground). Logic and +9 V go through the 9-pin accessory socket. The ground connector is anybody's choice (I used two pieces out of a wrecked Molex plug). I might point out that I get +9 V from the diode matrix supply connection for the channel where the programmer will be selected. This means that the only IC-22S internal connections are to the diode matrix board. Additionally, it means that when you move off the programmer channel, the programmer is disabled and it's business as usual in the 22S.

The parts count for the little beauty is low. About 51 diodes, 7 resistors, 2 switches, the chip, etc. The buck count is commensurately small, as I spent just under $8 for all new parts. Design, layout, and debugging took 3 nights. However, I might note that this was my first foray into the area of CMOS and at first I omitted the pull-down resistors, which caused some very puzzling results. Also, I had never used perfboard/push-terminal construction before. After parts accumulation, I think an experienced person should be able to build the programmer in one evening.

A final note about dial calibration. All N1 settings are scribed with the 1-kHz suffix omitted, and N2 readings have 1 kHz added. That is, 144.51 MHz on N1 is written 144.5, and .00 kHz on N2 is called .01 kHz, etc. This greatly improves one's ability to mentally add the N1 reading to the N2 (and N3, if "on") to get the effective frequency selected.

The programmer has a side advantage in that you (as I do) can use it as a remote tuning head. The 22S can skulk under the seat where one can "braille-read" the relatively large power and frequency-split front-panel toggle switches. You may never see the 22S face-to-face again until the car is traded.■

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The Oscilloscope Survival Course

—the finer points of scope usage

Let's face it; in this day and age, one of the handiest pieces of electronic equipment you can own is an oscilloscope, and there is a good chance that if you do much building, you either own a scope or want to buy one. That's great, because there is nothing like a scope picture to show you what a signal looks like. However, you must know the finer points of using a scope to get the full benefit of the instrument, and that is what this article is all about.

If you have read my other "Survival Course" article you will understand that I am trying to discuss the finer points of using modern electronic test equipment. Most of my hints are based on actual hands-on experience with the latest electronic gear, plus the observations I have made as an engineer. Thus, I am in a position to offer you operating hints that will help you to get more out of your equipment, and, I hope, to make it last much longer. You might not find many of the things I discuss mentioned in the user manuals that come with your equipment, as the manufacturer often takes for granted you have some knowledge of the equipment or chooses to ignore the basics of the product. I feel that since many changes are taking place in the instrument industry, it is especially important to discuss the often-over-looked fine points of test instruments. With that, let's spend some time with the oscilloscope.

Let's limit our discussion of oscilloscopes to the more common units with single-ended vertical-input amplifiers. There are so many different types of scopes and combinations of plug-ins, that there just isn't room to discuss the samplers, spectrum analyzers, logic analyzers, and umpteen more combinations of scopes. It would take several books just to cover the use and care of such exotic devices! If enough readers are interested in a particular type of scope, perhaps I can oblige with another article, but for this one our discussion is limited to the simpler models.

One of the biggest weaknesses of most scopes is the signal-handling overload ability of the vertical input—and often the horizontal (often labelled "Ext. Sweep") input is even less tolerant. You must exercise reasonable caution when connecting a signal to your scope. What happens if you don't? Depending upon the type of signal (pulse, dc, ac, etc.) and its level, you can expect to blow an FET amplifier and possibly part of the vertical attenuator. Needless to say, watch what you apply to the input jack, because if you don't, you may end up shelving the scope for parts or sending it back to the factory. Let's look at some of the types of voltages to handle with care and to avoid putting on the input of your scope.

One of the most common ways to kill a vertical amplifier is to put more voltage on the input than it is designed to take. Often the input attenuator will be set to the lowest range, compounding the problem. Thus, the input stage will connect directly to the input jack via any overload protection circuitry. At the first sign of overload, out goes the amplifier! Good sources of high voltage include any form of vacuum tube equipment, power transformer secondaries, and tuned circuits in transmitters. One way that you easily can cause damage to your scope is by using it to tune up your car's engine. Invariably, the input connection will be a turn of wire around one of the spark plug leads; all that's necessary is one arc through the wire—and scratch one scope! This method of tuning up an

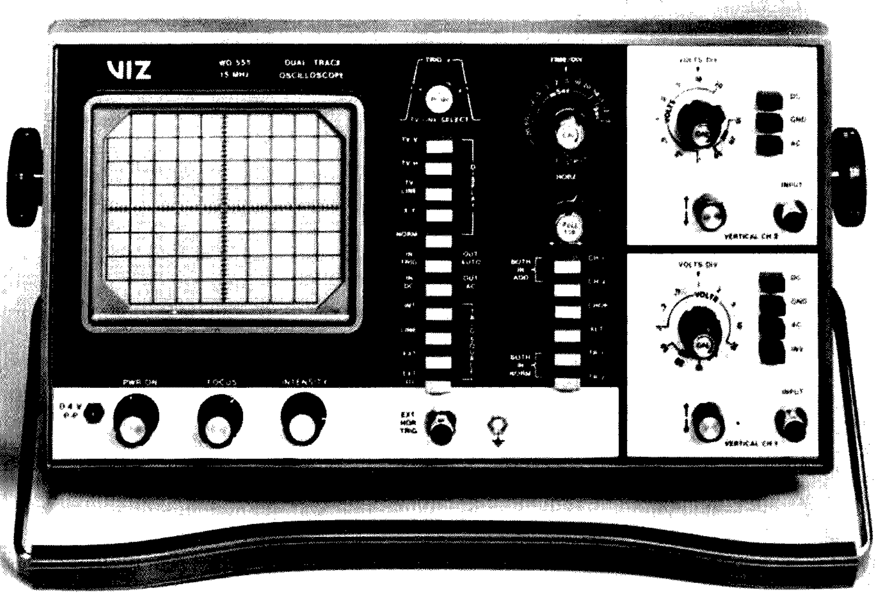

Photo A. VIZ WO 555 15-MHz dual-trace oscilloscope.

engine is fine, but some basic precautions must be taken. It should be mentioned that you can kill an input amplifier with *less* than a cycle of an overload signal if it is great enough.

The precautions that you can take to save your scope from overloads are simple and easy to implement. First, you should know the capability of your scope. Dig out the manual, if necessary, and look in the specifications section for the rated maximum input voltage on the vertical input. Note that if only one voltage is given, it must be the total of any dc plus the *peak* value of any ac signal. Thus, if you are looking at the plate of a tube and see 150 volts dc and a 15-volt ac signal, the total voltage to the scope is 165 volts. Remember this total value, as sometimes it is easy to forget how the voltages combine and can exceed the maximum input of your scope. If you can't find how much voltage your scope can take, simply check the vertical attenuator for a clue. If the highest range is 20 volts per division and there are 10 divisions, you can safely apply 20 x 10 = 200 volts. Generally, there's a 150% or greater overload factor, so you can apply up to 300 volts peak-to-peak.

If there is a switch-selectable coupling capacitor on the input of your scope, you are limited to the total dc plus peak ac voltage equal to the working voltage of that capacitor, so bear this in mind when you work with large dc offsets. In practice, the lesser of the two (attenuator + overload vs. capacitor working voltage) determines the maximum signal you can safely apply to the vertical input of your scope.

The horizontal input (or Z-axis, or other input) is often less defined as to what voltage levels it can take. The manual is the best source of information, as there generally is no attenuator on this less-used input. That's unfortunate, because commercial scopes—especially the cheaper ones—do not always have good input protection. Play it safe and limit your input voltages to under 10 volts peak-to-peak if you can't find the voltage rating.

It's easy to avoid damaging input overloads. You should always use scope probes with your unit. Not only are they easy to use, but they are also much safer than alligator clips. Also shielded probes are a must when looking at very low level signals in high-impedance circuits where hum can play havoc with the signal. If you are unsure about the level of the signal, use a X10 probe and set the vertical attenuator to the highest range. Then connect the probe and adjust the attenuator accordingly for a reasonable display. Avoid exceeding the probe's voltage ratings (usually 500-600 volts) when you make your measurement. Also, the use of a X10 probe offers more protection to the scope due to the attenuating effect of the probe. This is because damaging current is limited by the 9-meg resistor in the probe cable. Watch how you connect the probe to the equipment. If possible, power the equipment first, connect the probe, adjust the attenuator, and then read. Remove the probe, turn off the power, and you are all set.

This method allows you to quickly remove the scope from the circuit in case of an overload, minimizing any damage. Also, any equipment turn-on/turn-off surges won't reach the scope and fry the front end circuitry. To be completely safe, check the schematic of the equipment you are working on and avoid any point with voltages higher than the scope/probe combination can handle. This includes power transformer secondaries (tube equipment), tank coil circuitry in transmitters, and so on. Let me wrap this up by saying that overvoltage is still one of the more common ways to kill a scope, and despite low-voltage logic circuitry becoming more common, it can be a problem. With just a few simple precautions, you shouldn't have problems.

Another sort of input overload problem is more subtle and needs explanation. That is the effect high pulse voltages have upon a scope input circuit. Often you can be measuring a signal containing a pulse big enough to damage your scope and not know it. If you do much

TV repair, you know what I mean! TV sets have stages like the vertical and horizontal outputs with skinny pulses, plus signal, that can exceed several kV! Your best protection is to check the equipment schematic and avoid measurement on any point marked "Do Not Measure."

Now you know why this phrase turns up in electronic equipment. What happens when you measure one of these points? The pulse gets into the probe, sometimes causing internal arcing. It may damage the internal resistor on X10 probes or break insulation in X1 probes, and the result is always permanent change of accuracy. If the signal gets into the scope attenuator, it may cause arcing in resistors and capacitors, changing the accuracy of the attenuator. If that isn't enough, the pulse may reach the input FET, knocking it out and—get this—often *without* harming the over-voltage protection circuitry! This is because the over-voltage protection circuitry may act too slowly to save the FET, which must be a fast device.

So play it safe, and keep away from those "Do Not Measure" points. Also, be wary of any part of a circuit where there is an inductive component (transformer, choke, etc.) involved, plus any power handling circuitry. These combinations are good candidates for big pulses. Prime types of equipment to be careful *around* include radar (naturally), any TV, most transmitters with tubes, and unloaded power transformers. Transformers are mentioned because they generate horrendous spikes when power is removed. Either put a load on them or use the scope only when power is on.

While on the subject of inputs and signals to avoid, I would like to mention a situation that comes up occasionally that damages the cables only. I call it "cable-itis," and the story on this ailment goes like this: On good scopes, the case is grounded to earth through the 3-wire power cord and the building wiring. Not to be forgotten is the fact that it is sometimes necessary to check either the power line or some piece of equipment not containing a power transformer. So, with conditions like these, it is inevitable that the ground clip on the cable is connected to the ground in the equipment. Since that ground is either ground or 120 volts, depending upon which way the equipment plug is inserted, the result is *boom!* Scratch one scope cable. Often you will lose only the ground wire coming off the probe, but more important is the harm that can be done to you when the wire explodes. Play it safe and always use an isolation transformer on the equipment in such a case. Never use an adaptor plug on the scope, since the case still will be hot—and that can be just as dangerous as a wire exploding.

Your input cables and probes are just as important as the scope itself. Let's take a quick look at the different types and what they can do for you. Coax cable is used for most general-purpose connections to the scope. It offers shielding to the signal and not much more. A pitfall you should know about is that the capacitance of coax cable is high—and that means increasing attenuation as your input frequency goes up. In fact, if you use just three feet of any coax cable, your input impedance (standard scope impedance) of 1 meg will drop quickly as you check frequencies above 1 MHz or so. If that sounds bad, substitute ordinary microphone cable for the coax, and the higher losses will attenuate your signals even further!

The point is, an ordinary coax cable is best for only general-purpose low-frequency use. If you want to work at high frequencies, you either shorten the cable or terminate it at the scope end with a resistor. Commercial scope probes offer a way around these limitations. While there is a standard X1 scope probe, its primary purpose is for general low-frequency applications. Most X1 probes offer little improvement over the coax-and-clip-leads lash-up, electrically. Mechanically, however, a X1 probe offers a safer and easier method for connecting to a piece of equipment. Thus, that X1 probe is recommended for most uses.

Of course, if you are looking at the output of, say, a signal generator, you would find a coax cable with mating connectors on each end a much more desirable way to go. But the choice is yours. The most useful probe, and one that offers a higher degree of safety to the user, is the X10 probe. Not only does it divide input signals by 10, but it raises the input impedance to 10 megs at dc levels. These features allow you to read higher voltages with your scope while providing a greater safety margin, and you can work with sensitive circuits with reduced loading. And, to top that off, good X10 probes have extended frequency response and less capacitive loading so that you can look at rf voltages with vastly reduced loading due to the probe. This means less disruption of the circuit and more accurate waveforms on the scope. Typical X10 probes have responses to within a few dB from dc to 60 to 100 MHz. This probe is thus a necessity to anyone working with signals in the rf range, and you should have one.

There is a very good X10 probe on the market—the Heath PKW-105. Made in England, it offers switchable X1-ground-X10 positions, plus a bunch of adaptors for making different types of connections. At $28.00, it's not cheap, but that's better than half the cost of other probes.

To get maximum performance out of a X10 probe, you should be aware that they all have a compensation trimmer to null out cable capacitance. You connect the probe to your scope and touch the probe tip to a square wave signal source. Then you adjust the compensation trimmer to make the corners of the waveform as square as possible. This simple step will give you maximum bandwidth out of your probe/scope combination.

Let's continue by discussing the controls on the front panel of your scope. Since all scopes are slightly different, I can describe only the common controls among them. You will note, however, that the controls I mention are for a scope with triggered sweep. If you have the asynchronous type of scope, you can probably relate some of the things we are talking about—then someday they will mean more when you get a better scope. If you get the impression that I don't care for the free-run sweep scope (asynchronous), you are right. Their uncalibrated vertical amps, unstable sweep, and nonlinear trace have precluded their use in serious electronics work. About the only thing asynchronous scopes are good for is as modulation monitors, and that's fact! They are toys. If you are buying a new scope, avoid this type

of scope and you will avoid being sorry. Spend the extra money to get a decent unit.

Let's start with the vertical controls. These include the vertical sensitivity switch (sometimes called Vertical Attenuator), vertical gain adjust (sometimes called Vert. Sens. Vernier), and the vertical centering control.

Basically, the vertical sensitivity is a coarse gain adjust with typical positions labelled 1-2-5, for 1 mV, 2 mV, and 5 mV. It is used to set the gain of the vertical section of the scope to what is appropriate for your signal. This control is one of the most-used on your scope.

The vertical gain vernier is just a pot the fine-tunes the sensitivity of the vertical input over a small range. In short, it is a calibration control, as it affects the sensitivity of your input. Normally, there is an off or CAL position at which to set this knob, so that the vertical input is calibrated and the sensitivity is equal to the numbers on vertical sensitivity knob.

The vertical centering knob is used to move the trace around the screen, or center it, as the name implies. That takes care of basics with which you already should be familiar.

There are a number of things to consider when setting the vertical controls on your scope. For longer life, it is wise to keep the vertical attenuator set at the highest range, even when the scope is not used. As mentioned before, one of the easiest ways to kill a scope is to put a 200-volt signal on it when it is set to the 2-mV position. Play it smart and keep that switch set to the highest voltage position if you don't know your input voltage. And, better yet, use a X10 probe. The vertical gain vernier pot is always left in

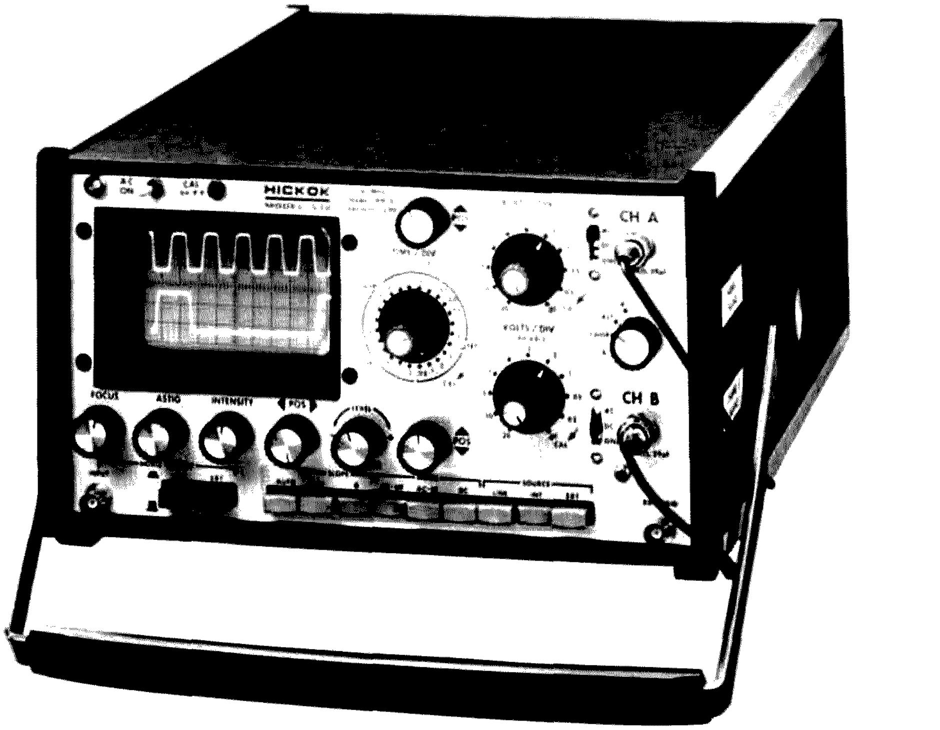

Photo B. Hickok Model 532 30-MHz dual-trace oscilloscope.

the CAL position, of course. The only exception to this is when you want to look at the top of a waveform just slightly larger than the screen and don't want to change the attenuator position. Turning the knob reduces the gain and allows you to see all of the waveform.

This knob also is useful when setting your scope up for Lissajous figures and X/Y measurements, where you are comparing two signals and want them to be the same size. The vertical centering control is used to position the trace and waveform at a convenient place on the screen. This is done, of course, so that the waveform can be positioned on the graticule (illuminated crosshair on screen) for measurement.

If your scope is left on unattended for long times, it is wise either to turn the centering control so the trace is off the screen or to turn the intensity control down to extinguish the screen. This will save you from burning a hole or creating a dim spot in the CRT. CRTs are expensive, so always take a moment to move or dim the trace before leaving the scope unattended.

The next important controls are the horizontal sweep controls. These include the sweep time switch, sweep time vernier, and the triggering controls. The sweep time switch is the most often used of the group, and its function is to set the sweep speed, or the rate at which the spot moves across the screen. Typically, this switch is calibrated in a 1-2-5 sequence like most vertical attenuators, and the numbers correspond to values like 1 ms, 2 ms, 5 ms, and so on. Note that these values are always in time-per-division on your scope. If you set the switch to 10 ms and you have 10 divisions, your total sweep time is 100 ms. This is important when estimating frequency of a signal off your scope.

The sweep time vernier is a pot, and its function is to change the calibration. Like the vertical vernier, it allows fine tuning of the sweep, and, also like the vertical vernier, the sweep time vernier normally stays in the CAL position.

The trigger controls consist of the slope switch, trigger level, and auto/manual trigger switch. These controls get almost as much use as the sweep time switch, so you should be familiar with them. The slope switch selects the point at which the sweep starts on your input signal. Remember that in a scope with triggered sweep, the signal starts the sweep run-

ning, and the sweep is not adjusted to it as in those old-fashioned asynchronous scopes. The switch tells the sweep to trigger either when the signal goes positive or negative and is nothing more than a coarse setting.

The trigger level is a fine-tune adjustment, and it allows you to move the trigger point up or down the positive or negative part of the waveform (set by the slope switch).

The auto/manual switch on your scope may have several names, but regardless of what it is called, it serves one purpose and that is to select normal triggered sweep or a free-run mode. The free-run mode is the triggered sweep circuitry continuously being triggered by an internal signal source. This ensures having a trace on the screen at all times, even in the absence of an input signal. When a signal is connected to the scope, it locks onto the signal, triggering properly. This free-run mode is valuable for when you are looking at a dc signal or a steep-sided ac signal that may not trigger the scope properly in the manual-trigger mode.

Setting the horizontal sweep controls is easy. If you turn on the scope and can't find the trace, simply set the auto/manual switch to auto to bring on the sweep and adjust the centering controls. On the more expensive scopes, there is a switch marked Beamfinder to minimize knob-tweaking. You simply press the button and a large spot appears showing you where the trace should be. If it's not where you want it, you adjust the centering controls to put it where you want and adjust the sweep controls to get a trace.

When setting the sweep controls, the sweep vernier always stays in the CAL position, and the sweep time switch is adjusted for two or more cycles on the screen. If you have no idea of what the signal will look like, always start the sweep time switch on its lowest position (slowest sweep) so that you don't miss anything. This is fine for looking at dc levels, too. The 100 ms/div position is about right for most purposes. You probably will spend a lot of time fiddling with the triggering controls, as their positions may vary with the size of your signal and its shape. Even the most expensive scopes are very "tweaky" in this respect, and some require a lot of adjustment for a stable trace.

The slope switch is adjusted for either a positive or negative going display. Note that you don't have much choice if your signal is a logic level, swinging from ground to plus 5 volts!

The auto/manual switch is set to suit you—or, if you can't trigger on your input signal, try auto. Then, the trigger level control is adjusted for a stable trace. If you have trouble locking in the signal, a good rule of thumb is to check the slope switch, then switch to the auto sweep (auto/manual switch), and adjust the trigger level. This should do it. If you are looking at many signals at once, like a line of TV composite video, for example, remember that you will be able to lock in only the vertical or horizontal sync pulses, and not the video or all signals at once. The fact that a triggered scope can lock only one signal at a time is overlooked at times!

The remaining scope controls are few and easy to adjust. The intensity control is adjusted to show the trace in normal ambient light. Excessive brightness usually broadens the trace, making identification of narrow pulses difficult, so use minimum brightness. If necessary, move the scope away from bright overhead lights, or cut a lightshield for the CRT to screen out glare.

The focus control is adjusted for the sharpest trace, or course, but you can sometimes expose a narrow pulse in a signal by defocusing slightly; try it! That takes care of the scope panel controls.

Your scope has many important physical features of which you may not be aware. First, most low-cost scopes are very sensitive to magnetic fields. The most sensitive areas are the face of the CRT and the back of the scope. If you get too close to a magnetic field, you will bend the trace, and that can goof up your readings. Keep away from large power transformers, for example. Also, high-performance scopes generate quite a bit of heat, so for longer life allow plenty of ventilation. That means you should never stack equipment next to and over your scope if it generates a lot of heat. Finally, you should know that scopes are very sensitive to drops. If you drop it, or if it falls off a bench, you probably will damage something (not the CRT, one hopes). At the least, the calibration may have changed, so always check after a drop. It is wise to open the case and visually check the chassis for anything that has broken loose. Then, resolve to put it in a more secure place next time!

Let's hope this article enables you to get a little more out of your scope. It's tough to cover a subject like this in such a short article, but high spots have been discussed and pitfalls exposed, and that should help.■

FCC

Reprinted from the Federal Register.

47 CFR Part 97

[Docket No. 19852; FCC 79-758]

Providing for the Amateur-Satellite Service

AGENCY: Federal Communications Commission.

ACTION: Notice of Proposed Rulemaking.

SUMMARY: The Commission orders a Notice of Proposed Rulemaking to revise Part 97 of the Commission's rules and regulations. It is evident that the amateur satellite service has become an important facet of amateur radio, thus, it is now time to develop rules for the service. Hence, a statement of the amateur satellite service requirements in the rules would give notice to the amateur community on procedures to follow when engaging in amateur satellite service operations.

DATES: Comments must be received on or before February 5, 1980 and reply comments must be received on or before March 6, 1980.

FOR FURTHER INFORMATION CONTACT: Roy C. Howell, Federal Communications Commission, Private Radio Bureau, Personal Radio Branch (202) 254-6884.

ADDRESSES: Federal Communications Commission, 2025 M Street NW, Washington, D.C.

Adopted: November 20, 1979.
Released: December 4, 1979.

In the matter of amendment of Part 97 of the Commission's Rules to provide for Amateur-Satellite Service, Docket No. 19852. See Also 39 FR 1643, January 11, 1974.

Background

1. On February 14, 1973, the Commission adopted amendments to Part 2 of the Commission's rules in Docket No. 19547. These amendments incorporated into the rules the Amateur-Satellite Service (AMSS) as established by the World Administrative Radio Conference for Space Telecommunications in Geneva, 1971. Certain frequencies already allocated to the Amateur Radio Service were also allocated to AMSS. Furthermore, AMSS frequency bands 435-438 MHz are also shared with the Government Radiolocation Service on a secondary basis.

2. On October 25, 1973, the Commission adopted a Notice of Inquiry in Docket No. 19852 which was published in the **Federal Register** on November 8, 1973, 38 FR 30566 (1973). In our Notice of Inquiry, we indicated the desire to receive comments from interested parties concerning: The structures of the new Amateur-Satellite Service: the technical standards licensees in the Service should have to meet; and, the qualifications licensees should possess.

3. The Commission received approximately fifteen comments in response to the October 25, 1973 Notice of Inquiry. All comments received have been carefully analyzed by the Commission's staff and we are now prepared to issue formal proposals in this proceeding.

4. Prior to WARC-ST, five amateur space stations licensed by the FCC were placed in operation. Since WARC-ST, three more space stations licensed by the FCC became operational. These stations were operated pursuant to waiver of the Commission's rules for amateur radio stations (Part 97). It is evident that AMSS has become an important facet of Amateur Radio; thus, it is now time to develop rules for the service. Hence, a statement of the AMSS requirements in the Rules would give notice to the amatuer community on procedures to follow when engaging in AMSS operations. Therefore, the Commission could discontinue its present system of granting waivers on an individual basis. Consequently, the end result would be uniform regulations of AMSS operations.

International Regulations

5. As a result of WARC-ST, a new paragraph was added to Article 41 *Amateur Stations*, of the Radio Regulations of the International Telecommunication Union (ITU) (see. 156A Spa2 § 6, and the Appendix to this Notice). *This paragraph requires space* stations in AMSS to be fitted with devices for controlling emissions in the event harmful interference is reported. Furthermore, it requires FCC to inform the International Frequency Registration Board (I.F.R.B.) of all space stations to be authorized in AMSS. Additional, Article 7 of the ITU provides that "space stations shall be fitted with devices to ensure immediate cessation of their radio emissions by telecommand, whenever such cessation is required under the provisions of these regulations" (see 470 Spa2 § 24).

6. Elsewhere in the Radio Regulations of the ITU, definitions of terms related to space station operations were added, as were the requirements for advance publication coordination and notification.

Experience in Licensing Space Stations

7. F.C.C. experience in licensing space stations has brought Commission attention to various problems encountered when attempting to operate a space station pursuant to rules enacted to regulate other types of amateur radio stations, via Part 97. These are:

(A) § 97.79 *Control operator requirements and § 97.88 Operation of a station by remote control.* These rules require a control operator to be at an authorized control point whenever the station is in operation. For low earth orbit satellites, the station is not in view of any telecommand station for extended periods. Therefore, no single control operator, or any reasonable number of control operators, could possibly be at all times at a control point(s), able to command the space station, as required by the general rules.

(B) § 97.84 *Station identification.* This rule requires every amateur radio to transmit its assigned call letters. None of the amateur satellites authorized by the F.C.C. have had this capability. Furthermore, based on the F.C.C.'s experience in this area, the nature of space operation would seem to make such a requirement meaningless.

To date, F.C.C. licensed amateur space stations have simply identified themselves with the letters "HI" in Morse Code telegraph. Except for the first few amateur satellites, even this identification probably, serves no useful purpose.

Another area of concern regarding station identification is telecommand operation. To maintain the integrity of the telecommand capability, knowledge of the location and identity of such stations must be limited to only those persons engaging in controlling the space station. Otherwise, information on controlling the space station could fall into the hands of persons who could use it to effect improper operation of the station, possibly resulting in interference to other services or damage to the station.

For this reason, telecommand stations are not required to identify with F.C.C. assigned call signs. Their transmissions are brief, (time required to transmit a call sign could exceed the time required to transmit a series of commands), and their transmissions are directed skyward making the causing of interference unlikely.

(C) § 97.85 *Repeater operation and § 97.126 Retransmitting radio signals.* The only amateur radio station permitted to automatically retransmit the radio signals of other amateur radio stations are stations in repeater operation or auxiliary operation. This capability is one of the principal features of amateur satellites, so provision has to be made to permit it.

(D) § 97.91 *One-way communication.* This rule lists the types of one-way transmissions permitted in amateur radio which are not considered broadcasting (amateur radio stations may not broadcast). One-way space-to-earth telemetry transmissions from a space station, and one-way earth-to-space telecommand transmissions to a space station are not covered by this rule.

(E) § 97.117 *Codes and ciphers prohibited.* This rule prohibits the use of codes and ciphers in the Amateur radio service, where the intent is to obscure the meaning. Telemetry transmissions must use codes to transfer data, as do telecommand transmissions. While telemetry codes are only to facilitate communications, telecommand codes must also obscure the meaning of the message for the same reasons discussed under § 97.84 Station identification.

The Comments

8. Generally, very few comments expressed opposition to the establishment of an Amateur-Satellite Service. Only one comment expressed total opposition to the establishment of an Amateur-Satellite Service,[1] and, the rationale for this opposition was the following: "Whenever rules are issued governing a rapidly growing field, progress in that field inevitably slows or stops completely." Hence, according to the one negative comment any regulations for AMSS would hinder technological growth in this area. The Rules proposed herein are fundamentally the same set of rules AMSS has been operating under. We are proposing to move from a procedure based on a series of waivers, to one which is premised on rules developed via the rule making process.

9. One comment suggested that amateur communication achieved by reflection from the moon, should not be governed by the rules adopted for AMSS.[2] Such communication, it is claimed, does not represent a significant source of interference to other radio services, and is better regulated by the existing rules governing the Amateur Radio Service. Article 1 of the Radio Regulations of the ITU defines AMSS as "a radiocommunication service using space stations on earth satellites for the same purposes as those of the amateur service" (see, 84ATA, Spa2). This definition is used for the purpose of AMSS in the proposed rules. Therefore, communications conducted by passive reflection of signals off the moon would not constitute operation in AMSS.

The Proposal

10. The Commission proposes to add a new Subpart H, *Amateur-Satellite Service,* to Part 97 of the rules. The rules for the Amateur Radio Service would apply except in those instances specifically covered by the proposed Subpart. Generally, all amateur stations and amateur radio operators would be authorized to operate in the Amateur-Satellite Service to the extent of the privileges authorized by their amateur radio licenses, without any additional authorization by the Commission. Space operation would be limited to holders of the Amateur Extra Class operator license. Examination material related to the Amateur-Satellite Service is incorporated only in Examination Element 4(B), a requirement for the Amateur Extra Class license.

11. Any amateur radio station licensed by the Commission, having a control operator holding an operator license with the necessary frequency privileges, could be designated by the space station licensee to conduct telecommand operations. Certain privileges not afforded other amateur stations would be permitted authorized telecommand operations for the above-discussed reasons. Furthermore, the licensee of the space station could authorize amateur radio stations in other countries to conduct telecommand operations, subject to the regulations of the licensing authority in the other country. In regard to space stations licensed by the Commission, however, there would have to exist the capability to effect an immediate, permanent cessation of emissions from the space stations via telecommanded operations conducted by one or more stations licensed by the Commission.

12. We are proposing to exempt both space stations and telecommand stations from the station identification requirement for the reasons given in paragraph 7, above. Article 19 § 2 of the Radio Regulations of the ITU provides:

> "A station shall be identified by a call sign or other recognized means of identification. Such recognized means of identification may be one or more of the following necessary for complete identification: name of station, location of station, operating agency, official registration mark, flight identification number, selective call number or signal, selective call identification number or signal, characteristic signal, characteristic of emission or other clearly distinguishing features readily recognized internationally."

Instead of transmitting their call sign, information of the type specified by Article 19 § 2 would be filed with the F.C.C. by the station licensee.

13. In addition to Article 41 (see paragraph 5, above), Article 7 provides that "space stations shall be fitted with devices to ensure immediate cessation of their radio emissions by telecommand, whenever such cessation is required under the provisions of these Regulations" (see 470V Spa2, § 24). All of the frequency bands allocated to AMSS are shared with the Amateur radio service. Furthermore, AMSS frequency band 435-438 MHz is also shared with the Government radiolocation service. We are proposing to incorporate these requirements into the Rules.

14. Article 9A§ 2 (see, 839AA, Spa2) of the Radio Regulations of the International Telecommunication Union (ITU) sets out the procedure for the Advance Publication of information on planned Satellite Systems. The procedure is the following:

> "An administration (or one acting on behalf of a group of named administrations) which intends to establish a satellite system shall, prior to the co-ordination procedure in accordance with No. 839AJ where applicable, send to the International Frequency Registration Board not earlier than five years before the date of bringing into service each satellite network of the planned system, the information listed in Appendix 1B."

Article 9A, § 2, No. 839AJ provides the following:

> "Before an administration notifies to the Board or brings into use any frequency assignment to a space station on a geostationary satellite or to an earth station that is to communicate with a space station on a geostationary satellite, it shall effect co-ordination of the assignment with any other administration whose assignment in the same band for a space station on a geostationary satellite or for an earth station that communicates with a space station on a geostationary satellite or for an earth station that communicates with a space station on a geostationary satellite is recorded in the Master Register, or has been co-ordinated or is being co-ordinated under the provisions of this paragraph. "For this purpose, the Administration requesting co-ordination shall send to any other such Administration the information listed in Appendix A."

We are proposing that informational filings be at: two years, and three months (the three months are to allow for processing); updates one year, and three months. Further, we anticipate the first filing period could be waived where justified. However, amateur satellites placed into orbit prior to receiving international sanction may be required to discontinue operation in favor of a prior request, or to avoid interference to other radio services.

[1] This comment was filed by Amateur radio operator Mark Zimmerman.

[2] This comment was filed by amateur radio operator K. D. Tentarelli.

15. We seek comment on the proposal and on the desirability of the information requirement, particularly in terms of clarity of the questions, instructions, and format. The information requirements included herein are subject of General Accounting Office clearance.

Comments Solicited

16. The specific amendments we are proposing are set forth in the Appendix. Authority for issuance of this Notice is contained in Sections 4(i) and 303(r) of the Communications Act of 1934, as amended 47 U.S.C. 154 (i) and 303(r). Pursuant to procedures set out in § 1.415 of the rules and regulations, 47 CFR 1.415, interested persons may file comments on or before February 5, 1980, and reply comments on or before March 6, 1980. All relevant and timely comments will be considered by the Commission before final action is taken in this proceeding. In reaching its decision, the Commission may take into consideration information and ideas not contained in the comments provided that such information or a writing indicating the nature and source of such information is placed in the public file, and provided that the fact of the Commission's reliance on such information is noted in the Report and Order.

17. In accordance with the provisions of § 1.419 of the rules and regulations, 47 CFR 1.419, formal participants shall file an original and 5 copies of their comments and other materials. Participants wishing each Commissioner to have a personal copy of their comments should file an original and 11 copies. Members of the general public who wish to express their interest by participating informally may do so by submitting one copy. All comments are given the same consideration, regardless of the number of copies submitted. All documents will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, DC.

18. For further information concerning this rule making, contact Roy C. Howell, Rules Division, Private Radio Bureau, Federal Communications Commission, Washington, DC 20554, (202) 254–6884.

Federal Communications Commission.
William J. Tricarico,
Secretary.

Appendix

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is proposed to be amended as follows:

§ 97.3 [Amended]

1. In § 97.3, paragraphs (i) and (k) are deleted and designated (Reserved).
2. A new Subpart H is added, as follows:

Subpart H—Amateur-Satellite Service

General

Sec.
97.401 Purpose.
97.403 Definitions.
97.405 Applicability of rules.
97.407 Eligibility for space operations.
97.409 Eligibility for earth operations.
97.411 Eligibility for telecommand operation.
97.413 Space operation requirements.

Technical Requirements

97.415 Frequencies available.

Special Provisions

97.417 Space operation.
97.419 Telemetry.
97.421 Telecommand operation.
97.423 International advance publication.
97.425 International coordination.
97.427 Notification required.

Authority: Secs. 4(i) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i) and 303(r).

Subpart H—Amateur-Satellite Service

General

§ 97.401 Purposes.

The Amateur-satellite Service is a radio communication service using stations on earth satellites for the same purposes as those of the Amateur Radio Service.

§ 97.403 Definitions.

(a) *Space operation.* Space-to-earth amateur radio communication from a station which is beyond, is intended to go beyond, or has been beyond the major portion of the earth's atmosphere.

(b) *Earth operation.* Earth-to-space-to-earth amateur radio communication by means of radio signals automatically retransmitted by stations in space operation.

(c) *Telecommand operation.* Earth-to-space amateur radio communications to initiate, modify, or terminate functions of a station in space operation.

(d) *Telemetry.* Space-to-earth transmissions, by a station in space operation, of results of measurements made in the station, including those relating to the function of the station.

§ 97.405 Applicability of rules.

In all cases not specifically covered by the provisions of this Subpart, stations in space operation, telecommand operation, and earth operation, shall be governed by the provisions of the rules governing amateur radio stations and operators (Subpart A through E of this part).

§ 97.407 Eligibility for space operation.

Amateur radio stations licensed to Amateur Extra class operators are eligible for space operation.

§ 97.409 Eligibility for earth operation.

Any amateur radio station is eligible for earth operation, subject to the privileges of the operator's class of license.

§ 97.411 Eligibility for telecommand operation.

Any amateur radio station designated by the licensee of a station in space operation is eligible to conduct telecommand operation with that station in space operation.

§ 97.413 Space operation requirements.

An amateur radio station may be in space operation where:

(a) The station has not been ordered by the Commission to cease radio transmissions.

(b) The station is capable of effecting a cessation of radio transmissions by commands transmitted by station(s) in telecommand operation whenever such cessation is ordered by the Commission.

(c) There are in place, sufficient amateur radio stations licensed by the Commission capable of telecommand operation to effect cessation of space operation, whenever such is ordered by the Commission.

(d) The notifications required by § 97.423 (b) & (c) are on file with the Commission.

Technical Requirements

§ 97.415 Frequencies available.

The following frequency bands are available for space operation, earth operation, and telecommand operation.

Frequency Bands

kHz

7000–7100
14000–14250

MHz

21.00–21.45
28.00–29.70
144–146
435–438(1)

GHz

24–25.05

Stations operating in the Amateur-satellite Service shall not cause harmful interference to other stations between 435 and 438 MHz

Special Provisions

§ 97.417 Space operation.

(a) Stations in space operation are exempt from the station identification requirements of § 97.87 on each frequency band when in use.

(b) Stations in space operation may automatically retransmit the radio signals of other stations in earth operation, and space operation.

§ 97.419 Telemetry.

(a) Telemetry transmission by stations in space operation may consist of specially coded messages intended to facilitate communications.

(b) Telemetry transmissions by stations in space operation are permissable one-way communications.

§ 97.421 Telecommand operation.

(a) Stations in telecommand operation may transmit special codes intended to obscure the meaning of command messages to the station in space operation.

(b) Stations in telecommand operation are exempt from the station identification requirements of § 97.87.

§ 97.423 International advance publication.

All stations to operate on earth satellites or to communicate with stations on earth satellites are subject to the international advance publication procedure for the purpose of informing foreign administrations, in advance, of the intended operation. The proposed technical parameters of planned stations are to be published internationally (generally from 2 to 5 years prior to the commencement of space operations). The data required for this purpose are set forth in Appendix 1B of the international Radio Regulations.

§ 97.425 International coordination.

All stations proposed for earth and space operations and which utilize an earth satellite in a geostationary orbit are required to be prior coordinated with affected foreign administrations pursuant to the provisions of Article 9A of the international Radio Regulations. For this purpose, the Commision is obligated to collect and forward the data specified in Appendix 1A of the international Radio Regulations. No coordination is required for operations utilizing non-geostationary orbits.

§ 97.427 Notification required.

(a) The licensee of every station in space operation shall give written notifications to the Private Radio Bureau, Federal Communications Commission, Washington, D.C. 20554.

(b) Pre-space operation notification.

(1) Three Notifications are required prior to initiating space operation. They are:

(i) *First Notification.* Required no less than twenty-seven months prior to initiating space operation.

(ii) *Second Notification.* Required no less than fifteen months prior to initiating space operation.

(iii) *Third Notification.* Required no less than three months prior to initiating space operation.

(2) The pre-space operation notification shall consist of:

(i) *Space operation date.* A statement of the expected date space operations will be initiated, and a prediction of the duration of the operation.

(ii) *Identity of satellite.* The name which the satellite will be known.

(iii) *Service area.* A description of the geographic area on the Earth's surface which is capable of being served by the station in space operation. Specify for both the transmitting and receiving antennas of this station.

(iv) *Orbital Parameters.* A description of the anticipated orbital parameters as follows:

Non-geostationary satellite

(1) Angle of inclination
(2) Period
(3) Apogee (kilometers)
(4) Perigee (kilometers)
(5) Number of satellites having the same orbital characteristics

Geostationary satellites

(1) Nominal geographical longitude
(2) Longitudinal tolerance
(3) Inclination tolerance
(4) Geographical longitudes marking the extremities of the orbital arc over which the satellite is visible at a minimum angle of elevation of 10° at points within the associated service area.
(5) Geographical longitudes marking the extremities of the orbital arc within which the satellite must be located to provide communications to the specified service area.
(6) Reason when the orbital arc of (5) is, less than that of (4)

(5) *Technical Parameters.* A description of the proposed technical parameters for the station in space operation and all other stations to engage in satellite communications; however, recognizing that a wide variety of amateur radio stations would be transmitting and receiving from a station on an earth satellite, only the parameters of a "typical" such station should be indicated. The description where possible, shall include the following:

(1) Carrier frequency [1]
(2) Necessary bandwidth [2]
(3) Class of emission [2]
(4) Total Peak Power [2]
(5) Maximum power density (watts/Hz)
(6) Antenna radiation pattern [3]
(7) Antenna gain (main beam) [3]
(8) Antenna pointing accuracy (geostationary satellites only) [2]
(9) Receiving system noise temperature [4]
(10) Lowest equivalent satellite link noise temperature [5]

(c) *In-space operation notification.* Notification is required after space operation has been initiated. The notification shall update the information contained in the pre-space operation notification. In-space operation notification is required no later than seven days following initiation of space operation.

(d) *Post-space operation notification.* Notification of termination of space operation is required no later than three months after termination is complete. If the termination is ordered by the Commission, notification is required no later than twenty-four hours after termination is complete.

* * * * *

3. In Appendix 2, the undesignated paragraph following the headnote is revised, and a new paragraph SEC. 6 is added as follows:

Appendix 2

Extracts From Radio Regulations Annexed to the International Telecommunications Convention (Geneva, 1959), as revised by the World Administrative Radio Conference for Space Telecommunications, Geneva, 1971.

* * * * *

Article 41—Amateur Stations

* * * * *

Sec. 6. Space stations in the Amateur-satellite Service operating in bands shared with other services shall be fitted with appropriate devices for controlling emissions in the event that harmful interference is reported in accordance with the procedure laid down in Article 15. Administrations authorizing such space stations shall inform the International Frequency Registration Board (I.F.R.B.) and shall ensure that sufficient earth command stations are established before launch to guarantee that any harmful interference that might be reported can be terminated by the authorizing Administration.

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[1] Only the frequency range in which the carrier frequencies will be located need be submitted for international advance publication purposes if carrier frequencies have not been determined.

[2] Not required for international advance publication but should be included if this information is available.

[3] These antenas characteristics shall be provided for both transmitting and receiving antennas.

[4] For a station in space operations.

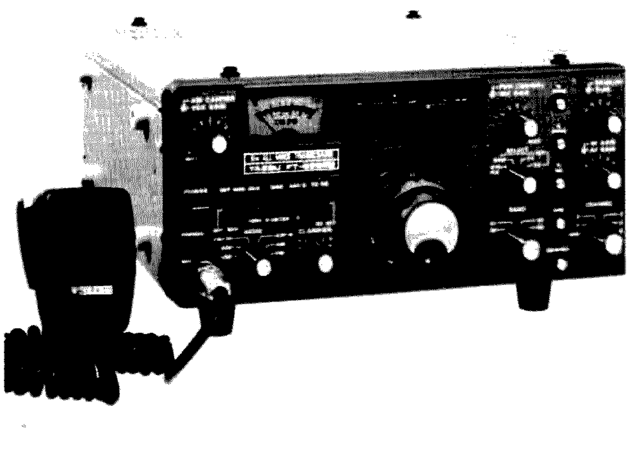
[5] The noise temperature at the input of a typical amateur radio station receiver corresponding to the radio frequency noise power which produces the total observed noise at the output of the satellite link excluding noise from other non-associated radio systems.

6m Fun with the FT-625RD

—six is hot, so why not?

Glenn W. Malme W6OJF
9337 Gotham Street
Downey CA 90241

Probably 95% of the current ham population knows that six meters is one of their bands, and that's about all. Others have heard about TVI problems—and gave up before they started. Those days are now gone, for the most part.



The Yaesu FT-625RD.

After World War II, six meters became my first love. It all started when Pappy Dow, who ran a surplus store in Pasadena, sold a group of us the Collins MBF. The name Collins did the trick. All we had to do was move that ac/dc transceiver to the six-meter band. TV was just starting out here on the coast. W6XAO was the station call for Channel Two. To say that we had TVI problems was putting it mildly. I recall one neighbor walking around the block getting signatures on a petition to have me forced off the air.

About this time I met Faust Gonsett. Faust had introduced his world-famous two-meter Communicator. Why not one for six meters, I asked Faust? Sure enough, his little company in Burbank soon gave birth to the six-meter version.

Six meters was as hot as the proverbial two-dollar pistol. It was open worldwide every day and sometimes late into the night. I recall putting my six-meter Gonset (one T for the product, two Ts for Faust's name) in my 1953 Plymouth, connecting the antenna from the car's radio to the rig, calling CQ, and literally working the world. Each noon I had regular skeds on my way home for lunch with LU9MA in Argentina. He'd give me 40 over 9 reports for my little "4-Watts-out" Gonset while mobiling. The car antenna pulled out to 55 inches, which was just right for six. And, in just one weekend in the early 1950s, I worked all 48 states. This was before Hawaii and Alaska joined the group.

So why am I telling you all this? Simply because it's about to happen again. Six meters is again coming into its own and along with 10 meters will be the hottest of the ham bands. I had been reading the propagation reports, and my blood pressure began to build up. Could it really be? I dusted off my Gonset Com 3, checked it over, fired up the old girl, and connected it to a makeshift CB ground plane which I had hurriedly chopped down for six meters. The old Gonset tuned up just fine. The output was about 4 Watts, and the swr was 1.5:1 after a bit of tinkering.

The band was dead, not a signal to be heard. So I did some more tinkering and then QRZed the band. Now I heard a carrier. To make my story short, it was a KH6.

He was as surprised as I was. "I think everyone just sits around and listens; no one ever calls CQ," he observed. He flipped his two-meter rig on one of the

island repeaters and rousted up two others who quickly fired up on six. When we were through, I tuned the band and found several sideband stations down around 50.1, but as the old Gonset is strictly AM, I couldn't do much.

So that started me looking about, and the end result is that I now have a new do-everything Yaesu all-mode FT-625RD transceiver on my operating desk. This beautiful little rig will do everything but make a cup of coffee. The FT-625RD covers 50-54 MHz in four one-MHz switch positions. Frequency readout is in red-colored LEDs. The rig offers a memory system which provides for storage and recall of any transmit, receive, or transceive frequency. A 600-cycle CW filter is available for CW operators.

Built into every FT-625RD is an rf speech processor, a noise blanker which just can't be beat, VOX, semi-break-in CW with sidetone, and offset tuning (clarifier) for both receive and transceive frequencies. It has a novel automatic mike gain control (AMGC) which acts as a microphone squelch to minimize transmission of random noises in the operating room.

Hey, I forgot to tell you appliance operators that once you peak the receive signal on a multipurpose S-meter (one knob does it), you are all set to transmit—no tuning, dipping, and loading! And, there's a knob which varies the output anywhere from one to 25 Watts.

For FM enthusiasts, the FT-625RD includes a plus or minus 1-MHz repeater split plus an auxiliary split for use with a crystal. Tone burst and a discriminator center meter are included for maximum versatility.

For you guys who want to lift the hood and see what the motor looks like, you're in for a pleasant surprise. Completely solid state, all circuits are on plug-in computer-type circuit boards. Rear panel connections are for relay control, ALC input, PTT (for foot-switch control if you wish), CW jack, and connection for an external speaker if you so choose.

The front panel has every conceivable goody you can ask for. The mode switch provides LSB, USB, FM, AM, and CW. While the rig is vfo controlled, there is provision for 5 crystal positions and any split up to 4 MHz is possible with optional crystal.

And, like all Yaesu products, the transceiver will accommodate any 50-to-60-cycle line voltage, thanks to a tapped power transformer, from 100 volts to 234 volts. The FT-625RD transformer in the US models is set for 117 V ac. And, if you want to run the rig mobile, a second power cord is provided for 12 V dc. It takes 700 milliamps on receive and 7 Amps on transmit. On AM, you'll get 8 Watts of rf output, and, as I said, up to a comfortable 25 Watts on other modes. All you need to get on the air is an antenna. All power cords, PTT mike, and built-in speaker are furnished.

I just signed with WB6WOX, WB6JBC, and WB6DLR, each of whom praised the transceiver's performance at the receive end. After we signed, I tried to call WB6DLR back, only to be told that he was on his way to "the local candy store"—no doubt to get his FT-625RD.

Six meters will be a new frontier for most of the hams today. So, why not join the gang and, as the band gets better each day, work the world?■

Paul Lutus
291 N. Gold Canyon Dr.
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Albert and his Theories
—a layman's look at Einstein

"I do not know how I may appear to the world; but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me."
—Isaac Newton

"In the light of knowledge attained, the happy achievement seems almost a matter of course, and any intelligent student can grasp it without too much trouble. But the years of anxious searching in the dark, with their intense longing, their alternations of confidence and exhaustion, and the final emergence into the light—only those who have themselves experienced it can understand that."—Albert Einstein

You might as well discard the belief that relativity theory is too complex for mortal man or woman to comprehend, because you will have a good understanding of its physical and philosophical implications in a few more pages—perhaps in spite of yourself. You may then join in some speculations about those matters which lie beyond the theory, areas about which little is known for sure. If you are clever enough, you may someday make a fundamental contribution to that frontier of knowledge, as Einstein did in his own time. He, after all, was mortal, rumors to the contrary notwithstanding.

Some History

Someone once defined science as not so much knowing, but knowing that we know, in the sense of testing each theory exhaustively and inventing hypotheses to tear down existing beliefs. It is hoped that, by straining ideas this way, only those unshakable ones will survive and win general acceptance. It doesn't always work that way. Sometimes the theories include hidden assumptions that are themselves not subjected to test, assumptions so intrinsic in our thinking that we don't realize that they can be questioned.

While all his friends were out getting the plague, Isaac Newton was hiding in his mother's house in Woolsthorpe, England. He had some prisms to play with, among other things. He was very clever, and experimented at length with the prisms, until he was sure that the prevailing theories of light were wrong. He had few hidden assumptions, which was very helpful. The young are like that.

It was then thought that colors appeared from prisms because thin glass passed only red, and hence through the colors to the thickest part of the prism, passing violet. Newton disproved this in a simple way: He divided a beam of sunlight into its component colors with one prism, and then placed a second prism in the colors which resulted. He saw that there were no further changes in the colors, which would have been required by the prevailing theory. He foolishly printed this proof, which, among other things, made all the existing physicists look silly for having swallowed the old belief without test. One of them, Robert Hooke, literally argued with him until he (Hooke) was dead. The old are like that.

The important thing to come out of Newton's work with light, however, was the idea that it consisted of waves, not particles. (It may turn out that neither is true, but that's another story.) This had important consequences, for a particle can just fly along, but a wave must have a medium through which it passes. When you watch spreading ripples on a pool of water, you aren't watching a physical thing, after all—you are watching energy transfer itself through the water accord-

ing to some rules having to do with, for example, the water's density and the gravitational force acting on the water. The water must be there for the ripples, and air is needed for sound waves, and so forth.

As a result of Newton's finding, therefore, it was seen that some kind of medium must permeate all of space, to carry the waves of starlight to us. It was named ether, and within a short time everybody called it The Ether (doubtless, named by the same guy who called fluxions "The Calculus"), as if it was a sure thing and nobody would call it wrong. Lots of experiments seemed to confirm its existence, and after a while people got tired of talking about it. It became a hidden assumption. So everybody was happy and went home. Very human. Don't forget: Scientists are *human*.

But a man named Maxwell rocked the boat in the late 1800s. He didn't mean to: In fact, his theories about electromagnetism included the ether assumption. He just thought it would be fascinating to measure the Earth's speed through the ether. He saw that this could be done by measuring the speed of light in different directions, for, by so doing, one could find the direction and speed through the ether.

An American, Albert Michelson, saw a way for this to be done with sufficient sensitivity to detect the motion, using two beams of light, one moving out and back in the presumed direction of travel, one moving perpendicular to this direction. These two beams could be combined after their trips, and compared. By measuring the two beams, it was possible to get around the problem of actually measuring the speed of light directly; one measures instead the difference in travel time for the beams, using, in other words, one beam to test the other.

This can be done in the following way: If one drops two stones in a pond, the waves will meet in the center and create an interesting pattern of bumps, elongated areas, and quiet areas. The quiet areas are those places where the two waves oppose exactly, peak to trough. This is called interference, and it works for all waves.

When two light waves (of a single color) are made to meet in this way, the areas of opposition are dark. This results in a pattern of light and dark bars, each dark bar indicating an interval of distance nearly as small as that of light waves themselves. This makes the method very sensitive, sensitive enough to measure the difference between the two beams in their journeys.

The difference Michelson intended to measure was to be the result of the different travel time taken by a beam of light moving along the direction of travel versus one moving across the path. (See Fig. 1.) At first glance, it would seem that a beam moving out and back would be slowed down on the outward trip, then speeded up equally as it came back, pushed forward by the ether. But it turns out that the outward trip takes longer, because it is slower, and this results in a measurable difference when compared with the crosswise beam. If such a difference existed, this device would detect it. Michelson intended to rotate the entire apparatus, so that the out-and-back and the crosswise beams would trade places, and look at the interference pattern to see if it changed appearance.

Poor Mr. Michelson! He was so upset. No matter how he turned his apparatus, there was no change in the appearance of the light and dark bars. As if there were no ether! But, of course, there had to be.

He repeated his experiment with better equipment, in collaboration with Edward Morley. (Scientists always gang up when they get nervous; very human.) This was a beautiful piece of equipment, a huge slab of marble (to minimize the effect of vibration on the interference pattern), floating in a pool of mercury (to facilitate turning). All this served to reinforce the original conclusion: no difference.

Michelson considered the experiment a failure, but some saw the other, more frightening possibility, that of no ether. Immediately, however, it was decided to try to save the ether (a term actually used at this time) by developing an explanation for Michelson's null result. Perhaps the ether is dragged along by the Earth, like a sheath, so that experiments conducted at the surface would not reveal the motion? Experiments ruled this out. Maybe the Earth doesn't move? Such was the state of panic.

George FitzGerald proposed a really strange explanation: Everything gets shorter in its direction of travel through the ether, using the following formula: $L' = L\sqrt{1-(V^2/C^2)}$, where C is the velocity of light, V is the speed of travel in compatible units, L is the original length (at rest) and L′ is the length that comes about by moving at velocity V. This would explain the null result of Michelson's experiment: Everything gets a little shorter, just compensating for the expected difference in travel time of the light beam!

Hendrik Lorentz later expanded on this idea (thus perhaps saving FitzGerald from the nuthouse), including an even stranger correction for a problem he foresaw: No test at that time could distinguish between the forward-moving travel-time problem, and the smaller crosswise problem, which also would

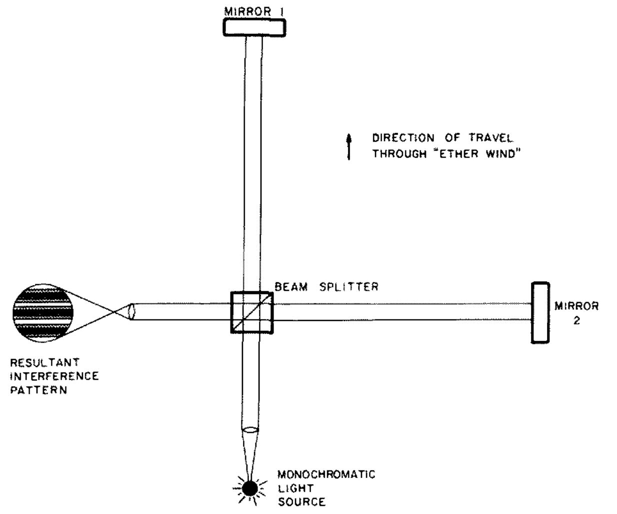

Fig. 1. The Michelson-Morley Interferometer. The travel time for forward case (mirror 1): $t' = t/[1-(V/C)^2]$; for perpendicular case (mirror 2): $t' = t\sqrt{1/[1-(V/C)^2]}$, where t = travel time "at rest," t′ = travel time when apparatus is at velocity V, through "ether wind," and C = speed of light in compatible units.

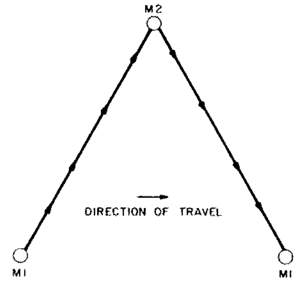

Fig. 2.

have to be explained eventually. The crosswise problem is illustrated in Fig. 2.

A beam leaves mirror 1, and travels to mirror 2, then back again. An observer who is "not moving" relative to the experiment sees it as drawn. Instead of the distance being straight between the two mirrors, the beam must move at an angle, and, more importantly, move over a greater distance, than if the system were "at rest." For some involved reasons, the shrinkage used in the forward direction cannot be invoked here. So what's left? What else can we bend, in order to save the ether? Time, said Lorentz; time is all we have left. If the beam moves over a greater distance, and takes no longer, which was shown in the Michelson-Morley experiment, then time itself must change nature at the velocity of travel to compensate. He invoked the same formula used for lengths, this time dividing instead of multiplying, so that time was dilated as lengths were shortened.

These ideas were met with wonder, but the alternative was to abandon the concept of an ether, which was far worse. That would have meant giving up the wave theory entirely, leaving lenses and other such commonplace devices without an explanation. Light, after all, had been shown to faithfully propagate at a specific and constant velocity. Particles move at all kinds of speeds, depending on their

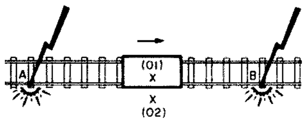

Fig. 3.

nature and energy, but light was constant.

Nobody wanted to give up the ether—the world would have become a scary place. So they listened nervously as Lorentz explained about the effect of traveling at the speed of light. Lengths in the direction of motion would shrink to zero, he said, and time would stand still. Lorentz was a physicist, remember, not a diplomat.

The Special Theory of Relativity

When Albert Einstein was 16, he asked himself the question, what would the world look like if I were traveling on a beam of light? No one could have helped him at that time, there being a great fuss about the threatened "loss" of the ether, and a lot of new theories were trying to rescue it, some simple, some complex, none subject to experiment. He pondered this idea alone in Germany, and later in Switzerland. (He chose Switzerland, when he was permitted to choose, because he hated the military atmosphere in Germany, and swore himself to lifelong pacifism; isn't fate cruel?)

He worked in the patent office in Bern in his early twenties, sometimes surreptitiously working on his calculations, quickly hiding his notes whenever someone approached. His job was to evaluate patents submitted to the office for worth. I have a copy of one before me now that he may have had occasion to see. It is an improved popgun. Isn't that great? "Hey, Sam, Al Einstein over at the patent office likes your popgun!"

The job at the patent office followed a so-so academic career; his salary was augmented by tutoring positions, in which he taught mathematics and physics to private individuals for small fees. His attempts to enter the universities as a teacher, hoping eventually to become a professor, were not successful. The pile of notes in his desk grew more voluminous as time passed.

In 1905 Einstein submitted a paper to a famous German journal of experimental physics, *Annalen Der Physik*. The title of the paper was "On the Electrodynamics of Moving Bodies." The contents of this paper were later to become known as the theory of special relativity. Special relativity deals with the theory that uniform (non-accelerated) motion cannot be detected in the sense of being compared with some universal frame of reference, such as an ether. In this theory, Einstein explains the apparent failure of the Michelson-Morley experiment (without referring to it specifically) and gives the Lorentz contraction theory a new interpretation. Essentially, he kept all of Lorentz's formulas, but explained them differently.

In his theory, it is postulated that there is no experiment which can be conducted inside a closed, uniformly moving vessel to detect motion. Newton's theory stated that no mechanical experiment would reveal any motion which might exist; Einstein's theory extended this to include optical or other experiments.

Think about this for a minute. If no optical experiment can reveal the speed of travel (inside the closed frame of reference), then Michelson's ether either doesn't exist, or is of no use in establishing speed. This means that every experiment ever conducted that gave a speed for light referred that speed to something other than the ether, or the background stars, or the sun's environment. What, then?

It was Einstein's genius that revealed to him the hidden assumption of those before him: that the speed of light existed apart from the truly basic things that make up the universe of the senses, space in three dimensions, and time. He explained that the speed of light is as basic to the structure of space as up, down, or sideways. And, in some cases, if it came to a necessary change in one of these, the speed of light would bend the others to fit its own constant velocity. It was shown to be as fundamental in the structure of space as any of these, to be, in essence, a yardstick of time, although that specific description was to come later.

Besides expanding on Newton's mechanical relativity, therefore, Einstein included the requirement that the speed of light be constant, regardless of the motion of its source. A spacecraft traveling at half the speed of light, sending a beam of light out in the direction of travel, would be seen by another spacecraft (which was at rest, relative to the first) to be sending a beam of light at the normal velocity. But measurements onboard the first would reveal that the beam is traveling at the usual velocity of light, which, in the world before Einstein, would have meant a speed 1½ times that of light!

One may ask, which is the true speed? Which spacecraft is "right"? In the world of Einstein, there are no longer absolute answers

to such questions, because time and space are themselves no longer absolute.

The best example of this uncertainty is a thought experiment used by Einstein himself. Consider the following and see Fig. 3: Two observers (O1 and O2 in the illustration) are passing one another. One is standing on the embankment of a railroad track, the other is riding in the train. At the instant that the two observers are across from one another, two lightning bolts strike equidistant points along the railroad track, one in front of, one behind the train. The observer on the embankment sees the two flashes as simultaneous. The moving observer, since he is moving towards one flash and away from the other, sees the forward flash first. The observer on the embankment concludes that since he was stationary and saw the two equidistant flashes simultaneously, they really were simultaneous. The observer on the train, aware of his motion, calculates the difference between the arrival times of the flashes and he, too, concludes that they were simultaneous.

This all precedes Einstein, of course. In Einstein's relative view of these events, the observer on the embankment has just as much right to assume that he is the one in motion, he and the rest of the world, backwards in relation to the train, and that the observer on the train is stationary. Now the embankment observer concludes that since he is actually moving backwards toward the flash behind the train and he saw them simultaneously, the forward flash happened first and caught up. The train observer, using the same logic, agrees, since he is now "at rest" and saw the forward flash first.

So we can no longer say with absolute certainty whether two such events are simultaneous, or have any other order, and this uncertainty increases as the distances between events increases. Absolute determinism of the old kind remains only for events which have no spatial separation. Two colliding ice skaters still *really* collide simultaneously.

In some cases, it can be said that event B *followed* event A, such as a case where a radio signal (which travels at the speed of light) arrives, delivering a message to turn off the bath before it overflows. This case meets the requirement that the space-distance, measured as an ordinary distance, is less than the time-distance, measured with the new yardstick of the speed of light. This has important consequences other than baths, for, if the space-distance is greater than the time-distance, event B cannot have been caused by event A (the sending of the signal), because no signal or material particle can move with a velocity greater than that of light. Imagine a sphere of causality, spreading out through space at the speed of light, within which volume events may be caused by the original signal, but outside which, events *cannot*.

The interesting effects predicted by Lorentz now are part of the geometry of Einstein's universe, but for quite different reasons than originally formulated. In Lorentz's view, the shrinkage in the direction of travel was a change in an object's true dimensions, due to the pressure of the ether wind. In Einstein's view, whatever dimension is taken is the true dimension, because an object's reality is defined as much by velocity as by space coordinates and sizes. The time dilation described by Lorentz to save the ether is used in the same proportion to describe a geometric change in space-time, in which time and space are on an equal footing, and in accord with the requirement that the speed of light be the same for all observers in all states of motion.

Consider Fig. 4. Here, a rowboat moves across a river, seen (A) from the frame of reference of the riverbank, and (B) from the frame of reference of the flowing water. Clearly, an observer on the bank sees a larger distance traveled than the observer on the boat itself. If the boat were a beam of light, and its transit time were clocked both by a waterborne and beached observer, there would be two different velocities recorded for light, because velocity is distance per unit of time. To complicate matters unnecessarily, let us say that there is a helicopter flying overhead at three times the stream flow rate. This observer would see the boat moving backwards at twice the rate seen by the bank observer!

One might generalize and say that there are an infinite number of frames of reference, each giving a different value for the speed of light.

In the case of light beams, however, there is no "water" and no preferred frame of reference. A nosy spacecraft occupant, peeking into the window of another which is moving at a different rate of speed,

—might watch a test of the speed of light,

—might see just such an elongated light path brought about by the difference in the speeds of the two craft,

—might see the other's clock timing the transit of the beam,

—and might smugly note that, as far as *he* is concerned, the beam moved over a greater distance than the other crew perceives. He would then see the clock inside the other spacecraft, and notice that it is slow. Not just off, as in maladjusted, but running at a different rate entirely.

To make matters worse, the other astronaut is holding a sign up to him now, in the porthole through which he watched the experiment. It reads: *"Your Clock Is Slow."*

A final, and important effect of the special theory is the one having to do with mass. Let us say that one wants to measure the mass of a cannonball inside one of our disagreeing spacecraft. On Earth, one may simply weigh it, but in space we must employ a more roundabout method: We measure its inertia, its resistance to change. After all, Newton and Galileo showed that inertia is proportional to mass. So we push against the cannonball with a measured force, and see how much time it takes for the ball to get moving at a specified rate.

From the standpoint of our own clock, the mass is the same as on Earth. But our friends are waving another sign from the other ship: *"Your Clock Is Slow And That Cannonball Is Heavier Than You Think."* That other crew, who used their own clock to judge the mass of the ball, found it to be heavier since it took more time, as they perceived it, to get it rolling.

This is the real limitation to an approach to the speed of light: The mass of the craft would approach infinity, requiring infinite energy to make the final push to the speed at which photons move. And they seem so ordinary!

This mass increase rounds out the effects of

the special theory: Time dilates, length in the direction of travel shortens, mass increases; all as seen by a relatively stationary observer, and all in accord with the quantity: $\sqrt{1-(V^2/C^2)}$.

It is important to understand that everything, not just clocks, slows down on the moving frame. After all, the reason clocks slow down is because the paths by which atoms communicate with one another (at the speed of light) are lengthened by the above formula, and all the messages about mechanical state or energy level therefore take longer to deliver. In a balance-wheel clock, for example, the pressure of the spring can be transmitted to the wheel at no greater than the speed of light, and the path of travel is now longer. The present state of inertia of the wheel itself is transmitted back at the same speed, also over a greater distance. It doesn't require magic, it just required an Einstein to think of it in the first place!

If you happen to have a fantastic sense of rhythm, you still won't notice the change in the clock's ticking, because your body will slow down by the same amount. You will age less quickly than those at rest. Of course, if you look out a porthole, you will see everything happening at a faster pace than usual, and all inside the craft will seem completely normal.

Einstein kept on thinking, after the publication of the special theory. Three months later, he published another paper in which he showed that if a body gives off energy, it loses mass by the relation: $M' = E/C^2$, in which M' is the "lost" mass. During the next two years he realized that the reverse must also hold: that all mass has energy, and, finally, that they are equivalent. He expressed their equivalence this way: $E = mc^2$.

A proof of this equality was, at the time, difficult. Later on, it became easier.

Learning to resist the temptation to re-prove Einstein's mass-energy equivalence theory involving large groups of civilians has become the most important task facing us.

The General Theory

The special theory won Einstein wide recognition, although some physicists refused to accept the ideas—which is as it should be. Many changes came about for him as a result, but he was busy with a new problem. You will remember that the special theory dealt with the equivalence of uniformly moving bodies, those that are not being accelerated. Einstein wanted to prove that these, too, were equivalent, and that no test could distinguish between them, using the same rules as in the case of uniform motion.

This was going to be tough. After all, if a rocket's motors are pushing the rocket forward, it is very likely that the occupants will be pushed into their seats as a result of the inertia of their bodies, and they will realize, in the absence of any other clues, that they are being accelerated.

True, said Einstein, but can they distinguish between, say, a 32-foot-per-second acceleration in a spacecraft, and just sitting on the ground? He began to think about the similarity of gravitational and inertial effects.

Galileo had shown that the force of inertia is proportional to the force of gravity—that is, for a given mass, the force of gravity drawing it to the ground is in proportion to the inertial force resisting the movement. Thus, objects of greatly differing masses, ignoring air resistance, fall at the same rate. Isn't it strange, thought Einstein, that these forces are exactly proportional?

In 1916, after 11 years of study, he published the general theory of relativity, so named because all forms of motion, not just uniform, are shown to be equivalent as far as any test or special effects are concerned.

To accomplish this, it was necessary to deal with some very difficult questions. For example: In an accelerating spacecraft, an astronaut is being pushed into his seat by inertia. If we now take the spacecraft as the frame of reference, and assume the universe to be moving backward all around it, how does the inertial force arise then?

Einstein explained it this way: Inertial forces arise equally between any two material bodies which are accelerated relative to one another. Once the two bodies are in uniform motion, or at rest, the force disappears. Try to change the state of motion between them, and the force appears resisting the acceleration. Therefore, he said, inertia comes about as an interaction between the spaceship and all the rest of the matter in the universe, and one might as well think the universe is in motion, as the spacecraft—the force would be the same.

As for the relationship between inertia and gravity, Einstein had something wonderful to say about it, which will take a little telling.

In Fig. 5, a light beam is shown passing from one side of the spacecraft to the other, while the craft is being accelerated. This makes the beam, as seen from the spacecraft, take the path shown.

Does this remind you of something? The astronauts, measuring the time the beam takes, will find a different result than those not accelerating, and this would violate the constancy of the speed of light. But, as in the special theory, because of the curved path, the clocks used to measure the time are slowed down. (The formulas are more involved because the path is curved, but time-dilation is the result in either case.)

Now take the case of a laboratory on Earth, being accelerated by gravity at 32 feet per second. According to the general theory, there is nothing special about the frame of reference of the lab that can distinguish it from a spacecraft being accelerated by the same amount. Doesn't that mean the clocks will be slowed down in the lab on Earth, just as in the spacecraft? Yes, says Einstein. Time passes more slowly in a gravitational field than out in space.

And it happens in much the same way as in the special theory: by bending space itself, and time, so that the constancy of the speed of light is maintained.

Having said all that, we now come to the crowning achievement of the general theory: Gravity and inertia are the same thing. They're the same force! Because of the change of geometry of space near large masses like the Earth, objects move towards it, "thinking" themselves to be in uniform motion. This is important: The moon, traveling in its orbit, "thinks" that it is moving in a straight line, and no acceleration is required to make it move in a circle, or ellipse. How can this be?

Try this thought experiment. Two observers are on the moon, one on the far side, one on the

near side. They are required to operate little rocket motors so that both sides of the moon move forward at the same speed, so that it moves in a straight line. (They obviously were hired by Newton.) Every second, each pulses his rocket by a measured amount. This would seem to move the moon off and away in a straight line (in the absence of gravity, which we haven't yet invoked).

But the observer on the near side is nearer to the Earth than the other, and, as was shown above, his clock therefore is giving fewer ticks. His rocket motor is, therefore, operated less frequently, and the moon moves around and around the Earth, and the observers are mystified. (The actual geometry is more complicated than this, involving space as well as time changes.)

Another important effect of this equivalence between gravity and inertia is that a gravitational field will bend light waves! Look again at the diagram of the accelerated craft and the curved beam of light. It was shown that the same effect can be observed on Earth, therefore a beam of light that passed near the surface would also be curved, and take off in a new direction. This idea was tested in a very dramatic way in 1919 by the English astronomer, Eddington. It was realized that starlight would be deflected a measurable amount when it passed close to the sun. This effect might be perceptible during an eclipse of the sun, after which comparisons might be made of the stars' positions without the effect of the sun.

Eddington made an expedition to Brazil to photograph the stars' positions during an eclipse. Einstein had predicted a deflection of 1.7 seconds of arc. Newtonian physics also predicted a deflection, but one about half as large as that suggested by Einstein. No test of this kind had ever been conducted, and there were at least three possible outcomes: Einstein's value would be seen, Newton's would win out, or there would be no deflection of the starlight. According to a story of the time, two astronomers are discussing these possibilities. "What if there turns out to be a deflection twice as large as Einstein predicts?" "That's simple," says the other. "Eddington will go mad."

Despite some bad weather, some photographs were taken and compared with standard observatory pictures of that part of the sky, and the results agreed with Einstein.

It was chiefly because of the result of this experiment that the public became aware of the theory, and Einstein became famous. He later said about it, "Fate has punished my hatred for authority by making me an authority."

Some Consequences and Speculations

We have seen that inertia and gravity result from the interaction of matter, and are not independent of it. It therefore is possible that the force of inertia might be related to the total amount of mass in the universe and its distribution through space. An Austrian physicist, Ernst Mach, suggested that in an empty universe there would be no inertial forces. One could shine a flashlight out the back of the Queen Mary and it would get moving in a hurry! The only moderating influence in this case would be the negligible mass of the ship itself. In practice, investigators have used this concept (called Mach's

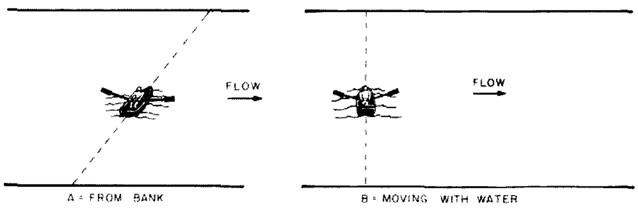

Fig. 4.

Principle) to estimate the total mass of the universe, assuming that local forces are the result of this interaction.

Einstein was aware of this possibility, and saw that his universe would tend to spread outward or fall inward rather than stay put, because any tendency to fall inward, for example, would increase the inertial, and therefore the gravitational, forces between the galaxies, thus increasing the speed of collapse. His universe was like a coin balanced on edge. He introduced a cosmological constant, therefore, the effect of which was to hold widely separated masses apart, thus balancing the forces.

In the 1920s, Edwin Hubble discovered that the universe is expanding, and the need for a cosmological constant went away. If the universe is expanding, it no longer must maintain any balance. (Einstein hadn't liked the cosmological constant, anyway; it was inelegant.)

Now, if the universe is expanding, which seems likely, it must have been all together at once sometime in the past, and started moving apart. George Gamow, a Russian-born physicist, proposed what is now known as the big bang theory, in which the present state of the universe was initiated by a tremendous explosion, throwing energy and matter all over. Wow, said just about everybody. And various experimental evidence has supported the theory. Distant galaxies are receding

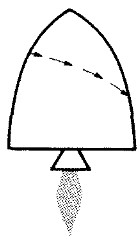

Fig. 5.

from us in proportion to their distance, the farthest ones moving the fastest. Gamow predicted that there would be a small thermal residue of the original big bang, sort of a cloud of thermal energy all over the universe. He guessed that it would be at about 5 degrees kelvin, and recent tests using airborne microwave detectors are in good agreement with this prediction: about 2.7 degrees Kelvin.

One of the possible consequences of this expansion is that inertia, and therefore gravity, gets slowly weaker, because the density of matter is declining. This might explain planetary cracking and fissuring as forces other than gravitation begin to get the upper hand. This idea is being subjected to experimental test in devices made to measure the force of gravity with great precision. Some theories have gravity and inertia changing in different proportions, so that orbits would slowly move outward and take longer. A study of the moon is presently underway to try to detect this effect.

Other studies are underway to try to decide whether the universe will continue to expand, or

eventually collapse inward again. It really is a simple calculation—all one needs to do is find out how much matter there is in the universe, and its distribution, and apply the gravitational rules including Mach's Principle (if it turns out to be so) to the results. If the average velocity of the masses is greater than the "escape velocity" mandated by their mutual attractions, the universe will expand forever. If not, then there will have to be a theory devised to explain the collapse (big thump?). Finding and tallying all the matter that exists is another problem. Some galaxies may be receding from us so fast that we can no longer see their light. Some may be hidden behind dust clouds.

We now know (or assert, arrogantly) that stars emit energy by way of nuclear processes according to Einstein's mass-energy equivalence principle. The energy is emitted in the course of transformations of elements. In the life of a star, however, there comes a time when all the likely candidates for transformation are used up and truly basic matter remains which won't give up any more energy. When this happens, the star begins to collapse to a smaller, denser configuration. This comes about because the energy emission, which used to maintain the size of the star through thermal turbulence and sheer pressure, has greatly decreased.

If a star is somewhere between three and ten times the size of our sun, it can collapse into such a small, dense configuration that the escape velocity required is greater than the speed of light. This means that no light can escape it, nor any other kind of signal. And if a stray bit of light or matter should come by, it will be sucked up and never heard from again. The star itself and all that is captured by it are literally crushed into nothingness.

These things, called "black holes," are thought to exist; in fact, there are some candidates in the night sky, but they do present a paradox: Matter and energy can be changed only in form. It isn't permitted to take it away entirely! Some people claim that the stolen mass-energy must pop up somewhere else, say, out of a "white hole" in another universe. In which case there might be white holes in this one from black holes in that one; all we need to do is figure out which of our new, fascinating observations is actually a white hole.

People who have to believe in relativity (there are always some of those, for any theory) are made nervous by the idea of antimatter. There are lots of versions of the theory in which antimatter is at least possible, and the existence of certain antiparticles is taken for granted in the high-energy physics labs, where electrons and positrons (the antimatter equivalent of an electron) are made to collide in huge storage rings. But if a ball of regular antimatter were proven to exist (or coexist, to be more specific), then relativity would be in a big jam.

Consider the following two cases: In one, the ball of antimatter is floating inside a craft, and the craft's motor is started. The floor starts to rise toward the ball. Of course, the ball stays in place until the floor hits it since it has no forces acting on it until then. In the other case, the craft is assumed to be sitting on Earth instead of firing its rocket. Antimatter is repelled by ordinary matter, so the ball takes off toward the ceiling. These two frames of reference are therefore no longer equivalent, as required by the theory. A space crew could keep a little bit of antimatter around on their journeys, and use it to find out things not permitted by Einstein!

A group of theorists once came up with a mathematical treatment of the universe in which matter is no more than a local space-time irregularity, instead of creating such irregularities, as presented here. After all, it's the chicken-and-egg problem: Did the matter or the local distortions in space-time appear first? And what does "first" really mean, in the world of Einstein? These guys were sure that they had lost their collective minds, and were all set to commit themselves. Moral: Understanding relativity too well is almost as bad as not understanding it at all. ■

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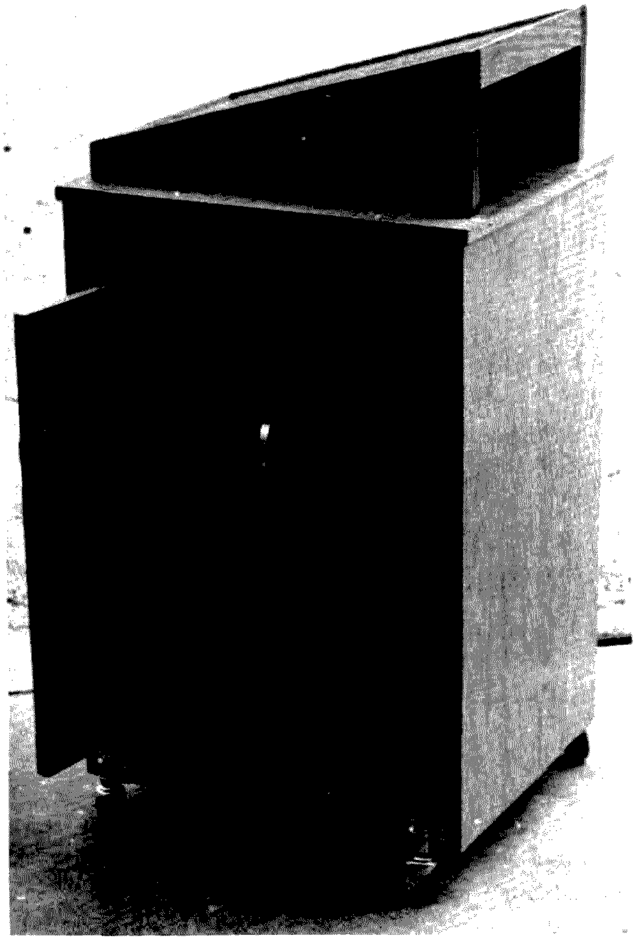
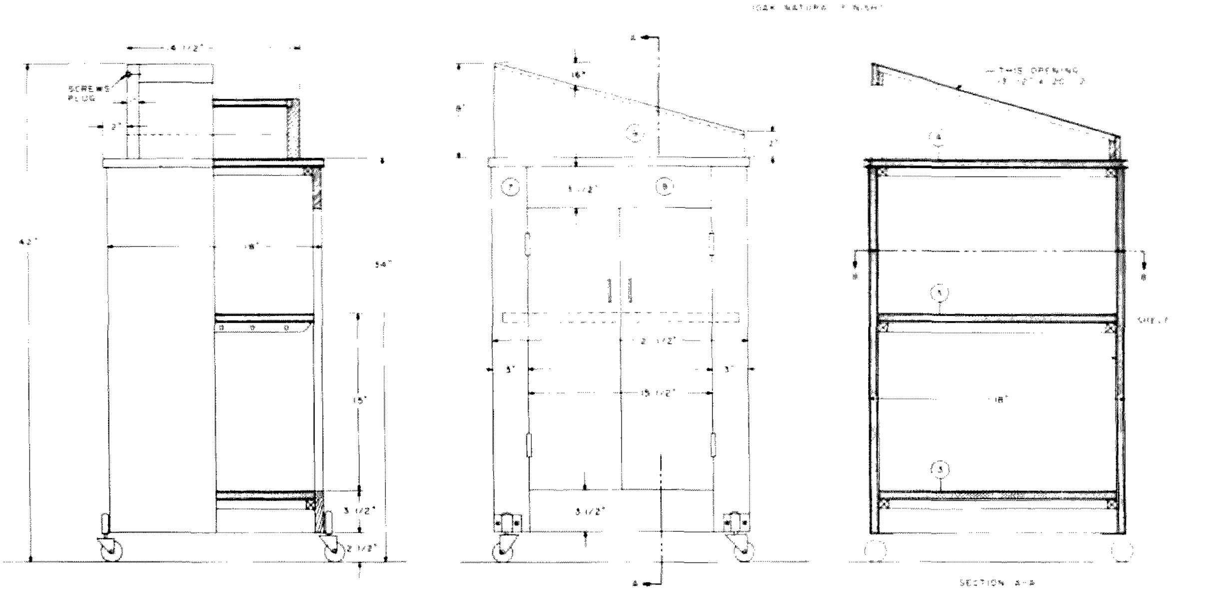


Go-Cart
—wheels for your test equipment

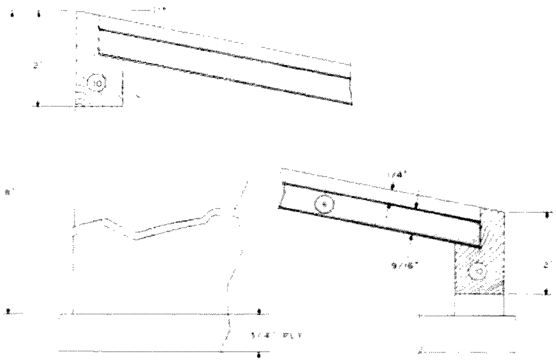
Max Holland W4MEA
Rt. 3, Rawlings Lane
Madisonville TN 37354

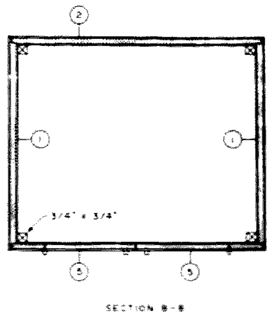
If you would like to combine the hobby of amateur radio with woodworking, then this might be the project for you. The original cart was designed for a graphic display terminal. It will be approximately the right size for even the largest oscillo-



scope. The doors on the cart could be left off; however, they do not add much to the total cost and do keep the items inside secure. The good quality wheels are worth the extra expense.

The cost of materials will be approximately $30.00. Compare this with the cost of a commercially-manufactured cart. The prices of other carts vary between $135.00 and $300.00. Very few would try to duplicate this cart exactly, so the drawing is used only to show some of the construction in this unit. The plywood is press-type wood with a thin veneer on both sides. G1S means "Good 1 Side," which means that one side is knot-free; however, the other side is often very good. This type of plywood can be used in place of G2S ("Good 2 Sides") if you want to save some money. ■





Part No.	No. Units	Size	Part Description
1	2	¾" x 18" x 30¾"	front and back, ply G1S
2	1	¾" x 21½" x 30¾"	left side, ply G1S
3	2	¾" x 16½" x 20"	shelf and bottom, ply G1S
4	1	¾" x 18½" x 22"	top, ply G1S
5	2	¾" x 7¾" x 23¾"	doors, ply G2S
6	1	½" x 13½" x 20¾"	sloping top, ply G1S
7	2	¾" x 3" x 30¾"	sides of frame for doors, oak, solid
8	2	¾" x 3½" x 17½"	top & bottom for door frame, oak, solid
9	2	1" x 8" x 20⅝"	side of top unit, oak, solid
10	2	1" x 2" x 14½"	ends of top unit, oak, solid
		12 linear feet of ¾" x ¾" strips as required	
	4	casters and mounting brackets	
	4	hinges 2½" x 2½"	
	2	roller catches for doors	
	2	handles	

DX

from page 20

no relief from the problems created by the shared status of 3.5 and 7 MHz with HF broadcasting. These guesses, due to the lack of word from the conference, are like trying to bet Sunday's football games on Saturday with half the football league down with the flu.

Bits and pieces now from November's DX happenings:

Alex Kasevich W1CDC announced that the Caribe DX Association has had to scrap its plans for an expedition in August, 1980; Hurricane David last fall wiped out the group's seaplane, which was based in Florida.

USSR stations, including UB5WF, UT5BN, and UC2AAK, are operating on 160 meters, most often at 0400 between 1850 and 1855.

K1MM operated from Mauritius (3B8), then from Reunion as FR0MM during the *CQ* CW Contest, putting in a single-band 10-meter effort; he went next to Malagasy Republic (5R8), but failed in attempts to obtain a license to operate. Word is that no American will be granted permission there in the foreseeable future. Bill (K1MM) operated from the Hong Kong QTH of VS6DO in the *CQ* Phone Contest and racked up 2,000 contacts in a short operating session.

More pulse-type interference was heard on 20 meters in early November and continued intermittently for a month or so. While it was not as bothersome as the "woodpecker," we note that its source was reported to be the US government in the form of the US Air Force. Senator Goldwater K7UGA entered a note about the USSR woodpecker in the Congressional Record.

The 1S1DX Spratly expedition is still in the red; they have photographs of Amboyna Cay, from which the operation took place, available for $3.00 (3.5" x 5") and $10.00 (8" x 10"). Proceeds will go to the fund set up for the expedition. Orders to Bob Schenck N2OO, 212 Oak Leaf Drive, Tuckerton NJ 08087.

The US personnel on Diego Garcia Island ("Chagos" on your Countries List) have a new club callsign, VQ9CI, which made its debut during November.

N4HX/TT8 came on from Chad in mid-November and expects to be there for some time. "Bull" is active almost exclusively on SSB on the higher bands, although some operation on 40 and 80 meters is promised during contests. QSL to ON5NT, not the *Callbook* address, but rather Ghislain Penny, Box 5, Aalter, Belgium.

ON4LS appeared aboard ship off the Somalian coast, signing 6O4LS and claiming to be anchored at the shore. No word as we write on DXCC status, but the heavy betting is that it won't count until he sets foot on shore.

Jim Smith P29JS traveled in the Pacific and operated from the Solomons (H44) and Nauru (C21); he has been mentioned as one of the possible operators on a rumored upcoming operation from Heard Island.

TN8AJ, who opened up from the Congo in October, says he has become an avid DXer and is looking for new countries; after the initial shock of QSO demands, he has settled down and tries to work the pile-ups as best he can. He did not have a DM license when he left East Germany, so he is, in fact, a Novice. Two new Congolese licenses, TN8AH and TN8BF, both await equipment. An operation proposed for early December from both TN and TL by KA1BQ, KA1BOH, and I8MPO may have reduced the demand for the "Terrible Ts."

The *National Contest Journal* "has been reorganized. A board of directors has been formed to manage the business and publicity activities of the *NCJ*, in hopes of making the magazine a more viable and timely publication. The Board members are W2GD, K5RC, N6SF, and K0TO (a former editor of *NCJ*). The new editor is Randy Thompson K5ZD . . . There is an issue in distribution and another issue will be printed in late December with all the high-claimed scores of the fall contests. The December issue will be the first under the new management and will be mailed to all subscribers and all former subscribers. A new PO Box will also be announced, along with subscription information." The *NCJ* has been published more-or-less regularly, six times per year, over the past half decade; it is must reading for serious contesters and has DX information relating specifically to DX contests.

S2BTF showed almost nightly from Bangladesh, on the W7PHO "Family Hour" gathering on 21340; a list is taken at 0045 with two stations from each US call area making the list each night. Occasionally, S2BTF could be found answering CQs a half hour or so before his official appearance on the "net."

4N0MP was a special call from Yugoslavia, honoring the 125th anniversary of the birth of Michael Pupin, a Yugoslav/American inventor who taught at Princeton University for many years.

K7ZCW/3C1 showed up on 20 meters in late November for a brief operating stint; October's 3C1AA extravaganza had cleaned up much of the demand for Equatorial Guinea QSOs.

VE3HRS/TZ continues his on-again, off-again, activities from Mali; he is not particularly interested in working pile-ups, as much as DXers would like. Harassment will drive him from the bands, as it has others over the years.

If EI8H had actually been in all the places the bootleggers have had him the past year or two, he would have made DXCC in person. There was a reason why he was picked on, and many have wondered why so many of amateur radio's unofficial policemen made life difficult for him. The following report appeared in the September, 1979, issue of *Break-In*, the Official Journal of the New Zealand Association of Radio Transmitters:

"EI8H—This station, one of the biggest sources of QRM to DX for years, has been silenced. The operator, an aging Patrick, has finally been tricked into being caught for his blatantly stupid action on the bands. His consistent jamming, bugging, and illicit operation have resulted in him losing his EI8H call. It all came about after Patrick bugged so many DX nets with his high power signals. If one had worked in or listened in on any DX net, it would be found that sooner or later he would show up. He created chaos by placing a carrier on the net frequency; on many occasions, it was associated with music, bells, chiming, or buzzsaw noises which completely disrupted the operation. European stations could not work weak Pacific or other DX because of the bedlam. He certainly achieved his goal. On another operation, his call would appear with EI8H/A, GT, GJ, HB0, and many other areas. All of which cost DX dollars, IRCs, and postage for no end result. His operation was also linked with many other bogus calls as well.

"His downfall came about on August 1st, when P29JS and several European operators put their plan to the test. They gave advance notice about a special station which was to show up on the P29JS (Jim Smith) Net. SM5BBC made arrangements at the European end with the EI Post Office officials to be ready. Tracking stations in South West England, CT2, and SM soon confirmed their suspicions.

"Patrick duly came on as they expected and the Post Office officials swooped in, catching him red-handed. His license was cancelled, but they could not confiscate his station. If he were to operate again without a license, the officials could then take all of his station away.

"The person largely responsible for the closing down of EI8H has been SM5BBC, who has brought diplomatic pressure to bear on the EI Post Office to do something about the mess being created by EI8H's actions.

"SM5BBC is to be commended for his action which has nearly made him bankrupt. Financial remuneration is recommended to ZLs. If you can spare a dollar or IRCs, I suggest you send it; it will give confidence to those who are prepared to fight for the clearing of our DX bands of unwarranted, selfish operators who mean to cause hardship to amateur radio."

We couldn't have said it better. The above was written by Arthur Law ZL2HE, one of New Zealand's most active DXers and editor of *Break-In's* "DXing" column.

The information for this column, with the exception of the above excerpt, was from *The DX Bulletin* out of Vernon CT. Please support the DX bulletin of your choice by sending information when you have it. Better yet, send it to *all* the bulletins, plus, of course, to *73* for inclusion in this column.

Looking West

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arrangements were made over the amateur radio circuit for the pilot (Bob Morefield WA6FTN) to fly down at dawn, pick up Martinez, and fly him to the hospital in Ensenda, 700 miles to the north. During the rescue of Jesus Martinez, his mother and family were kept fully informed by Chuck Reiter WA6IWS and John Sidler WA6OZF, who were translating in Spanish at Ensenada net control.

"Once again, amateur radio operators proved that they could provide effective emergency communications across difficult terrain and distances."

LINKING DEPARTMENT (CONT.)

Let me say a few words about Bob Couger W6KPS, a human dynamo.

Bob is a person who believes that cooperation with others is the key to accomplishing his objectives. For example, a few years ago Bob pulled off what I consider an amazing feat. He placed into operation an open 146.34/.94 repeater, complete with autopatch facilities, and did so with the blessings of the remote-base owners who had been opposed to such a system until that time. How did he do it? He worked *with* the amateur community, rather than as an independent entity trying to conquer the world. It took quite a few years for him to reach his goal of setting up an open .34/.94 repeater in his area, but when it did go into operation, it was welcomed by everyone—including the remote owners who had originally been opposed to its establishment.

The latest venture that Bob is involved in is another "cooperative" open interlinked system between his own repeater, the WR6AFR Juniper Hills-Lancaster system and the WR6ACE system. At the WR6AFR site, Kitt Clover (the system's owner) has installed equipment that permits accessing other open repeaters as far away as Las Vegas, Nevada.

Bob explains the operation this way: "To operate this radio system, all that is necessary is to think of it as a string of dominoes. For example, if you are in Santa Maria, California, and want to talk to Las Vegas, you first dial your two-meter radio to the W6KPS/RPT repeater on 147.81/.21. You then enter a touchtone code that links you to WR6ACE, followed by another code that activates the link to WR6AFR. Entering yet another code turns the WR6AFR equipment to .28/.88 transceive and you have thereby gained access to the Las Vegas .28/.88 repeater. By sending the codes in reverse order, the link is terminated."

Bob stresses two important factors. First, that users of the interlink should identify themselves both before and after sending any control codes. Second, they should always remember that courtesy while operating is of paramount importance. To again quote Bob: "We are only guests *on these* other systems and do not own them."

Will this system ever be extended into Los Angeles and further south? I doubt it—unless the problems with jamming we have here can be dealt with and a semblance of order restored to LA two-meter operation.

More information about this interlinked system and its operation can be obtained by sending an SASE to Bob Couger W6KPS, 1095 McCoy Lane, Santa Maria CA 93454.

Microcomputer Interfacing

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so the divisor is added to the result of the subtraction by the ADDB instruction. The A register now contains the original partial dividend.

When the 8080 executes the instructions at NOADD, it must enter a logic zero or logic one into the quotient. Therefore, the state of the carry is complemented by the CMC instruction and then saved in the H register. If the subtraction did not generate a borrow, then the carry is a logic zero, but a logic one must be entered in the quotient. If a borrow was generated, the carry is a logic one. This means that a logic zero must be entered into the quotient. The CMC instruction complements the state of the carry to the state needed in the program. Finally, the content of the L register is decremented by the DCRL instruction. If more bits within the dividend must be tested, the 8080 jumps back to NXTBIT; otherwise, it returns from the subroutine with the quotient in the H register and the remainder in the C register.

There are a number of *software tricks* that can be used to simplify these two mathematical subroutines. However, unless your microcomputer can execute multiply and divide instructions or has special *multiply/divide hardware*, multiplication and division operations will have to be performed using these or similar algorithms.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 14

er, but which for some reason never was used.

From the lab, we were taken to dinner at a special chicken restaurant (no, not Colonel Sanders, though there are a number of them around Tokyo). The dinner started with raw chicken, served the same as they do raw fish, with a tare sauce. It was delicious. From there, we went through a series of chicken dishes . . . it seemed like dozens . . . until I wasn't sure I would be able to get up. Have I mentioned that you sit on the floor in most Japanese restaurants? It was a wonderful meal and I hope to have another chance at one next year.

The world is full of very good food if you are game to try. Some people can't even try these things and find out whether they are good or not. Some things don't taste good to me . . . some being an acquired taste . . . like beer. Some things are fine in the right setting. I am not much of a tea drinker, yet I do enjoy the Chinese green tea served in a glass, or even the most British of tea served with biscuits for afternoon tea. I can almost get into liking beer when I'm in a German beer hall, surrounded by people singing and having a good time, drinking beer by the liter.

The next afternoon, we stepped off the Pan Am plane in hot, humid Guam. I'd visited there for a few hours in 1959, but had not had a chance to see much on that trip. The trip before that was when my submarine, the *Drum*, pulled into Apra Harbor on Guam on January 17, 1945, after our 12th war patrol. We'd been patrolling around Okinawa and had had some very close calls during that patrol run. We'd been depth-charged enough so the Japanese had reported us sunk . . . news which went out on the radio in the U.S., but which fortunately my folks had missed.

When we cruised into Guam, the fellows on the other submarines in for refit and refueling were amazed. The Navy was amazed, too . . . they didn't even have our mail there for us, which made our Christmas presents even later . . . we got most of

them in February, which was tough on the cakes and cookies. The fruit cakes survived, but who cared?

As soon as the arrival orgy of eating fresh fruit, tomatoes, and ice cream was over, we packed our seabags and headed for Camp Dealey, a rest camp over near Talofofo village. We had two weeks of "rest" there. The rest consisted of distilling as much torpedo alcohol as possible in a converted coffee urn and mixing it with canned grapefruit juice. It got awfully drunk at times.

The crew quickly found other potables than their "gilly" (torpedo alcohol). The Guamanians had a pleasant-tasting lethal drink made from palm sap. They would cut off the top of a coconut palm, collect the sap, and distill it . . . lightning.

Bill Davis K7IRC/KH2 met us at the airport and drove us to the Guam Hilton. Guam has grown up. That almost completely devastated town of Agana in 1945 now looks more like the outskirts of Phoenix, with some tall buildings and a lot of stores and industries. The thatched huts are now ranch-style houses.

We had just time to unpack a few clothes and then get to a nearby hotel for a dinner with the hams and computer hobbyists of Guam. 114 of them turned out, with their wives, and we had a real fun dinner. After the meal, I talked everyone to sleep alternately on amateur radio and computers. I mentioned that I wanted to get a couple dozen hams to come on the tour next year and their enthusiasm was high . . . be sure to bring HTs to use the local repeater and be prepared to pair off with local hams to get in some rare DXing.

The next morning we were driven all over the island, including a try at finding old Camp Dealey. The camp was completely gone, remembered only by a gas station with the name on it. There are a few houses where the camp used to be and a whole lot of jungle. I talked over old times with some of the people in Talofofo, which used to consist of a few dozen grass huts and now looks like a small town in California.

The next stop was for a couple hours in Hawaii. I quickly got on the local repeaters and was called by Katashi Nose KH6IJ, a very old friend. He sounded surprisingly well and was obviously enjoying being able to get back on the air after his illness. He is still writing his column for the *Honolulu Advertiser* . . . it's been a fixture of the paper for many years.

That evening we arrived in San Francisco and an overnight rest before continuing to Boston and Peterborough. Sako had presented me with his latest HT, the 207, and I finally had an opportunity to get it charged up so I could try it out. I had a ball scanning all of the channels with it . . . imagine a scanner built into an HT! But for some reason I couldn't get it to transmit above 145.99 MHz. Hmmm, it can't be a Japanese model, because it has the 600-kHz split for repeaters, and it isn't an American model . . . what went wrong? I checked with Yaesu in California after getting back and found that it was a European model. They will send me an American model as soon as they get a new batch. I can hardly wait . . . the rig looks fantastic.

For some reason, I had no problem adjusting to the twelve hours of time difference when we arrived in Asia, but after getting back, I found myself struggling not to have six-hour afternoon naps and one-hour nightly naps. It took a couple of weeks before I was really back to normal.

The trip was more fun than I can ever describe . . . and I hope some of you readers will be able to make three weeks available next October and come along for some hamfests, a lot of Chinese food, and a wonderful time.

GOVERNMENT AT IT AGAIN

A newspaper clipping sent in by WB2EQG was so preposterous that I had to read it twice to be sure that it wasn't a joke in poor taste.

It seems that our government has such a desperate need to spend more and more money that they are now asking for recommendations on mandatory safety standards to prevent CBers from electrocuting themselves by leaning towers against power lines. This is being done by the U.S. Product Safety Commission, 1111 18th Street NW, Washington DC 20207.

Granted that some CBers managed to electrocute themselves . . . and possibly a few hams, though I have yet to get word of a ham fried this way . . . is this any reason to insulate the power lines? Or to force tower manufacturers to insulate them? Common sense has to be counted on somewhere. This, claims the bureau, is now the single largest cause of electrocution in our country. I don't believe it.

If this is a problem, it needs to be made more of in magazine articles. But with the continuing drop in CB . . . particularly in DXing, which was big a few years ago . . . I suspect that the tower biz for CBers is way down.

Again, if it is a problem, every CBer has to buy his tower from a dealer . . . so make sure that dealers remind the customers that such a danger is a real one. Ham dealers reading this: Be sure to mention this when a ham buys a tower . . . or anyone else . . . even a CBer.

In the meanwhile, Washington is going to move ahead on this serious problem and come up, at great expense, with a target deadline for the proposed standard set for April 30, 1981. Can't anyone stop this crap?

ON THE RADAR FRONT

Preliminary tests of the latest Radio Shack Micronta ($200) show it to be as good or even perhaps a tad more sensitive than any of the other detectors I've tested . . . and that's getting to be quite a bunch by now. I have it in parallel with the Fox in our RX7 and it is nip and tuck between the two. One thing is for sure: With this detector, your chances of getting clocked by a radar unit without knowing it are nil.

For those of you who are sanctimoniously mumbling that speeders ought to be caught anyway and that radar detectors should be outlawed, let me give you a piece of information: The estimates of speeding tickets given in error run as high as 30%, according to testimony in courts. That means that some percentage of perfectly innocent motorists who were driving under the posted speed limit were read inaccurately by a patrolman and given tickets. More and more non-speeders are seeing the light and arming themselves with detectors so they will know before getting into radar reading range and thus can lower their speed substantially below the posted limit.

For those readers who have managed to get a ticket, either through the 30% mischance mentioned, or even by operating your rig near a radar unit and thus giving it a false speed reading, you'll want to get a kit from Electrolert to help you fight the case. You may be able to find *The Ticket Book* in a local bookstore ($6.95) . . . if not, Electrolert has 'em available. But their $30 kit is a very big book . . . 1¾" thick and packed with information which will help your lawyer . . . or you, if you want to try the case yourself. There is a very complete deposition guide, plus detailed technical data on every radar unit . . . and data on many court cases which have been won. With lawyers running around $50 to $75 per hour, you really want this bundle of data. Electrolert, Inc., 4949 South 25A, Troy, Ohio 45373.

This same firm has just announced a new detector which they claim is as sensitive as the famed Escort. I haven't gotten delivery on our Escort as yet, though we've had one on order for several months. It's due in soon. Then, if I can get one of the new Fuzzbuster elite, I'll have a chance to see how they compare. We have plenty of radar in New Hampshire. It's the moving-car type, which has the very worst reputation for accuracy and falsing.

Of the units I've tested, I've found the $100 Micronta Road Patrol to be fairly good. It does false a bit more than I like, causing momentary panic. The $200 Micronta falses now and then, too, which is a common problem. The Fox is a very small unit and can be had with a remote control so it is invisible to the world . . . which is nice. Why aggravate the bears? It has not yet given a false alarm.

I've had nothing but miseries with the Whistler. The Fuzzbuster II works quite well . . . as does the Bearfinder. Both the Snooper and Super Snooper false so much that I just ignore them. The Centurion rarely speaks up until we are going by the radar unit, far too late for anything useful. One of the better units tested was the Long Ranger. Someone swiped it from my car and I haven't seen them advertised again, so I've lost track of the firm making them.

Other than as a very good

money-maker for towns, police radar serves little useful purpose. Most of the radar units are poorly designed and built, and those that are good cost so much that the police won't buy them. The units, even the best of them, require a lot of training of the officers . . . which also rarely happens. So you have a poor unit in the hands of an untrained officer . . . and you're the pigeon.

NONPROFIT

One of the reasons names are being changed on familiar things, such as "maintenance engineer" instead of "janitor," is that this also changes the way we feel about these things. Some recent letters from readers indicate that because *73 Magazine* is not a nonprofit organization, it must therefore be a profit organization. I don't think anyone with any familiarity with the magazine would describe it that way. The real case could be better described as a non-nonprofit organization.

The socialist and fascist camps preach that making a profit is a bad thing and making a larger profit is obscene (which I always thought had something to do with sex). I don't have anything against profits or even obscene profits, it's just that I have never been much oriented in that direction. I do have a thing about trying to break even . . . a little passion which developed when I got behind and had the aggravation of putting off creditors. That's a real bummer.

I don't really understand this whole business of nonprofit corporations. I belong to one nonprofit club which keeps from making a profit by paying delightful salaries to its top officers . . . and which has salted away close to two million dollars in cash and securities. I suspect that if I tried something like that with my non-nonprofit corporation, I would soon be hanging by the thumbs in court.

Most corporations have a bunch of stockholders who are forever pushing for profits . . . which are then (after taxes) distributed as dividends. Back when I started *73*, I had in mind going public and thus permitting the readers to share in the ownership of the magazine. But, as I looked into it, I found that this would put the pressure on for "performance" of the stock . . . the need for profits, which could then be shared. I felt it was better to share any projected profits in the form of a larger magazine. And why not spend any possible profits on payments for articles, making it so the hams with the drive to write, and thus benefit all of us, would benefit?

I started *73*, not as a way to make a lot of money, but as a way to publish a magazine which would be enjoyed by hams and would encourage them to build equipment and try new ideas. I think my goal has been accomplished.

Aha, but what about starting new magazines? Certainly that takes a big investment from somewhere? Oddly enough . . . and please don't let this get out . . . once you know what you are doing, you can start a new magazine for virtually nothing. I've done it several times recently. The only investment needed to get *Kilobaud MICROCOMPUTING* started was a $10 poster at a computer show. The 1,000 subscriptions sold paid for further subscription mailings and putting together the first issue. The ad revenue from the first issue paid for the printing and mailing of the magazine . . . and it was just a question of pulling on the bootstraps to build it up.

Unlike a nonprofit organization, *73* does not have one share of stock invested in securities. Nor are there any six-figure bank accounts kicking around. We still invest any probable profits in a bigger magazine and payments to authors. It will probably continue that way as long as I last.

OCTOBER WINNER

As much as we hate to, this month we will actually be *giving* money to one of our advertisers. Frank Kalmus WA7SPR, president of RF Power Labs, Inc., had the audacity to write "Easy-to-Build 220 Transverter," which our readers sagaciously voted October's best article, so we are forced to send him a $100 bonus check. Save us the the embarrassment, Frank: Hold the articles!

Contests

from page 30

March 8th to: SC QSO Party, Elliott Farrell, Jr. WA4YUU, PO Box 994, Walterboro SC 29488. Include an SASE with your entry for a copy of the contest results.

NEW HAMPSHIRE QSO PARTY

Operating Periods:
2000 GMT February 2 to 0500 GMT February 3
1400 GMT February 3 to 0200 GMT February 4

This year's contest will be sponsored by the Nashua ARC to promote the Worked New Hampshire Award. Stations may be worked once per band per mode. NH stations may work each other.

FREQUENCIES:

Novice—3730, 7130, 21130, 28130.

CW—1810, 3555, 7055, 14055, 21055, 28130.

Phone—1820, 3935, 3975, 7235, 14280, 21380, 28575.

VHF—50.115 and 145.015 FM simplex.

Suggested times—phone on the hour, CW at 30 minutes past. No CW QSOs allowed in the phone band.

EXCHANGE:

NH stations send RS(T) and county. Others work NH only and send RS(T) and ARRL section or country.

SCORING:

Score 1 point per QSO. NH stations multiply QSO points by the number of NH counties plus ARRL sections and countries. Others multiply by the number of NH counties.

AWARDS:

NH club competition awards will be certificates signed by the governor of NH with a trophy for the winning NH club. Mark your summary sheet with the club's name for any club entries. Other certificates and the Worked NH Award will be issued.

ENTRIES:

Mailing deadline for entries is March 16th. Send your entry with a large SASE for results and/or awards to: NARC, R. Lint, 10 Hartwood Drive, Merrimack NH 03054.

ANNUAL QCWA QSO PARTY

CW
Starts: 0001 GMT February 9
Ends: 2400 GMT February 10
Phone
Starts: 0001 GMT March 8
Ends: 2400 GMT March 9

Each contact made with another QCWA member will count as a single point. Contacts with the same station on more than one band can be scored only once. Contacts made with captive stations, such as when operating in local nets, are not valid. Remember this is a QSO *party* and not a contest. There will be no multipliers. All contacts are equal. The total number of contacts with QCWA members, wherever they may be, is your score. The QCWA certificates which you can earn are your "bonus." Put the activities manager to work with your request for certificates you were able to earn during the QSO Party.

FREQUENCIES:

Any authorized amateur frequency is permissible. The following suggested frequencies have been selected to minimize interference to others: Phone—3900-3930, 7230-7260, 14280-14310, 21350-21380, 28600-28630; CW—3530-3560, 7030-7060, 14030-14060, 21040-21070, 28040-28070.

EXCHANGES:

A valid QSO must contain the following minimum information exchange between both parties: QSO number, operator's name, chapter identification (official number or name). Members not affiliated with a chapter may use "AL" to so identify.

ENTRIES:

It is the responsibility of each contestant to provide a legible log, no carbon copies, and to list all claimed contacts. The total contacts for each page will be recorded at the bottom of each page in an appropriate place. The total contacts for the party should be recorded on the top-right of the first page of the log. Include your name, address, call, QCWA number, and chapter on each page. Log sheets will not be returned. Make sure you have correct postage when sending in your logs. Send your logs no later than March 31st to: Yankee Chapter, QCWA, Walter Woodward W1RCJ, 14 Emmett Street, Marlboro MA 01752. Separate logs and scores must be submitted for both the CW and phone parties.

Results

RESULTS OF WASHINGTON STATE QSO PARTY FOR 1979
sponsored by
Boeing Employees' Amateur Radio Society (BEARS)

K4ZGB	Alabama	134	29	8,932
AI7O	Alaska	3	4	36
W7ZMD	Arizona	86	26	6,032
N6PE	California	78	23	4,761
K6KV	Colorado	29	14	1,022
W1TEE	Connecticut	42	16	1,904
W4KFA	Florida	18	9	324
N4NX	Georgia	137	32	10,496
K7TAK	Idaho	5	4	60
W9QWM	Illinois	19	12	600
KØTJB	Kansas	24	14	672
WA4QMQ	Kentucky	40	14	1,218
W5WG	Louisiana	89	24	5,664
W1DLC	Maine	37	15	1,455
K3KX	Maryland	11	7	147
WB1ANT	Massachusetts	10	7	147
WD8QBB	Michigan	26	11	605
WBØLNO	Minnesota	27	11	594
W7RIR/Ø	Nebraska	35	16	1,376
KA1EP	New Hampshire	15	10	300
WA2DFC	New Jersey	18	12	564
WB2NDE	New York	66	20	2,640
K4YFH	North Carolina	15	9	387
WA2DJM/8	North Dakota	1	1	2
N8FU	Ohio	24	11	572
K7DRD	Oregon	17	9	441
WA3ISG	Pennsylvania	20	11	440
WA4YUU	South Carolina	20	10	440
WAØBZD	South Dakota	42	16	1,472
WA4CMS	Tennessee	19	10	530
W5NR	Texas	25	14	1,050
W4KMS	Virginia	30	15	1,155
K8KVX	West Virginia	19	12	456
W9YT (WB9PYE opr.)	Wisconsin	17	11	462
VE3CEF	Ontario, Canada	77	20	3,920
PY1BOL	Brazil	2	2	8
JA7KE	Japan	33	13	1,072

WASHINGTON

N7RC	Chelan	35	21	2,205
*VE7ZZ/W7	Clark	533	76	98,040
WA7PMW	Cowlitz	448	53	47,488
W7WMO	Grant	221	43	27,391
AI7J	Island	870	70	124,950
K7UR	King	129	43	13,330
W7IIT	Kitsap	50	20	4,350
WA7FMT	Kittitas	68	30	6,120
W7BUN	Pierce	787	61	96,197
K7EQ	San Juan	112	32	9,504
WA7JUJ	Skagit	406	58	47,720
*VE7ZZ/W7	Skamania	533	76	98,040
N7ABA	Snohomish	359	45	32,355
W7RVQ	Spokane	76	30	4,560
N7RV	Thurston	97	39	11,349
WA7LOQ	Walla Walla	140	36	10,080
WB7CAO	Whatcom	1,513	63	190,764

*Operated from Clark/Skamania county line.
Numbers after calls are: QSOs, multipliers, and total score.

ARRL INTERNATIONAL DX CONTEST
CW
February 16-17
Phone
March 1-2

A number of significant changes have been made to this year's rules for the DX contests. The new rules are as follows, as received in an advance copy from the ARRL.

The contest is open to all amateurs worldwide. The object is for amateurs worldwide to work as many amateur stations in as many DXCC countries of the world as possible using the frequency bands of 1.8 to 30 MHz. The contest periods are as shown above, starting at 0000 GMT on Saturday and ending at 2400 GMT on Sunday on the dates shown.

CATEGORIES:

Single operator—one person performs all operating and logging functions. Use of spotting

nets is not permitted. Single-operator categories are further classified as allband or single-band (one only) entries. It is recommended that single-band entrants who make contacts on other bands submit logs for checking purposes for the other bands.

Multi-operator—more than one person operates, checks for duplicates, keeps the log, etc. Multi-operator categories are further classified as single-transmitter or multi-transmitter. For single-transmitter, only one transmitter on any one band during the same time period is permitted. Stations must remain on a band for 10 minutes once a contact is made on that band, with one exception. One other band may be used during the 10-minute period if the stations worked are new multipliers only. Multi-transmitter has no limits other than only one signal per band.

QRP—single-operator stations with 10 Watts input or less.

EXCHANGE:

W/VE stations (includes 48 contiguous United States and does not include Canadian islands of St. Paul and Sable) exchange signal report and state or province. DX stations send signal report and power as a three-digit number indicating the approximate transmitter input power. The same station may be worked once per band. Crossmode, crossband, and repeater contacts will not count for contest credit. Incomplete contacts (includes callsign and exchange) do not count for points or multipliers. Aeronautical and maritime mobile stations may be worked for QSO credit only.

SCORING:

Contacts with your own country count for multiplier credit only. W/VE stations count three points per DX QSO. DX stations earn three points per W/VE QSO and two points per other DX QSO. The DXCC countries worked on each band count as multipliers. Multiply QSO points by the sum of multipliers per each band.

CLUB COMPETITION:

ARRL-affiliated clubs compete for gavels on three levels: unlimited, medium, and local clubs. Details can be found in the January *QST*.

AWARDS:

Plaques and certificates will be awarded in various classes; see *QST* for the complete list. DX entries making over 1000 QSOs receive certificates.

ENTRIES:

All entrants are encouraged to use forms available from the ARRL in reporting contest results. Include a large SASE or IRCs and send as early as possible. Logs should indicate times in GMT, bands, calls, and exchanges. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 QSOs must include cross-check sheets (dupe sheets). All logs must be in chronological order except for multi-multi entries. All operators of multi-operator stations must be listed. Entries must be postmarked within one month of the last contest weekend. All stations are requested to send their entries as early as possible. Entries received after mid-July may not make *QST* listings. Regular ARRL disqualification rules apply.

VERMONT QSO PARTY
Starts: 2100 GMT Saturday, February 23
Ends: 0100 GMT Monday, February 25

Sponsored by the Central Vermont Amateur Radio Club, everyone is urged and invited to join in the fun. The same station may be worked on different bands and modes for additional QSO points. Vermont mobile stations may be worked considering each new county they enter as a new station.

EXCHANGE:

Vermont stations send QSO number, RS(T), and county. Others send QSO number, RS(T), and ARRL section.

FREQUENCIES:

3685, 7060, 14060, 21060, 28100, 50260, 144-144.5.

3932, 7265, 14290, 21375, 28600, 50360, 145.8.

3909, 7290, 14325.

SCORING:

Out-of-state stations score 3 points per VT station worked and multiply this total by the number of Vermont counties worked on each band. VT stations score one point per contact and multiply by the number of ARRL sections and countries worked.

AWARDS:

A certificate will be awarded to the highest-scoring station in each ARRL section and foreign country submitting logs. A trophy will be awarded to the highest-scoring station outside of VT. The highest-scoring single-operator station in VT will have his/her name and call engraved on the Doris McGrath memorial plaque. This award, donated by Mrs. Doris McGrath in memory of her husband, W1EQB, will be awarded in this manner for a ten-year period. The operator winning the QSO party the most times, or the station with the highest score during the period, will receive the plaque. A special certificate will be awarded to the 2nd, 3rd, and 4th highest-scoring stations in VT. The W-VT (Worked Vermont) Award will be issued to stations working 13 out of Vermont's 14 counties, provided the station has not previously been issued this award. A special certificate will be awarded Vermont multi-operator stations.

ENTRIES:

Send logs or facsimiles together with an SASE no later than March 31st to: Gerald W. Benedict W1BD, 23 Foster Street, Montpelier VT 05602. Winners of awards will be announced the 3rd Thursday in April at the regular meeting of CVARC.

New Products

from page 34

free copy with poor signal conditions like fading. A rear apron scope jack provides 10 volts p-p at 100k Ohms for critical tuning applications.

The M-200E is designed to work alone for reception, or with a matching Info-Tech keyboard for transmission as well.

Construction

Info-Tech is not a newcomer to the scene of digital communications, and their quality control shows it. Double-sided, plated-through glass epoxy circuit boards are used throughout. All ICs are fitted with sockets. Extensive MOS circuitry reduces power consumption and keeps heat dissipation low. Tight power-supply regulation further increases reliability.

On the Air

The performance of the M-200E is very impressive. It is obviously designed by engineers who know ham radio requirements as well as commercial standards. We couldn't resist the temptation to connect the M-200E to a general-coverage receiver to see what was going on among the utilities. CW and RTTY reception was a snap. 66 and 100 wpm RTTY signals were copied with no problem. Even when used in conjunction with an inexpensive receiver, the unit performed flawlessly, so long as the signal was drift-free. The passband of the active audio filters is extremely tight . . . it has to be . . . and tolerates little off-frequency input.

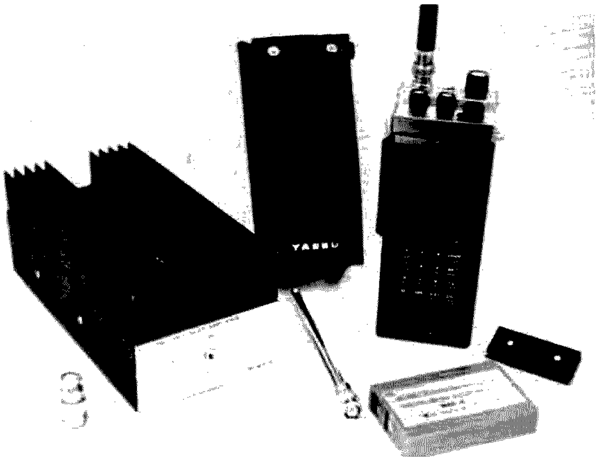
We recommend the Info-Tech M-200E to anyone seriously considering digital communications. M-200E tri-mode converter, $500. Available from *Info-Tech, 2349 Weldon Parkway, St. Louis MO 63141*. Reader Service number 145.

Robert B. Grove
Grove Enterprises, Inc.
Brasstown NC

REVIEWING THE YAESU FT-207R—AND MORE

The present overwhelming popularity of 2-meter FM seems to be situated between craze and epidemic proportions throughout the United States and the world in general. Almost every amateur holding a Technician or higher class license owns at least one 2-meter FM mobile rig, and it appears that an almost equal number of amateurs are beginning to also enjoy the pleasures of 2-meter handie-talkie operations. Judging by the unlimited capabilities of these hand-held portables, one can logically assume that personal portable communications will reach new peaks of success during the 1980s. Likewise, we can expect to see crystallized hand-helds give way to more sophisticated synthesized units of comparable size. That will create an open market for older crystal-controlled units while providing all the advantages of "big rigs" in the newer style hand-held units.

During previous years, I have owned one of almost ever avail-



The Yaesu FT-207R and assorted items used by K4TWJ. Vinyl case was cut from FT-202R item. Klitzing amplifier boosts handie output to 50 Watts. Full-length pull-up antenna significantly extends handie's range. Adapter at left mates PL-259 to BNC. Battery tester described in text placed beside 207. Finally, 207's battery pack is in front of unit. A Yaesu speaker mike and length of coax with PL-259 and BNC were secured in the car and thus omitted from this photo.

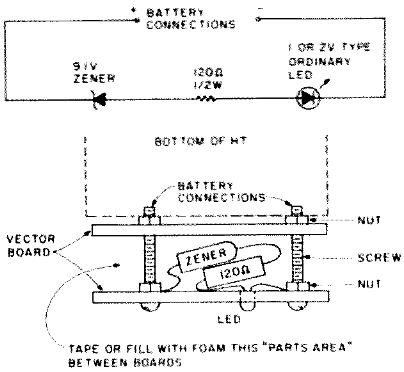


Fig. 1. HT battery monitor as described in text.

Conditions	Total Current
Receiver on, squelched, readout Off	38 mA
Receiver on, signal present, readout Off	70 mA
Receiver on, signal present, readout on	77 mA
LED readout	7 mA
Frequency memory	2 mA
Transmitter on, low power	255 mA
Transmitter on, high power	915 mA

Table 1. Current drains of FT-207R.

able 2-meter FM hand-held unit. Included in this list are Motorolas (the 100 is a gem), Wilson, Drake (TR-22 styles), Standard, Clegg, Tempo, and the Yaesu FT-202R. I recently purchased a new Yaesu FT-207R microprocessor-controlled, frequency-sythesized handie, however, and the results have created a whole new ball game of 2-meter fun.

The 207 is an 800-channel hand-held unit which is exactly the same size as the 202, except its upperfront section (speaker grill/mike area) is approximately ⅓ inch thicker. Since this extra size is placed in the handie's top front, it is practically unnoticeable. The unit fits my small hand exactly like a 202; the speaker/mike section doesn't interfere with handling or carrying. Rather than using a handful of penlight batteries, the 207 employs a 10.8-volt battery pack similar to that used in the Wilson units. The handie is well balanced and bears a striking resemblance to Motorola units. Audio quality is similar to the Standard: clean and natural.

Operation

Using a 207 is similar to operating a Yaesu CPU-2500 or Kenwood 7600 (complete with microprocessor unit) right from your hand. The last 3 digits of a frequency are entered on the touchpad and the red ENT/DIL bar is depressed. This frequency is LED-displayed in the area adjacent to the mike. The display automatically shuts off after 2 or 3 seconds unless the DISP switch is on, but the selected frequency is maintained. This frequency (or any other frequency appearing in the readout) can be placed in memory by depressing a number, 1 through 4 (memory address), and M. The other 3 memories can be loaded in a similar manner, and a 5th frequency can be programmed by stopping the previous procedure at the ENT/DIL bar depression. A selected memory can be recalled by depressing its address and MR, or the unit can be stepped through its memories with MR and UP or DWN. The memories can be automatically scanned by holding UP or DWN for two steps (approximately one second). A miniature slide switch on top of the handie determines if the scan stops on a clear or busy frequency or straight scans, letting you hear all the action at once (great for watching drive-time activity build). The scanning function may be manually canceled when desired by depressing UP or DWN or by squeezing the push-to-talk once. Subsequent use of the push-to-talk activates the transmitter as usual. Complete tuning of the 2-meter band is accomplished by selecting a bottom or top limit, if desired, and/or depressing ENT/DIL and UP or DWN once for each 10-kHz step. Holding UP or DWN for 2 steps (approximately 1 second) moves the handie into scan mode. Again, the scan is similar to that previously described and UP, DWN, or push-to-talk cancels the function. There are also 3 or 4 other ways of programming and using the handie, but that's the general concept. Incidentally, the LED readout is illuminated during scanning. If the DISP switch is off, the readout shuts off 1 second after scanning stops. The rig also holds that particular frequency until the UP or DWN button reactivates scanning.

The priority mode functions are as follows: Assume you want to listen or become involved in a conversation on, for example, .16/.76, and you want to monitor, say, .52 for a call. Let's further assume that .52 is programmed in memory 1. Press 676 and ENT. The rig is now on .76 and that frequency is displayed. Next, press 1 and MR. The rig switches to .52 and that frequency is displayed as 6.52 1, meaning memory 1 recalled. Now press # and the priority is enabled. If the DISP is on, the readout shows 6.76 P again. This cycle will continue until a call is received on .52. The rig will then halt on .52. The priority can be reinitiated by pressing #, if desired. The clear, manual, busy switch can also be used with priority functions.

If you make a mistake when punching frequencies on the handie, the display lights E. Punching the CE button clears your bungle and you can start again. The SET button is used for programming oddball splits. During transmit only, the keyboard becomes a touchtone™ pad. The LOCK switch disables the keyboard to prevent butter-fingered amateurs from accidentally changing frequencies when handling the rig. A small switch on the handle's bottom selects 250-mW or 3-Watt rf power levels, and an external earphone jack is mounted on top of the rig. An earphone is included on the transmitter offset switch for maintaining or removing power on the unit's memory when the main switch is OFF (backup OFF position). A removable belt clip is mounted on the handie's back. I'm sure the kitchen sink is also in there somewhere, but I haven't yet found it.

Personal Evaluation

Personally, I was sold on the 207 from the time I saw its first advertisement. It's small enough to fit in a coat pocket (its weight, however, gives people the illusion that you're carrying a .38). The LED display is great, since I seem to either be in an indirectly-illuminated room or outside at night when using the handie. The channel-busy LED can be noticed at a glance from across a large room, and that's quite convenient. The selectable power levels (250 mW or 3 W out-

put) have been enough reason in themselves for many amateurs to select a 207. Make no mistake: 250 milliwatts is the perfect rf level for using nearby repeaters or driving amplifiers at relaxed, lower levels. The 3 Watts is also beneficial for those "fringe" periods.

One of my main considerations when selecting an HT is microphone and antenna location. Possibly, this is a spin-off from recent propaganda concerning biological effects of rf, but I don't want rf radiating broadside into my eyes. This dictates the HT's mike being located at least midway of the unit rather than at its top, plus the ability to maneuver the antenna behind the ear and toward the back of my head (rig canted when transmitting). The 207 fits this requirement very smoothly.

The 207 uses a 10.8-volt (450 mA) nicad battery pack rather than a handful of rechargeable penlight cells. Thus, if the battery dies while you're in some strange airport, you can't simply purchase dry-cell penlights and continue on your way. On the other hand, an extra nicad battery pack is easily carried and exchanged, provided Yaesu produces more than one per radio. Since the battery situation is a main focal point of 207 discussions, I decided to measure current drains for myself. The results are shown in Table 1. Since I use the 207 on more of an occasional rather than a constant basis, the ability to switch off memory backup voltage is quite beneficial. It takes less than 30 seconds to reload the memories, but if this becomes a hassle, you can simply leave the memory backup on. The cost of memory retention is 2 mA, which theoretically drops a 450-mAh battery to half charge in approximately 115 hours or 4½ days. The receiver in my particular handie pulls substantially less than specified in the Yaesu manual, and the LED readout pulls a mere 7 mA. Thus, there's absolutely no concern about leaving the LEDs on continuously. I usually get between 3 and 5 days occasional use from the battery pack in my 207, which confirms the 207 is not a battery eater. Yaesu failed to discuss battery-charging considerations in the manual, and the 207 doesn't have a meter, so you're on your own. If you try watching the transmit LED, you'll probably be unexpectedly hit with dead batteries during an important QSO. This irritated me, so I rigged the circuit shown in Fig. 1 for battery monitoring. A discussion of this circuit appears at the end of this article.

I use the 207 either fixed, mobile, or portable while moving around during the day or night, and it has performed flawlessly. The receiver is "hotter" than any HT I've seen (it picks up 2 local repeaters without any antenna!). The transmitter measures 3.1 or .3 Watts (Hi/Lo) output. A Klitzing 3-Watt in/50-Watt out 2-meter amplifier and Yaesu remote speaker-mike round out the fixed/mobile setup. Since I carry the handie with me when leaving the car (and the amplifier is mounted out of sight), the chance of theft is minimized.

207 Battery Monitor

The circuit of Fig. 1 uses a common 9.1-volt zener, 120-Ohm ½-Watt resistor, and a garden-variety LED to accurately indicate the 207's battery-pack condition. The 120-Ohm resistor varies LED brightness to the point that battery-pack voltages between 11 and 10.2 volts produce bright LED illumination. The LED becomes quite dim at 10.1 volts and extinguishes at 10.0 volts. Approximately 30 minutes of use later, battery voltage drops below 10.0 volts, and recharging is required (all voltages measured on transmit: highest power level). This circuit (which costs approximately 45 cents to build) has proven more effective than any HT-installed meter I've seen. Quite simply, it uses the zener's avalanche point to accurately detect the "knee" of the nicads' discharge curve. Other HT nicad supplies could be monitored using a similar circuit. Merely select a zener with a voltage rating near your power supply's "knee" and calibrate the circuit using a variable voltage power supply.

My battery monitor is enclosed between 2 pieces of vectorboard + as shown in Fig. 1. The screws holding this "sandwich" together mate with battery contacts on the rig's bottom. The tester is then merely held in position when needed.

Conclusion

All aspects being considered, I honestly feel the 207 is a great little rig. If I didn't own a handie-talkie, there would be no reservations or time wasted—I would purchase an FT-207R. Once you become accustomed to handies, you'll truly feel undressed without one.

Yaesu Electronics Corporation, 15954 Downey Ave., Paramount CA 90723; (213)-633-4007. Reader Service number Y1.

Dave Ingram K4TWJ
Birmingham AL

DSI INTRODUCES 50 HZ-500 MHZ POCKET-SIZE LSI DIGITAL FREQUENCY COUNTERS

A new series of hand-held digital frequency measurement instruments that provide all the accuracy and high readout legibility of the full-scale types—yet are not much larger than a 120-millimeter cigarette pack—has been announced by DSI Instruments, Inc., San Diego, California. Two models, the 500HH that has a frequency range of 50 Hz to 500 MHz and the 100HH that has a frequency range of 50 Hz to 100 MHz, are offered.

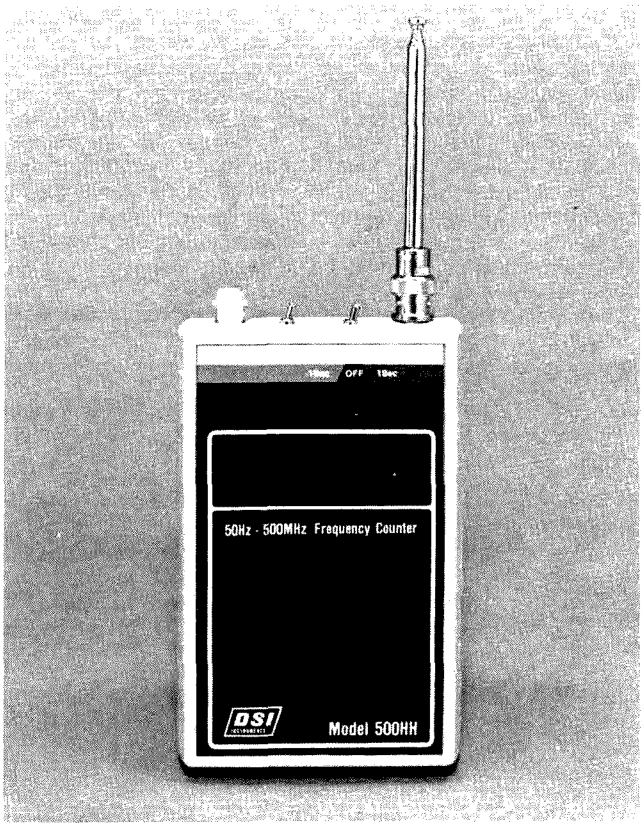
Their large 8-digit LED display, with characters that measure a full 0.4" high, features automatic decimal point shifting and zero blanking. Total case dimensions (excluding antenna) are only 3.5" wide x 1.25" deep x 5.75" high—about the same as a typical pocket-size calculator.

They're accurate to within 1.0 ppm (TCXO timebase) over a wide temperature range of +17° C to +40° C. The Model 500HH has a high sensitivity that is typically 30 mV at 100 Hz to 250 MHz and 50 mV at 250 MHz to 450 MHz, while the typical sensitivity of the 100HH is 30 mV at 100 Hz to 50 MHz. What's more, they have prescale input resolutions of only 10 Hz in just 0.1 second (or 1.0 Hz in 1.0 second).

They have BNC direct inputs of 1.0 megohm (50 Ohms prescaled). Utilizing low-drain LSI circuitry, they operate from a built-in rechargeable 8.2 to 14.5 V dc battery pack or 115 V ac using an external ac adapter that also trickle-charges the battery pack.

Applications cover a broad variety of service, testing, adjustment, and calibration uses where precise performance and high reading legibility across wide frequency range requirements—along with pocket-size convenience—are prime considerations.

Deliveries can be made immediately from local or factory



Pocket-size LSI digital frequency counter from DSI.

inventories. All the units are 100% factory pretested before shipment, and they carry a full one-year limited warranty.

For complete technical data, quantity pricing, and local outlet information, contact *DSI Instruments, Inc., 7914 Ronson Road, San Diego CA 92111; call toll-free (800)-854-2049, or from California exchanges call collect (714)-565-8402.* Reader Service number D25.

HEATH INTRODUCES AMATEUR RADIO RECEIVER AND MATCHING CW TRANSMITTER

Heath Company, the world's largest manufacturer of electronic kits, has announced the availability of a new amateur radio transmitter and matching receiver.

The new HX-1681 CW transmitter combines solid-state technology with vacuum tube finals to give a transmitter said to be capable of 100 Watts minimum output on 80 through 15 meters and 75 Watts out on 10. It features full break-in CW operation (QSK), built-in vfo, solid-state TR switching, sidetone output with adjustable tone and level, and receiver muting. Keying is provided for the addition of an external power amplifier.

The matching solid-state HR-1680 receiver covers the 80- through 10-meter band. It is said to feature a preselector-tuned dual-conversion front end for .05 uV sensitivity. Also featured are solid-state diode bandswitching, built-in 100-kHz calibrator, and switchable wide/narrow active audio circuitry for SSB or CW operation.

Both transmitter and receiver are offered in kit form and include instruction manuals said to be so complete and concise even a novice builder can complete either project. For more information on these and nearly 400 other electronic kits you can build yourself, write for the latest free Heathkit Catalog at: *Heath Company, Department 350-940, Benton Harbor MI 49022.* Heath is a subsidiary of Zenith Radio Corporation. Reader Service number H5.

FOX-TANGO CRYSTAL FILTERS

Fox-Tango Corporation, sponsor of the 4000-member, eight-year-old International Fox-Tango Club for owners of Yaesu amateur radio equipment, announces the expansion of its quality line of eight-pole crystal filters and related accessories to include not only popular models produced by Yaesu, but also those of Kenwood, Heath, Drake, and Collins.

Noting that most manufacturers of amateur radio equipment were content to supply relatively few filters to supplement the SSB unit supplied as standard equipment, and these as extra cost options of six poles or even less, Fox-Tango decided it was time to offer the worldwide amateur fraternity true "freedom of choice" by making available a variety of filter types and bandwidths never previously obtainable or adaptable to their rigs. For example, for its popular FT-101 line, Yaesu offered only a single 600-Hz bandwidth CW filter for direct installation, and while a 6000-Hz AM filter could be bought, it could be used only by sacrificing the CW filter whose spot it pre-empted. Both optional Yaesu filters were of six-pole construction. By contrast, for the same set, Fox-Tango now offers 250-, 500-, 600-, 1800-, 2400-, and 6000-Hz bandwidths—all carefully designed and manufactured eight-pole units made up of specially treated Hi-Q high quality quartz crystals. Moreover, to compensate for the lack of space in the original design for more than one optional filter, Fox-Tango offers inexpensive diode switching boards (both single and dual types) for most Yaesu and Kenwood models which permit the addition of up to three filters more than those for which the manufacturer provided room. Thus owners of older models can "update" their sets either by the "drop-in" installation of superior filters to supplant original units or can supplement them by adding selectable bandwidth filtering, often using switches already existing on front panels. All filters are custom-made to perfectly match the sets for which they are designed, both physically and electronically, so installation is a simple matter of tightening two nuts and soldering two connections. Fox-Tango filters are guaranteed on a money-back or replacement basis, as preferred, for one year.

The following filters are currently available for the brands indicated:

Yaesu: FT-101 (to F), FR-101, FT-301, FT-7/B, FT-901/101Z, FT-200, FT-401. Bandwidths: 250, 500, 600, 1800, 2400, 6000 Hz.

Kenwood: TS-520/R-599, TS-820/R-820. Bandwidths: 250, 400, 1800, 2100.

Heath: All but SB104. Bandwidths: 250, 400, 1800, 2100 Hz.

Drake: R-4B/C only. Broad 1st i-f (6- or 8-kHz BW). Narrow 1st i-f (600- or 800-Hz BW) with relays for switching from broad to narrow i-f for CW only. Very sharp 2nd i-f (plugs in) 125 Hz. Product detector kit: converts existing units to superior double-balance type.

Collins: 75S-3B/C. For superior CW. 250-Hz bandwidth.

Since not every bandwidth is available for every listed model, write for detailed specifications to: *Fox-Tango Corporation, Box 15944, West Palm Beach FL 33406; (305)-683-9587.* Reader Service number F24.

MAGNETIZED SIGNS FROM FOTOGRAFIX

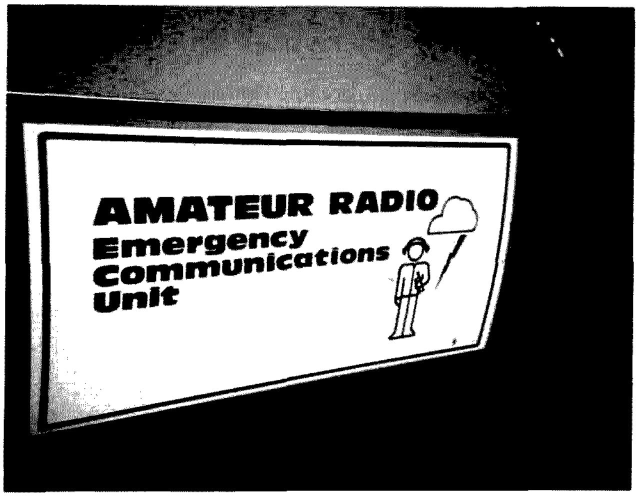
Now, any amateur radio club can receive the recognition for public service work it deserves. Fotografix announces the introduction of amateur radio public service signs for emergency and mobile use. The signs are entirely magnetic and are guaranteed safe at highway speeds. They have been wind-tested at above 70 miles per hour. Because the entire sign is made of a flexible magnetic material, it attaches securely to magnetic metallic surfaces without room for air pockets.

The signs are available with "AMATEUR RADIO Emergency Communications Unit" or "AMATEUR RADIO Public Service Volunteer" slogans and can be personalized with club names in quantities of 25 or more sets.

Each sign carries a special logo with radio operator, head-

Heath's HX-1681 transmitter and HR-1680 receiver.

Crystal filter from Fox-Tango Corporation.



Fotografix' magnetic sign.

phones and handie-talkie, and storm cloud in the background. The signs are waterproof and wash easily with mild soap and water. They will not fade, peel, or crack in hot sunlight.

For more information or to order, write to *Fotografix, PO Box 202, 522 Arizona St., Lawrence KS 66044*. Reader Service number F25.

NEW CATALOG FROM HAMTRONICS

Hamtronics, Inc., has announced a new 1980 catalog, which is yours for the asking. The 24-page catalog features many types of kits of interest to the radio amateur or two-way shop. Exciting new products in the catalog include a 435-MHz transmitting converter, a new UHF FM receiver, an AM receiver for aircraft and DX warning, a weather tone alert receiver module, a new low-noise VHF converter, and several new linear power amplifiers for VHF and UHF. These new products follow in the tradition of other fine Hamtronics kits, including their famous VHF and UHF converters and preamps and FM transmitters and receivers.

For your free copy of this informative catalog, call (716)-392-9430 or write *Hamtronics, Inc., 65F Moul Rd., Hilton NY 14468*. (For overseas airmail delivery, please send 4 IRCs.) Reader Service number H16.

BATTERY-POWERED WIRE-WRAPPING TOOL

The new BW-2630 is a revolutionary battery-powered wire-wrapping tool. The tool operates on 2 standard "C" size nicad batteries (not included) and accepts either of two specially designed bits. Bit model BT-30 is for wrapping 30 AWG wire onto .025" square pins; BT-2628 wraps 26-28 AWG wire. Both produce the preferred "modified" wrap.

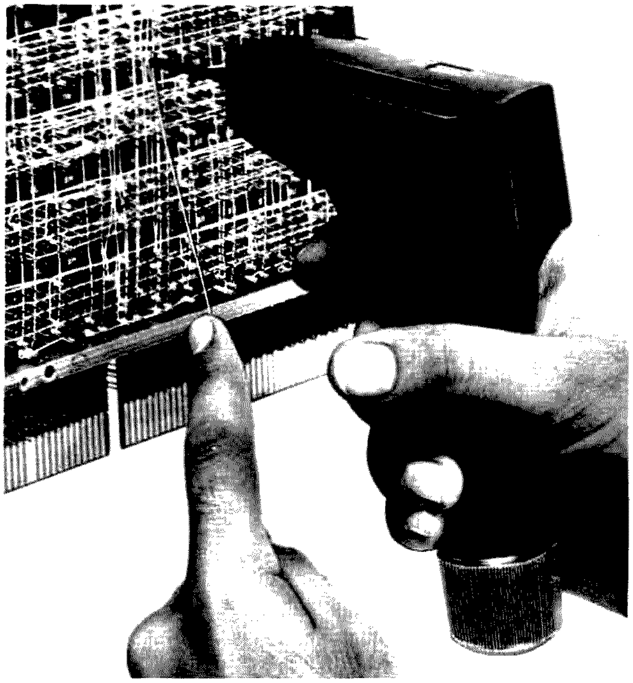
Designed for the serious amateur, BW-2630 even includes both positive indexing and anti-overwrapping mechanisms—features usually found only in industrial tools costing five times as much. Pistol-grip design and rugged ABS construction ensure performance and durability. In stock at local electronic retailers or available directly from *OK Machine and Tool Corporation, 3455 Conner Street, Bronx NY 10475*. Reader Service number O5.

NEW CLOCK KIT FROM BULLET

The new 6-digit mobile/fixed station Zulu clock kit is now available from Bullet Electronics. The kit features quality G-10 plated and drilled PC boards, detailed step-by-step instructions with illustrations and schematics, and all the required parts.

The kit nomenclature will be ZULU II and has as standard features large ½" character LED readouts, a quartz crystal timebase, battery backup, 12 V dc operation, readout blanking and brightness control, noise rejection circuitry, and a calendar-on-demand feature.

The ZULU II will be sold either without a case or with an attractive injection molded case in either blue or beige. The addition of a small 12 V ac transformer allows standard ac operation. The kit is aimed at the amateur radio market and is the result of numerous customer requests for a clock of this design.



BW-2630 wrapping tool from OK Tool.

For more information, contact *Bullet Electronics, PO Box 401244-E, Garland TX 75040; (214)-278-3553*. Reader Service number B8.

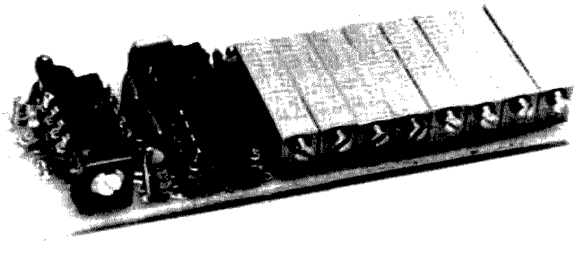
MULTI-FREQUENCY ENCODER

Selectone Corporation announces a versatile new multi-frequency encoder for both CTCSS and burst tone signalling applications. The miniature circuit board measures only 1" W x 2.85" L x .38" H and will accommodate up to eight (8) fully tunable tone frequencies. If fewer frequencies are required, the board may be sheared off to reduce the overall length.

Two standard configurations are available: the Model ST-105 CTCSS encoder and the Model ST-115 burst tone encoder. The ST-105 operates over the standard CTCSS frequency range of 67.0 to 250.3 Hz, while the ST-115 will generate burst tones with the range of 800 to 3000 Hz with field selectable burst durations of 300 ms, 500 ms, 1 second, or continuous. Other frequency ranges are available on special order.

The ST-105 and the ST-115 are furnished with complete installation instructions and 18" flying leads for wiring to a multi-frequency selector switch (customer provided).

For more information, contact *Selectone Corporation, 26203 Production Ave., Suite 6, Hayward CA 94545; (415)-887-1950*. Reader Service number S110.



Multi-frequency encoder from Selectone.

Awards

from page 28

DIPLOMA GUGLIELMO MARCONI (DGM)

This award is to celebrate the experiments carried out by Marconi in various parts of the world and bring them once again to the attention of radio amateurs. The DGM will be awarded to those who make contact with the localities in which Marconi once conducted his experiments. To qualify, it is necessary to forward to the ARI all details of your contacts and a) 40 QSLs chosen from the localities listed below, or b) 35 QSLs chosen from the list below plus the QSL from the official commemorative station, II4FGM, and one from any other G. Marconi memorial stations for a total of 37 QSLs.

When required (i.e., G = London, I4 = Bologna), the QSLs must indicate the city or region of the locality as required below. The DGM is made available for AM, SSB, CW, RTTY, SSTV, and mixed modes. There is no band limitation; however, all contacts must be made on or after January 1, 1973.

Being somewhat of a 10-meter QRP enthusiast using a converted CB rig, I recently contacted Hugh Aeiker WA8CNN, who happens to be the Awards Custodian for the QRP Amateur Radio Club International. After hearing everyone on the band claiming to run QRP or QRPp, I figured once and for all I would get the true definition of these terms from one of the orginators of an organized QRP group. Not only did I get this group's point of view as stated in their Constitution and By-laws, but I became the recipient of a full packet of information concerning their awards program.

It appears that this QRP fraternity, founded in 1961 by K6JSS, set the QRP standard to mean 100 Watts CW/AM or 200 Watts PEP . . . input. As for QRPp status, we find the group recognizing this power only in the 5 Watts or less range. Now this is not to be confused with standards set by other QRP societies, such as the Michigan QRPp Club International, which also defines QRPp as under 5 Watts output, yet QRP is much less than 100 Watts.

As for their awards program . . . it is packed full of incentives, as you'll witness by reading on.

The main objective of the QRP ARC International Awards Program is to demonstrate the use of limited power which creates less QRM on the amateur bands, while still allowing us to enjoy the usefulness of the hobby. The club issues the following awards which are available to any amateur meeting the requirements as set forth for each below.

QRP-25

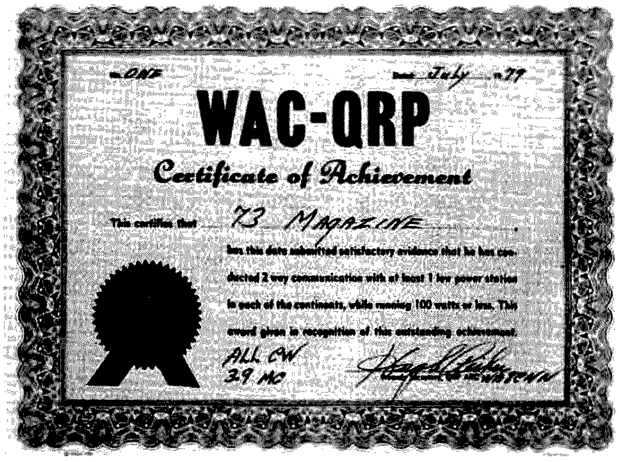
This award is issued to any amateur working at least 25 members of the QRP ARC International. Endorsements are issued for 50, 100, 200, and every additional increment of 100. To apply, send copies of logbook data, $1.00 or 5 IRCs, and a signed statement that you limited your power to 100 Watts input (200 Watts PEP SSB). Your list should also include the membership numbers of each station worked. There are no restrictions on band or mode recognition.

WAC-QRP

This award is issued to any

List of qualifying contacts for DGM

Country	*Specific Region or City*	*Prefix*
Capo Verde Island	Any	D4C
Portugal	Lisbona	CT1
Madeira Island	Any	CT3
Morocco	Any	CN8
Spagna	Cadice	EA7
Ireland	Any	EI
France	Any	F
Corsica	Any	FC
England	London	G
England	Flatholm Island	GB
England	Wight Island	G
Northern Ireland	Any	GI
Scotland	Any	GM
Switzerland	Any	HB
Vatican	Any	HV
Italy	Bologna	I4
Italy	Any	I5
Italy	Roma	I0
Italy	Fondaz G. Marconi	IY4FGM
Italy	Torre, Tigullio Marconi	IP1TTM
Italy	Sicilia	IT9
Italy	Sardegna	IS0
Japan	Any	JA
Argentina	Buenos Aires	LU-A-B-C
Belgium	Any	ON
Brazil	Rio de Janeiro	PY
Sweden	Stockholm	SM
Sweden	Gotland Island	SM1
USSR	Leningrad	UA1
Canada	Any	VE1
Newfoundland	Any	VO1
Labrador	Any	VO2
Australia	Sydney	VK2
Bermuda	Any	VP9
USA	Massachusetts	W1
USA	New York State	W2
USA	New Jersey	W2
USA	Missouri	W0
USA	Illinois	W9
India	Any	VU
Gibraltar	Any	ZB
Yugoslavia	Any	YU2
Libya	Tripoli	5A
Any	Memorial Stations	Any



amateur for confirmed contacts with low power stations in all six (6) continents. Power inputs again must be carefully adhered to and a statement must be made certifying the power was within rules governing the program. Keep in mind also that both your own station and the station you are contacting must be using QRP to qualify. Your QSL cards received must state the station's power used. Fee is $1.00 or 5 IRCs.

WAS-QRP

This WAS award is issued to any amateur who makes contact with QRP power and contacts stations, one in each of the 50 US states, who are also using QRP power or less. Award fee is $1.00 or 5 IRCs. GCR apply.

DXCC-QRP

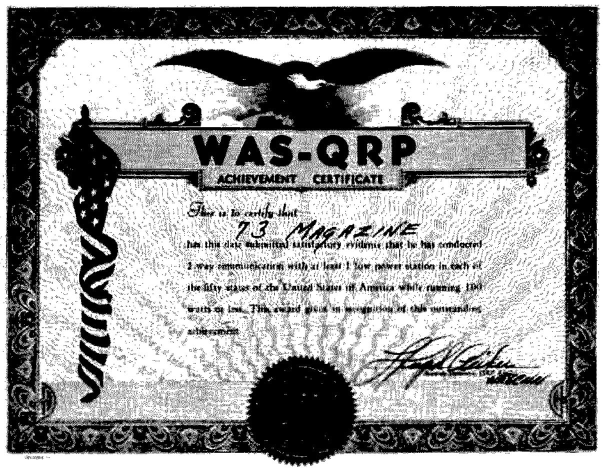
This DX award is issued to any amateur who utilizes QRP power and contacts 100 different countries, each of which must also be using low power and so stating such on their QSL card. To apply, send log data and $1.00 or 5 IRCs. GCR apply.

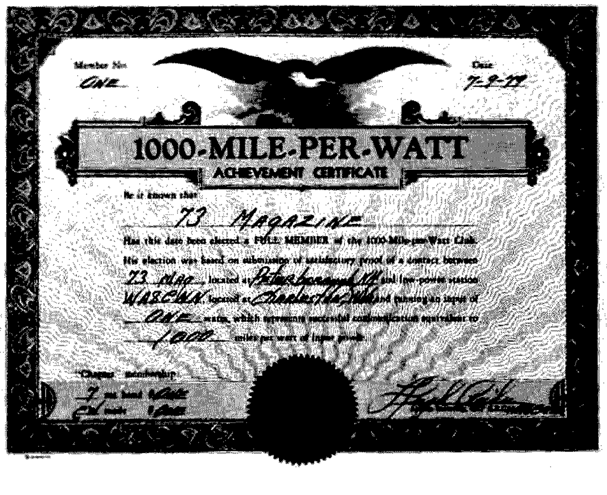
KM/W 1000-MILE-PER-WATT AWARD

Issued to any amateur transmitting from or receiving the transmissions of a low power station, such that the Great Circle Bearings between both sides divided by the power input of the low power station equals or exceeds 1000 miles per Watt. Confused? Ah, it's not all that bad! Special endorsements are given for single band or mode achievements. To apply, send copies of full log data including power used on both sides, signal reports exchanged, band and mode, and specific location of QTH on both sides. Include $1.00 or 5 IRCs. GCR apply.

DXCC-QRPp

Issued to any amateur for confirmed contacts with stations in 100 DX countries; power levels of 5 Watts or less must be used by the applicant. Reading the rules closely, I find no power restriction on the stations you must work. To apply, send logbook data, including power used and type of equipment used. Enclose $1.00 or 5 IRCs. GCR apply.





WAS-QRPp

Issued to any amateur for confimed contacts with each of the fifty (50) US states while operating five (5) Watts maximum output. To apply, forward all pertinent log data and $1.00 or 5 IRCs to the Award Manager. GRC apply. Special endorsements will also be issued for states contacted for levels of 20, 30, 40, and 50 states.

As with all awards offered by the QRP ARC International, should you wish to apply, in order not to delay processing of your award, please furnish not only the data, but also the power levels used for each award and the type of equipment used.

All award applications should be sent to: Hugh Aeiker WA8CNN, 5 Keiffer Drive, St. Albans WV 25177.

My special thanks go out to Ade WØRSP/K8EEG, QRP editor for *CQ Magazine*, who recently provided me with the latest up-to-date information concerning some very popular QRP awards being offered by amateur fraternities.

DXCC-QRPp

This award, initiated by the *MILLIWATT: National Journal of QRPp* in 1971, offers a very distinctive challenge to dedicated QRPp stations the world over.

The award requires contacts with DX stations in 100 different countries of the world with the aid of list- or net-type operations. The rules clearly state power must be limited to five Watts or less output. To apply, the applicant must submit a log list in alphabetical order of callsign prefix of the station worked, indicating date, time, and frequency of each contact. QSL cards must accompany your listing and a signed declaration must be made as to the maximum power and type of equipment used. Application fee is $15.00 to help defray the cost of the large 30-inch trophy suitably engraved.

DXCC MILLIWATT

This award is also sponsored by the *MILLIWATT: National Journal of QRPp*. The same rules apply for this award as for the DXCC QRPp except that all indications of power level should read "under one Watt output." Applications are the same as for DXCC-QRPp.

THE MILLIWATT FIELD DAY TROPHY

Initiated in 1970, this trophy is awarded to the highest-scoring QRPp station in the ARRL Field Day event held each year in the month of June. To enter, you must submit an ARRL summary sheet, or similar, plus a listing of the stations you work band by band. You must state in your application the power level used, the type of equipment, as well as your method of measuring output power. If you use 1-5 Watts, you may multiply your score by four.

For power level under one Watt output, you may multiply your score times 5. In addition, another 1.5 times your score may be added for operating your QRPp station independent of power mains. Another 150 bonus points are earned for full portable setup away from your QTH.

All three awards, the DXCC-QRPp, DXCC Milliwatt, and the Milliwatt Field Day Trophy, are obtainable by making application to: Adrian Weiss WØRSP, 83 Suburban Estates, Vermillion SD 57069.

Ham Help

I am interested in becoming a radio operator. Does anyone know of any radio classes near me?

Herbert E. Scott
84 Torrey St.
South Weymouth MA 02190

Although our Michigan Technological University Amateur Radio Club has a long history, any records of the club prior to 1971 are not known to us. If someone knows anything about the early days (before 1971) of our club, please contact me. Any help will be appreciated.

Hideki Yumoto AG8C
133ECH MTU
Houghton MI 49931

LETTERS

from page 35

ing that your publication is one of the most widely read among hams, I thought your readers might be interested in a recent experience we had which has resulted in our offering a new service.

Our emergency department became involved with a distress call at sea that was picked up by a local ham. They needed medical advice and called Memorial Hospital. We agreed to accept the collect call and our emergency department physician was able to provide the appropriate medical advice.

W6CRD's phone patch, which we received last month from VP5TJ/MW, Region 3, from the 77-foot motor vessel *Tin Ajo* to our hospital's emergency room, was what precipitated our getting involved. Via the patch, Dr. Allen Hooper was able to successfully treat the vessel's chief engineer for severe coral-induced infection though he was across the Pacific at the time. W6CRD ran follow-up contacts between the ship and Dr. Hooper until the infection subsided and the patient was out of danger.

Fortunately, these situations arise infrequently, but when they do, medical advice is a necessity. In the aftermath of this recent incident, we are now offering to accept collect calls from amateur radio operators in California, Nevada, Oregon, and Washington who are in contact with maritime mobile stations who have medical emergencies. All they need do is call our hospital's emergency department, which is (213)-595-2133.

William J. Loveday
Vice President,
Memorial Hospital
Medical Center
Long Beach CA

PARANOIC

I read with interest Mr. Conklin's letter in the November, 1979, Letters (p.16). First of all, my actions concerning the Russian woodpecker were not booboos. The Russians are obviously experimenting with their point-to-point 14-MHz band. I and hundreds of others were merely trying to verify the reports we read in *73*.

I chased the woodpecker on three occasions, and my excursions into this mess were experimental in nature; they were intended to help determine the nature of the phenomenon. I am now drafting a report to the FCC detailing my experiences (mostly of a monitoring nature) and if they feel that my actions were not useful or warranted, they may take any action they desire. *They* will decide points of legality.

My position on this matter is that I (and the others) was emitting signals of an experimental nature regarding an unusual phenomenon found on the 14-MHz ham band. My references to using SSTV and other modes were, of course, frivolous. Any other images created by my letters are incorrect (and in some cases paranoic!).

The reason Mr. Conklin could not find me in the ARRL Intruder Watch program is that I prefer direct action. The record of the Watch program is well known. I cannot speak for the other hams mentioned in Mr. Conklin's fascinating letter.

Steve Baumrucker WD4MKQ
Durham NC

WORTH WAITING FOR

The November *73* was a little late in arriving, but the splendid article by W5KHT entitled "The Satellite TV Primer" was well worth waiting for.

This is an upcoming technology that will change long-distance radio transmissions as well. Many thanks.

Paul G. Stecher
Westwood NJ

GREAT HELP

For some time, I have been intending to write you and tell you how much I enjoy *73*. Your November issue was the best yet. Your timely article on satellite reception was excellent and well done.

Another factor that really interests me is the amount of advertising. Receiving *73* is like receiving a ham catalog every month. The ads are tremendous and always well done.

This is my last renewal for *QST*. I'm just plain disgusted with the ARRL. I have been a member for 56 years and during that time the ARRL has watched our ham bands be nibbled away and done little or nothing. Every time you criticize them, the headquarters staff draws up the drawbridge, fills the moat, and shoots arrows at you.

Keep up the good work—your *73 Magazine* and policies have really been a great help to amateur radio.

Wells Chapin W8GI
Kingsley MI

Thanks for the letter, Wells. Your many articles on the history of amateur radio have been extremely well done. You obviously have been keeping much closer track of events than most amateurs and have things in perspective. We don't really know how the results of WARC will work out, though I join amateurs everywhere in hoping for the best. If we do luck out, it will be galling to see any group crow about the results and try to claim credit. The pattern of events leading to WARC held no reason for optimism for amateur radio, despite years of golden opportunities to do the needed groundwork. You have written about this many times, with your ideas and helpful suggestions falling on deaf ears.—Wayne.

PROGRESS

The "Bad Taste" letter from Dale Richman (November, 1979, p. 190) leaves me with deep concern, also. If it were not for *73*, I would not find out the latest in solid-state technology and how MDS and satellite TV works.

As an avid fast-scan ATV operator, I am interested in the challenge of receiving a picture from distant sources. If *73* did not publish such material, I couldn't learn and progress in amateur radio.

So, please keep publishing all kinds of articles, like home-brew UHF and microwave devices. After all, where would we be if no one had info on how to build these receivers?

John Du Bry K6KDO
Yucaipa CA

Ham Help

First, I'm interested in getting in touch with a net for disabled amateurs, if there is one. If not, is anyone interested in forming such a net?

Second, I need information and specifications on the following pieces of equipment:
•Link VHF high- and low-band transmitters, receivers, and transceivers (2210, 1623, 2552, 1905 ED-2, 2240 ED-18, and 2365);
•Teleprinter TT-4;
•Test set CPR-60 AAB, a two-band VHF-UHF test receiver;
•ARC-1, Command Sets (ARC-5), VHF ARC-5;
•BC-1206 and BC-1306 receivers;
•Western Union Telefax transceiver (no model number). It has three push-buttons: "incoming," "stop," and "outgoing";
•Hickok vacuum tube volt-ohm-milliammeter, made for the Department of the U.S. Navy;
•ARB receiver;
•Realistic Timekube®, model 12-159;
•Realistic Jetstream AM-AIR Band receiver.

Any help would be very much appreciated.

John C. White WB6BLV
560 N. Indiana St.
Porterville CA 93257

I am in need of a schematic and operating instructions for a Hammarlund HQ-180A. I would be happy to pay copying and shipping costs. Any help would be greatly appreciated.

Dante H. Ventriere KA4JRE
17831 NW 18 Avenue
Hialeah FL 33015

The Kenwood International Users' Club is now operational. Send an SASE for details.

Robert A. Pohorence N8RT
9600 Kickapoo Pass
Streetsboro OH 44240

OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the Imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
23845	1	0118:54	87.9
23857	2	0018:13	72.8
23870	3	0112:29	86.4
23882	4	0011:49	71.2
23895	5	0106:05	84.8
23907	6	0005:24	69.7
23920	7	0059:40	83.2
23933	8	0153:56	96.8
23945	9	0053:16	81.7
23958	10	0147:32	95.3
23970	11	0046:51	80.1
23983	12	0141:07	93.7
23995	13	0040:27	78.6
24008	14	0134:43	92.1
24020	15	0034:02	77.0
24033	16	0128:18	90.6
24045	17	0027:37	75.4
24058	18	0121:53	89.0
24070	19	0021:13	73.9
24083	20	0115:29	87.5
24095	21	0014:48	72.3
24108	22	0109:04	85.9
24120	23	0008:24	70.8
24133	24	0102:40	84.3
24145	25	0001:59	69.2
24158	26	0056:15	82.8
24171	27	0150:31	96.4
24183	28	0049:50	81.2
24196	29	0144:06	94.8

OSCAR 8 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
9728	1	0127:32	71.1
9742	2	0132:31	72.4
9756	3	0137:30	73.6
9770	4	0142:29	74.9
9783	5	0004:16	50.4
9797	6	0009:15	51.6
9811	7	0014:14	52.9
9825	8	0019:13	54.2
9839	9	0024:12	55.4
9853	10	0029:11	56.7
9867	11	0034:10	58.0
9881	12	0039:09	59.2
9895	13	0044:08	60.5
9909	14	0049:06	61.8
9923	15	0054:05	63.0
9937	16	0059:04	64.3
9951	17	0104:03	65.6
9965	18	0109:01	66.8
9979	19	0114:00	68.1
9993	20	0118:59	69.4
10007	21	0123:57	70.6
10021	22	0128:56	71.9
10035	23	0133:55	73.2
10049	24	0138:53	74.4
10062	25	0000:39	49.9
10076	26	0005:37	51.1
10090	27	0010:36	52.4
10104	28	0015:34	53.7
10118	29	0020:33	54.9

OSCAR 7 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
24208	1	0043:26	79.7
24221	2	0137:42	93.3
24233	3	0037:01	78.1
24246	4	0131:17	91.7
24258	5	0030:36	76.5
24271	6	0124:52	90.1
24283	7	0024:12	75.0
24296	8	0118:28	88.6
24308	9	0017:47	73.4
24321	10	0112:03	87.0
24333	11	0011:23	71.9
24346	12	0105:38	85.5
24358	13	0004:58	70.3
24371	14	0059:14	83.9
24384	15	0153:30	97.5
24396	16	0052:49	82.3
24409	17	0147:05	95.9
24421	18	0046:24	80.8
24434	19	0140:40	94.4
24446	20	0040:00	79.2
24459	21	0134:16	92.8
24471	22	0033:35	77.7
24484	23	0127:51	91.2
24496	24	0027:10	76.1
24509	25	0121:26	89.7
24521	26	0020:46	74.5
24534	27	0115:02	88.1
24546	28	0014:21	73.0
24559	29	0108:37	86.6
24571	30	0007:56	71.4
24584	31	0102:12	85.0

OSCAR 8 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
10132	1	0025:31	56.2
10146	2	0030:29	57.5
10160	3	0035:28	58.7
10174	4	0040:26	60.0
10188	5	0045:24	61.3
10202	6	0050:22	62.5
10216	7	0055:21	63.8
10230	8	0100:19	65.0
10244	9	0105:17	66.3
10258	10	0110:15	67.6
10272	11	0115:13	68.8
10286	12	0120:11	70.1
10300	13	0125:09	71.4
10314	14	0130:07	72.6
10328	15	0135:05	73.9
10342	16	0140:03	75.2
10355	17	0001:48	50.6
10369	18	0006:46	51.9
10383	19	0011:44	53.1
10397	20	0016:42	54.4
10411	21	0021:39	55.7
10425	22	0026:37	56.9
10439	23	0031:35	58.2
10453	24	0036:32	59.4
10467	25	0041:30	60.7
10481	26	0046:28	62.0
10495	27	0051:25	63.2
10509	28	0056:23	64.5
10523	29	0101:20	65.8
10537	30	0106:18	67.0
10551	31	0111:15	68.3

Review

COMPLETE GUIDE TO AMATEUR RADIO
by Joseph DuBovy
Parker Publishing Company, 1979

You are not alone if you have ever wished that there was ONE book that had all the answers to questions about ham radio. The publisher's description of a *Complete Guide to Amateur Radio* might make you think that such a book is finally available. Billed as "the indispensable guide to amateur radio," this 264-page hardcover book from Parker Publishing Company may turn out to be a disappointment to many amateurs. It is intended for beginners who are full of questions and looking for easy-to-understand answers.

The *Complete Guide to Amateur Radio* will not leave a prospective ham baffled by a lot of unexplained technical jargon or long-winded theoretical discussions. The author, Joseph DuBovy W2TCC, guides his readers from an introduction to the "magic of ham radio" to a description of how to build a simple transmitter and antenna. Along the way, topics such as satellite communication, receiver block diagrams, and basic semiconductor theory are discussed. While no subject gets thorough treatment, most of the questions a beginning ham might have are answered.

Promotional literature and the book's jacket claim that the knowledge needed to pass the Novice or General/Technician license exam is included. Unfortunately, much of the information is several years old. The author even refers to a $9.00 license cost, something that changed about five years ago! The guts of the licensing material is of the question-and-answer variety. As the exams get tougher and include many questions on the frequently changing rules and regulations, it is unlikely that the dated information will be adequate to pass the exams.

Another advertised feature of the book is its chapter on the Navy's special method for mastering Morse code. While the segment on sending is painstakingly complete, the "secrets" for

receiving code are brief. I think that the secret of learning code is not held in a few paragraphs of a book; it is in regular practice, using a challenging source of code.

The one-tube transmitter described in the *Complete Guide to Amateur Radio* would be easy to construct if you were already an experienced builder. Unfortunately, the author gives an incomplete explanation. Only a smattering of construction practices can be found and the table showing the color-coding scheme for resistors does not tell the reader what number each color stands for. The most obvious omission is a mention of safety practices. This is especially important when the first-time builder is tackling a project containing a high-voltage supply like the one described.

Much of the book's strength lies in its numerous diagrams and charts. Many of these are from ARRL publications and they do a good job supplementing the text which contains a lot of generalities. The book is not published by one of the traditional ham radio firms, which may account for the expansive description on the book's jacket and in mail-order advertising. The retail price, $14.95, may make many amateurs think twice about buying the book. The *Complete Guide to Amateur Radio* is suited for beginners, but they should realize that other sources of information may be needed.

Tim Daniel N8RK
Terre Haute IN

Corrections

K	INV/I-17	INV/I-16	INV/I-15	INV/I-14	INV/I-13	INV/I-12	INV/I-11
K				X	X		X
X			X	X			X

Revised Fig. 3, "Son of Keycoder."

With regard to my article, "Son of Keycoder" (November, 1979, p. 106), several sharp-eyed readers have called my attention to two small errors in the diode matrix encoding chart (Fig. 3, p. 109). The letters in error are K and X. The correct encoding is shown here.

I will be happy to answer any questions readers may have about the circuit or construction details.

L. B. Cebik W4RNL
Knoxville TN

Ham Help

I have several old automobile radios that have vibrator power supplies. Somewhere in my readings I saw an article that gave circuit descriptions and parts data to convert to transistor power *in the vibrator can*. In other words, the whole circuit is built in the can itself and the present socket is used. I cannot remember where I saw the article. Any assistance will be appreciated. Thanks.

Walter F. Seaberg, Jr. WA4TQI
1801 Pimmit Drive
Falls Church VA 22043

I am willing to pay for a copy of pages 19 and 20 of the Galaxy III transceiver manual (#183-29).

Arthur H. Curling W5MIC
131 Archimedes
San Antonio TX 78223

I would like to obtain a copy of an owner's manual to Xerox, or a Xerox copy, for an RCA Senior volt-ohmist VTVM, model WV98C. Also, what is the availability of dc/ac-Ohms probe and cable, model WG299D.

Please advise about what you have and price. I will ensure return of manual.

Harry C. Lein W7HNP
1109 Highland Avenue
Bremerton WA 98310

I would like to hear from anyone interested in starting a ragchew/roundtable on 50.150 MHz, Thursday evenings, 2000 Pacific Standard Time, 0400 GMT.

Berand Kirschner WB0YCQ
4439 Jupiter Drive
Riverside CA 92505

I recently obtained a Heath SB-102 transceiver and am interested in hearing from hams who have made modifications/improvements to the unit, especially in the receiver.

John DiLorenzo KA1FN
Box 179BR
Griswold St.
Jericho VT 05465

I need an instruction book, service manual, and/or schematic for a General Radio model 1601 A VHF bridge. Please advise cost of original or reproduction.

Roger Moe W7KGG
Route 1, Box 1140
Wapato WA 98951

I would appreciate any information, especially a schematic, on a Narco Superhomer VHF aircraft transceiver. I would also like to get a schematic and information for a Dumont model 304-A oscilloscope.

I will copy and return with a postage refund or purchase at a reasonable price.

Gary B. Trustle WB8SPV
424 Franklin Ave.
Waverly OH 45690

If you had trouble with either the code or theory and rules & regs (or both!) when you were studying for your Novice ticket but conquered those problems and went on to join the ranks of licensed radio amateurs, then I need your help. Please write to my wife, Cindy, and relate your experiences and hardships so she will realize that she's not the only one who is having a hard time. She really needs help and encouragement.

Timothy M. Mrva WD8QLB
436½ E. Exchange St.
Owosso MI 48867

I need any available data on a Hickok Vacuum-tube volt-ohmmeter, Department of Ships Model OBQ-1. Thanks.

John C. White WB6BLV
560 N. Indiana St.
Porterville CA 93257

I need a schematic for my vintage National NC57B receiver. I will gladly reimburse costs. Thanks.

Larry Pike WD9HCR
PO Box 3766
Quincy IL 62301

Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

GRAND JUNCTION CO
FEB 9

The Grand Mesa Repeater Society will hold its 1st annual Western Slope Swapfest on Saturday, February 9, 1980, from 10:00 am to 4:00 pm at the Lincoln Park Barn, Grand Junction, Colorado. Table reservations are $2.00 in advance, per table. Talk-in on 146.22/.82. For further information, write to Larry Brooks WBØECV, 3185 Bunting Ave., Grand Junction CO 81501.

MANSFIELD OH
FEB 10

The Mansfield mid-winter hamfest and auction will be held on February 10, 1980, at the Richland County Fairgrounds, Mansfield, Ohio. Featured will be prizes, a flea market, and an auction to be held in large heated buildings. Doors will open to the public at 8:00 am. Tickets are $1.50 in advance and $2.00 at the door. Talk-in on 146.34/.94. For additional information or advance tickets, contact Harry Frietchen K8HF, 120 Homewood, Mansfield OH 44906, or phone (419)-529-2801 or (419)-524-1441.

MINONG WI
FEB 17

The Wild Rivers Amateur Radio Club will hold a midwinter swapfest on Sunday, February 17, 1980, from 10:00 am to 3:00 pm at the Minong village hall, Minong, Wisconsin, 45 miles south of Duluth-Superior, 90 miles north of Eau Claire on Highway 53, and 135 miles from Minneapolis-St. Paul. Admission is $1.50 and tables are free. There will be a raffle drawing for a scanner. Talk-in on .28/.88 and .52. For information, contact Roger Doehr W9DLY, Rte. 5, Box 452, Hayward WI 54843.

LIVONIA MI
FEB 17

The Livonia Amateur Radio Club will hold its 10th anniversary Swap 'n Shop on Sunday, February 17, 1980, from 8:00 am to 4:00 pm, at the Churchill High School, Livonia, Michigan. There will be plenty of tables, door prizes, refreshments, and free parking available, plus reserved table space of 12-foot minimum. Talk-in on 146.52. For further information, send an SASE to Neil Coffin WA8GWL, c/o Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48150.

GLASGOW KY
FEB 23

The Mammoth Cave ARC will hold its annual Glasgow swapfest on Saturday, February 23, 1980, from 8:00 am to 5:00 pm at the Glasgow Flea Market, south of Glasgow on Highway 31E. There will be a large heated building with plenty of free parking. Spaces are available for $3.00 each. There will be no meetings or forums, just door prizes, free coffee, and a large flea market. Admission is $2.00. Talk-in on .34/.94. For additional information, contact WA4JZO, 121 Adairland Ct., Glasgow KY 42141.

LANCASTER PA
FEB 24

The Lancaster Hamfest will be held on February 24, 1980, at the Guernsey Pavilion, located at the intersection of Rtes. 30 and 896, east of Lancaster, Pennsylvania. General admission is $3.00, except children and XYLs. Doors will open at 8:00 am. All inside spaces are available by advance registration only and are $3.00 each for an 8-foot space, which includes a table. There will be free tailgating in a specified area outside, if the weather permits. There will be a two-hour Dutch Country tour by an advance registration of $4.00. Food will be served at the hamfest. Also, there are excellent restaurants and accommodations in the area. Talk-in on .01/.61. For information, write Sercom, Box 6082, Rohrerstown PA 17603.

AKRON OH
FEB 24

The Cuyahoga Falls Amateur Radio Club will hold its 26th annual electronics equipment auction and flea market on Sunday, February 24, 1980, from 8:30 am until 4:00 pm at North High School, Akron, Ohio. Tickets are $2.00 each. Even though it is suggested that you bring your own tables, some tables will be available for $2.00 each. Featured will be refreshments and prizes, including a first prize of a Kenwood TS-120S and a second prize of a Kenwood TR-2400. There will be plenty of room for buyers and sellers. Talk-in on 146.52 and 146.04/.64. For details, write CFARC, PO Box 6, Cuyahoga Falls OH 44221 or phone K8JSL at (216)-923-3830.

LAPORTE IN
FEB 24

The LaPorte Winter Hamfest will be held on February 24, 1980, starting at 8:00 am, in the LaPorte Civic Auditorium, LaPorte, Indiana. There will be plenty of free tables, plus coffee, donuts, and hot food will be available. Admission is $2.50 at the gate, or $2.00 in advance. Talk-in on 146.52. For information, write LPARC, PO Box 30, LaPorte IN 46350.

DAVENPORT IA
FEB 24

The Davenport Radio Amateur Club will hold its ninth annual hamfest on Sunday, February 24, 1980, from 8:00 am to 4:00 pm, at the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th Street, Davenport, Iowa. Tickets are $2.00 in advance; $3.00 at the door. Tables are $3.00 each, no limit, with a $2.00 additional charge for ac electrical hookup. Talk-in on 146.28/.88 WØBXR repeater. Advance tickets can be purchased by writing to club treasurer Clarence Wilson WAØOEW, 1357 W. 36th Street, Davenport IA 52806.

VIENNA VA
FEB 24

The Vienna Wireless Society will hold its annual WINTERFEST™ on Sunday, February 24, 1980, at the Vienna Community Center, Vienna, Virginia. There will be indoor tables, sales, prizes, food, and outdoor frostbite tail-gating. The event at 6:30 am for vendors; 8:00 am for general admission. Admission is $3.00, including one prize ticket; $2.00 for an extra prize ticket. Pre-teens with parents are free. Tables are $5.00 to $2.00, depending on the quantity. Frostbite tail-gating is $1.00. Reservations close February 15. For reservations, contact Carrol N. Guin, 7533 Oak Glen Court, Falls Church VA 22042. For other information, contact the Viennna Wireless Society, PO Box 418, Vienna VA 22180.

MARLBORO MA
FEB 24

The Algonquin Amateur Radio Club will hold its 3rd annual ham radio flea market on Sunday, February 24, 1980, at the Marlboro Jr. High School Cafetorium, just off Rte. 85 North, Marlboro, Massachusetts. Admission will be 50¢. The event will be held rain, shine, or blizzard. Food will be available. Tables will be $5.00 in advance or $7.50 at the door. Talk-in on .01/.61 and .52. For more information or reservations, contact Charles D. McCarthy W1BK, 128 Forest Ave., Hudson MA 01749, or phone (617)-562-5622.

WINCHESTER IN
MAR 15-16

The Randolph Amateur Radio Association will hold its 1st annual hamfest on March 15-16, 1980, from 8:00 am to 8:00 pm, both days, at the National Guard Armory, 700 Western Ave., Winchester, Indiana. Featured will be door prizes, food and drink, and a program of speakers for both days. The cost per table, or an equivalent space, is $3.00. Tickets are $2.50 at the door, or $1.50 in advance. Talk-in on 147.90/147.30, 223.30/224.90, and 146.52.

propagation

by
J. H. Nelson

Due to unforeseen circumstances, J. H. Nelson's "Propagation" was unavailable this month. His column will resume soon.

1980 INTERNATIONAL SSTV CONTEST

Saturday, March 8, 1500 to 2300 GMT
Sunday, March 9, 1500 to 2300 GMT

SPONSOR *73 Magazine*, Peterborough NH 03458 USA

OBJECT To exchange SSTV pictures with as many stations in as many parts of the world as possible during the contest periods.

FREQUENCIES All amateur frequencies between 3.5 and 29.7 MHz where SSTV is permitted.

EXCHANGE Exchange of pictures must include callsign, RST report, and consecutive contact number starting with 001. FCC rules require a verbal exchange of callsigns for US stations. Do not include the contact number in the verbal exchange.

CREDITS One (1) point for each station worked. A station may be worked once on each band for credit. One (1) point for each US state or Canadian province worked. Five (5) points for each country worked. Five (5) points for each continent worked. Each state, province, country, and continent may be counted only once for credit. Total score is the sum of all credits.

ENTRIES Activity sheets should show station worked, state or province, country, continent, and band (80, 40, 20, 15, 10). Summary sheets should show number of stations worked, number of states and provinces worked, number of countries worked, number of continents worked, and total score. Entries become the property of the contest committee. Excessive discrepancies in a contest entry may cause disqualification. Contest entries must be postmarked no later than April 30, 1980. The decisions of the contest committee are final.

AWARDS The top scorer will receive a certificate and a one year subscription to *73 Magazine*. Certificates will also be awarded to the station working the most countries and to the station working the most continents.

Send all entries to:

R. Brooks Kendall W1JKF
10 Stocker St.
Saugus MA 01906

or David Ingram K4TWI
Eastwood Village, #1201 South
Rte. 11, Box 499
Birmingham AL 35210

March 1980 $2.50

73 Magazine for Radio Amateurs

Info

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Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the 73 editorial offices. "How to Write for 73" guidelines are available upon request.

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W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

ST. LOUIS

The May hamfest/computerfest in St. Louis has been recognized by the League and this year will be a combination Midwest/Central Division ARRL Convention. Not bad when you remember that this show was boycotted last year by the League.

With Dynamic Dannals for a speaker, I would be eclipsed anyway, so it is best that I keep to my work at home and see how the show fares this year as an ARRL convention.

Between starting a new magazine this spring, working on plans for a software plant in Ireland, getting ready to promote two new modes of ham communications, laying plans for getting amateur radio into a bunch of Third World countries, and a few other things like that, I can ill afford to take time to visit hamfests, much as I enjoy them.

Amateur radio has been in the doldrums for a year now and there is a need for some ideas to get it going again. The number of new hams has been drying up . . . old-timers have been getting fed up with the garbage on the bands, repeaters are getting killed by crazies, sales of equipment are way down, and many dealers are folding up . . . things are a mess. I have some ideas on tackling this mess . . . including the FCC, which has been laying bummers on us one after the other for a couple of years. I was going to present a comprehensive plan for getting things going at St. Louis, but instead I'll hold it for release in *73* later on. Some of the plan has to do with the two new modes of ham communications which I will have discussed with the industry at Aspen in January, but which will be kept secret for a while.

COPING WITH PSYCHOS

California has developed the kerchunking nerd to a new art form, the compleat psychotic repeater jammer. This has developed into a cult around Los Angeles and has driven the straight groups bananas.

My advice, which seems to be a drug on the market, is to find out whether the straights are smarter than the fruitcakes. If the FC group is winning, then they obviously have the brains on their side.

One approach is to turn helplessly to the FCC for assistance. The odds are very high that they will react poorly to this, being government employees and thus not accustomed to having to deal with actual work . . . other than handling reams of forms. Remember that the amateur radio "service" is reputed to be self-policing. My suggestion is to take this seriously and get set up to do this policing. I favor taking measures as strong as are required to get the needed results . . . the Pyscho Posse, if you will.

In my experience, physical force seldom accomplishes anything beneficial. It is difficult to get a group together to brainstorm a problem when all you want to do is go out and break some SOB's neck. But what you want to do is put psychological pressure on, not break arms or cut coax. Look on such an occasion as a blessing, an opportunity for you to try to outsmart a nerd . . . if you are up to it.

The chances are very good that you will be able to enlist the help of the nerd's neighbors, too, for it is unlikely that someone who is so inconsiderate of his fellow hams is going to be more considerate of people who live around him. You may be able to get some help from his fellow workers, who are probably also suffering in their own way. It is very unlikely that someone who is making a career out of being a lousy ham is going to be a pillar of his community in any other way.

I would like to come up with more concrete suggestions, but most of the ideas which are coming to mind are far too fiendish. Get together in a group and brainstorm it. Not only will the exercise of the brains be fun, but you'll be surprised at the devilish ideas you'll come up with. All you want to do is make life as interesting for the bastard as he has for you . . . right?

Of course, you can always just give up, turn off your two-meter receiver, and move to other ham activities. This will immediately solve your problems. I presume you've already considered this course of action and found it wanting. Perhaps you take a perverse delight in getting mad at the buggers who screw up the repeater? Well, enter into the spirit of it and see if you can, in turn, make life frustrating and aggravating for them.

If you continue to shirk your responsibility as an amateur to participate in the self-policing action we are mandated to provide and you insist on trying to get the FCC to do your dirty work, be prepared for the FCC to react in some way that you don't expect and for the end result to be most unpleasant. Can you think of a single time when someone has petitioned the FCC for rule changes that the

result has been other than complete neglect or a disastrous proposal which overkills the problem beyond belief? This is not going to change.

Some hams have been unhappy over the FCC refusing to react at faster than their usual glacial pace (for which I give thanks) and have gone on to get their congressmen to put pressure on the FCC. This will, I predict, result in even more awful end results. The FCC is almost immobile, but when really pushed (as by a congressman), it moves in a direction which cannot be predicted. Leave it alone.

NEW RADAR DETECTORS

When I heard that every participant in the coast-to-coast Cannonball Rally, which is a race rather than a rally, had used the Cincinnati Microwave "Escort" radar detector, I suspected something was afoot. None of the radar detectors which have been on the market for some time has been spectacularly sensitive and some have been incredibly insensitive. So, even at the high ticket price of $300, it seemed prudent to check this new entry out in comparison with the best the field had to offer heretofore.

The *73* van, fitted out as a traveling office and radio test lab, bristles with from four to six radar detectors, giving us a good idea of the sensitivity, degree of falsing, relative merit, etc., of most of the popular makes of detectors. The Escort, ordered back last summer and subject to a five-month delivery wait, finally arrived and was put on the test line in the van.

There is no shortage of effective radar detector tests in New Hampshire, where virtually every state police car and most town police are equipped with moving radar. It quickly became apparent that the Escort, the first of a new type of detector using the superheterodyne principle, is a breakthrough in microwave receivers. We found that it often gave at least double the warning of the other detectors . . . even the best of them.

When the Escort would light up and start to beep, we would have to look hard for the coming police car. Sometimes we would see it off in a parking lot a quarter to a half mile away. At other times, we would eventually see it pass us going the other way. The unit has an S-meter on it, so you can see about how strong the radar signals are and react appropriately.

Many of the standard detectors scare the hell out of you by suddenly beeping away for no good reason. Some take off when you go under a bridge; some sound when you are near a radio station tower or a CBer. Others just chirp for no apparent reason at all. These false reports detract from the value of the detector. The Escort is subject to false alarms, too, but it is perhaps unfair to use the term "false" since what it is detecting is the signals from security systems which are sharing the police radar channel. You often get these signals when you drive by warehouses and stores where alarm protection is used. These are seldom in areas where one would expect to encounter police radar, so this falsing has not been particularly annoying.

The other detector manufacturers have recognized the power of the Escort and most of them are bringing out their own version of this superhet circuit . . . and at about the same $300 price tag. Whistler has announced the Q-1000, promising quick deliveries. The Fox people now have the SuperFox, with 3-4 weeks delivery quoted. Fuzzbuster, which faked some people out with the claim that an earlier model was a superhet, has now announced for real their new superhet.

Of the non-superhet detectors, we found the Fuzzbuster and Bearfinder to both be good, with the Fox and Long Ranger being just a bit better most of the time. Our worst experiences were with the Whistler and Centurion, which seemed to wake up to the police at about the time a policeman's foot would be put on the van running board.

Why all this fuss over radar? Considering that the van can hardly go over 55 mph going down a steep hill with the wind in back of it, the likelihood of actually speeding is slight. The problem is this: Up in New Hampshire, where most of the radar is the moving radar type, we are all too familiar with the roughly 30% error in giving citations which goes with this type of radar. That's right; the testimony in a trial of radar units recently brought out that about 30% of the speeding tickets given with this type of radar are given in error. This means that the motorist needs every possible warning that a disaster is imminent in the area so that he can be super careful. When the detector sounds off, you first make sure that your speed is well below the allowed speed, then you quickly make a check of the traffic around you (both the cars going your direction or the other way), you look for trucks which might give large targets on the radar and which might be interpreted by the police as being your car by accident, and you watch most carefully for the police car.

We have mountains in New Hampshire and it is all too common to coast down a long hill in neutral as a way to conserve gas. To use the brakes would be to obviously waste fuel. So where do the police lie in wait? You know it . . . at the bottom of long hills. I remember a little trap the police in Whitefield (NH) had set up a few years back. At the foot of a particularly steep and long hill coming into town, they had a few feet marked with a not too obvious sign and a speed limit of 5 mph. That cost me $25 in a speeding fine one day . . . $10 fine and $15 court costs. Oh, I *was* speeding . . . they clocked me at 15 mph through the area.

The radar detectors are also handy when we are working with the ham 10-GHz equipment. With them we can find out if the 10-GHz stuff is working, which all too frequently it isn't. That equipment spends more time on the test bench than in service.

"220 CB IS DEAD . . ."

In case you run into a ham with a conveniently short memory, it was not very long ago that we were exposed to a bunch of BS about who saved the amateur 220 band. No, it wasn't me, though I did my little part . . . as did a lot of other people. I bring this up because there are some hints that we are about to suffer another emerdement of credit-grabbing, all to the detriment of those really responsible.

I see that I am getting top billing as the villain of amateur radio in some quarters. I guess I should be happy with any top billing . . . it's *something.*

Perhaps I am too defensive about enthusiasm for amateur

Continued on page 152

DX

Propagation forecasts are some DXers' staples and others' after-dinner tea. All the monthly magazines have a propagation column and each has its uses. They are all prepared using the 56-day forecast method, due to the constraints of publishing. Forecasts found in the various DX bulletins and on the W1AW on-the-air propagation bulletins are based on 28-day recurrence of solar phenomena with some last-minute updating as necessary. One DXer who deserves recognition for the service he provides is Ted Cohen N4XX, who regularly supplies propagation forecasts to bulletin editors and others. Ted's up-to-the-minute forecasts prove to be more accurate than, say, the local weather forecaster who has thousands of dollars of equipment at his disposal.

The value of propagation forecasts in these sunspot-rich times is debatable. Those who are looking for the exquisite long-path openings on 15 and 10 meters may find the forecasts of use, although long-path propagation is vastly more difficult to predict than short path. Today's bands can generally be counted on to provide the necessary paths to what one is trying to work; the determining factor is availability of a station to work. At least that's better than during the sunspot doldrums, where both Sol and the operator at the other end often seem to be working to the DXer's detriment. During December, the N4XX forecasts, which are always labeled Above Normal, High Normal, Normal, Low Normal, and Below Normal (or combinations thereof), totalled 9 Above, 14 High, 3 Low, and 5 combinations. No days were relegated Below Normal status.

Those who noted somewhat less than sterling radio conditions in January and February, compared to autumn, are advised that worry is *not* in order. Typically, spring and fall provide more excitement than the dead of Northern Hemisphere winter, when propagation settles down and fireworks abate. Look for increasing delicious openings, especially on 20 and 15 long path, around the end of March. Meanwhile, enjoy the 40- and 80-meter bands, and 160 if you have it, during their winter peaks.

Any country you need is a rare one . . . anything you have is run of the mill. One year ago, Art Westneat W1AM ran his last list of "Most Needed" countries in the *West Coast DX Bulletin*. Seventy-five strong, the list read like the blank spaces on the countries list of most operating positions around the world. Dennis Sullivan K6YCM took that list, subtracted the countries which have been available in the past year, and came up with a final tally of the twenty-five countries craved most. Now, take a copy of this to your local travel agent and get out the checkbook!

25 places to visit in 1980:

1. BY China
2. VS9 Kamarans
3. XZ Burma
4. ZA Albania
5. VK0 Heard Island
6. VU7 Laccadives
7. 7O PRD of Yemen
8. FB8W Crozet (on now)
9. XU Cambodia
10. 3Y Bouvet (on briefly in '79)
11. VU7 Andamans
12. 3X Guinea
13. 6O Somalia
14. FR7 Glorioso
15. CE0 San Felix
16. YA Afghanistan
17. XV5 Vietnam
18. 9U5 Burundi
19. 4W Yemen
20. FR7 Juan de Nova
21. S9 Sao Thomé
22. HK0 Malpelo
23. 5A Libya
24. 7Q Malawi
25. 5X5 Uganda

Now, if anyone out there needs just 25 countries and they match with our list, we'd like to hear from you. Some sort of prize would be in order. Your editor, who is holding at about 290 after 20 years of on-again, off-again DXing, has ten of the 25, but the other 15 are enticing. Admittedly, we worked most of the ten in the early 70s and haven't heard them since.

The list is interesting from several points of view. Ten of the 25 are islands. Nine are in Asia, twelve in Africa, two in South America, and one each in Oceania (Heard) and Europe (Albania). Several have essentially zero population, including Crozet, Bouvet, Juan de Nova, Glorioso, San Felix, and Malpelo. The Kamarans have only about 2,000 souls and the Andamans and Laccadives combined have less than 100,000. Of course, the most populous country on Earth tops the list.

What seems to set these 25 countries apart is a commentary on world affairs: They are all either so down and out technologically that radio is simply out of the question or else they have closed their doors to outsiders, even outsiders from their "mother country." They are all hard to get to, to get into, and probably impossible to get into with radios. The Bahamas, they ain't.

WARC is over, finally, and amateurs will probably be getting three new HF bands over the next five years or so. The implications are tremendous: 10 MHz will take much of the long-distance load off 20 meters during years of low sunspot activity, 18 MHz will be the premier DX band much of the time, and 24 MHz will give much of the fascination of 10 meters while not being quite so dependent on the solar flux. However, most radios in use around the world will not be able to receive and transmit on these bands with the simple addition of a crystal or two, so extensive use of the new spots will depend on how much the manufacturers gear up for them in the next few years.

What the new bands will do is increase enthusiasm among amateurs who have run out of accomplishments to shoot for on our present bands. There will be a #1 DXCC to be made on each band, and the scramble will be on. Some of the five-band awards will undoubtedly be expanded to eight-banders and the rush for contacts and QSLs will commence. Along with the Phase Three OSCAR satellites upcoming, these new HF bands will make the 1980s a banner decade for DXing.

AROUND THE BANDS IN DECEMBER

Possibly the high point was an operation from the Central African Republic, TL0BQ, by KA1BQ, KA1BOH, and I8MPO. Their week-long SSB-only operation pretty much put the demand for this one to bed, except for those on the CW Honor Roll, however, who were stymied in attempts to get a Morse contact. Plans for an operation from the Congo by this group were thwarted. QSLs for TL0BQ go to Giampaolo Nucciotti I8KDB, V. Fracanzano 31, 80127 Napoli, Italy.

SM3RL fired up from the Maldive Islands as 8Q7AM, working mostly CW. SM3ITL is a semi-permanent resident of the islands now and uses the call 8Q7AL. Cards for either of these go to SM3CXS.

W6QL and W6KG continued their travels in the Caribbean. Following operation from Grenada as J3ABV, they opened up on St. Vincent as VP2SAX; 9,000 contacts included 141 countries and *CQ* CW and ARRL 160-Meter Contests. K1XA and K1TO operated from St. Vincent as VP2SX during the *CQ* CW Contest, also, causing some confusion. QSL VP2SAX to YASME and VP2SX to AB1U.

TN8AJ returned to the bands in late December and his operations became more professional daily. Another Novice operator testing the DX waters from Africa is TZ4AQS, who first appeared in November, 1979. He is Jan Wilholt and his home callsign in Holland is PE0AQS. His QSL manager, ON6BC, assisted on frequency for a few weeks, but Jan soon took the bull by the horns and began working split frequency pileups with aplomb. He is found mainly on Saturdays and Sundays on 15 and 20 meters, using a Kenwood receiver and transmitter with dipoles. He is expected to be in the Mali Republic for two years, where he is an electrician for a Dutch company building roads.

Marion Island's ZS2MI showed on 20 meters in December; the best time to find him is 05-0600 UTC around 14240. The present operator departs in April.

Mike Smedal, formerly EP2LI, now signs A7XD from Qatar. Considerable effort resulted in his equipment finally getting out of Iran in the autumn and A7XD is now found several times a week on 20 meters. His QSL manager is WA4PYF.

Four Norwegians began operating from Svalbard in December, expecting to stay until June. Calls and QSL routes are: JW1SO/LA4DM, JW7FD/LA5NM, JW5IJ/LA5NM, and JW8FG/LA8FG. Their quad loops produce a booming signal

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Contests

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

VIRGINIA QSO PARTY
Starts: 1800 GMT Saturday, March 8
Ends: 0200 GMT Monday, March 10

This party is sponsored by the Sterling Park Amateur Radio Club. The same station may be worked on each band and mode; VA stations may work other VA stations. The Central Virginia Contest Club plans to put a number of rare VA counties on the air during the contest.

EXCHANGE:

QSO number, RS(T), and VA county or state, province, country.

FREQUENCIES:

Phone—3930, 7230, 14285, 21375, 28575.

CW—60 kHz from low end of each band and Novices' bands.

Check phone bands on even hours GMT.

SCORING:

One point per QSO. VA stations multiply total OSO points by sum of states, provinces, countries, and VA counties worked. Others use number of VA counties for their multiplier (98 max.).

AWARDS:

Certificates to high scorer in each state, province, country, and each VA county; to high score Novice in state and out of state; and special certificate to the top out-of-state score.

ENTRIES:

A summary sheet and a check sheet are requested. Only QSOs on 160 through 10 meters will be counted. Logs must be received by April 15th and mailed to: Virginia QSO Party, PO Box 599, Sterling VA 22170. Those desiring a copy of the results are requested to provide an SASE.

EUROPE AND AFRICA GIANT RTTY FLASH
Contest Periods:
1400 to 2400 GMT March 9
0800 to 1800 GMT March 10

Sponsored by the IATG, this is the 12th annual RTTY Flash Contest as part of a new promotional program for RTTY. The basic purpose of this contest is to increase interest in RTTY, and, even more, to increase interest in intercontinental contacts rather than just international contacts. Remember, this contest is valid towards the final standings of the Continent World Championship. The contest is open to RTTY SWLs with the same scoring rules. Use all amateur bands from 80 to 10 meters on 2-way RTTY only. Each station may be contacted only once on any band; additional contacts may be made with the same station if a different band is used. The DXCC list will be used for country status except that the VE/VO, W/K, VK, PY, LU, JA, and UAØ/9 call areas will be considered as separate countries.

EXCHANGE/MESSAGES:

The message will consist of RST, QSO number, and continent.

SCORING:

Each completed exchange counts 1 point on 80/40 meters, 2 points on 20 meters, 8 points on 15 meters, and 12 points on 10 meters. No points or multipliers for any contacts with one's own country. Multipliers are given for countries and continents. A multiplier is given for each country worked on 20/15/10 meters. No multipliers for 80 and 40 meters. A separate multiplier may be claimed for the same country if a different band is used, up to a maximum of 3 times. Only countries which appear in at least 5 other logs will be valid as multipliers. One's own country is not a valid multiplier. The continents are valid as multipliers, and for contacts with Europe and Africa, both the sender and the receiver will each receive 100 points as a multiplier. 50 points will be assigned for each of the remaining continents contacted. An additional 100 points will be given for each contact with Europe and Africa on 10 or 15 meters. Final score is then: total QSO points x total number of countries x total continent points + total points for Europe and Africa stations worked. Example: 600 QSO points x 10 countries worked x 100 continent points = 600,000 plus 20 Europe and Africa stations worked on 10 or 15 meters, giving a great total of 602,000 points.

PROMOTIONAL PERIODS:

Two promotional periods are included in the contest as follows: Saturday, March 9, from 1700 to 1800 GMT, and Sunday, March 10, from 1000 to 1100 GMT. Stations operating from North America, South America, Australia, Oceania, or Asia who contact Europe and/or Africa during these hours will *double* their points for these periods.

ENTRIES & AWARDS:

Prizes include grand prizes (as usual, reserved for the four first place winners). Consolation prizes along with medals and certificates will also be awarded. Use one log for each band. Logs must contain: date/time in GMT, cailsign, RST and QSO number, continents sent and received, country and continent multipliers, points, and final score. In order to qualify, all logs must be received no later than April 15th and be sent to: Prof. Franco Fanti, Via A. Dallolio n 19, 40139 Bologna, Italy.

RTTYers entering logs in the Giant Contest who have not participated in previous contests will receive an additional bonus of 5% of their final score.

Usual disqualification rules apply. Logs with compiling errors which exceed 10% of the final score will also be excluded from the final standing and will serve only as check logs.

DARC "CORONA" 10-METER RTTY CONTEST
Contest periods will be held from 1100 to 1700 GMT on the following dates:
March 15, May 10, September 27, November 15

The DARC eV invites radio amateurs worldwide to participate in the annual contest which is held to increase RTTY activity on the 10-meter band. There will be four tests within the year with each test scored separately. Use the recommended portions of the 10-meter band.

EXCHANGE:

RST, QSO number, and name.

SCORING:

Each station can be contacted only once. Each completed 2-way RTTY QSO is worth 1 point. Multipliers include the WAE and DXCC lists and each district in W/K, VE/VO, and VK. Also count each different prefix as a multiplier. Final score is total number of QSOs times total multiplier. European country list: C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Gurnsey, GC Jersey, GD, GI, GM, GM Shetland, GW, HA, HB9, HB8, HV, I, IS, IT, JW, JW Baer, JX, LA, LX, LZ, M1, OE, OH, OHØ, OJØ, OK, ON, OY, OZ, PA, SM, SP, SV, SV Crete, SV Rhodes, SV Athos, TA1, TF, UA13456, UA2, UA Franz Josef Land, UB5, UC2, UO5, UN1, UP2, UQ2, UR2, YO, YU, ZA, ZB2, 3A, 4U, 9H1.

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Calendar

Mar 1-2	ARRL DX Competition—Phone
Mar 8-9	QCWA QSO Party—Phone
Mar 8-10	Virginia QSO Party
Mar 9-10	Europe and Africa RTTY Giant Flash
Mar 15	DARC Corona 10-Meter RTTY Contest
Mar 22-23	Tennessee QSO Party
Mar 22-24	BARTG Sprint RTTY Contest
Mar 29-30	YL International SSBers QSO Party—CW
Mar 29-31	Wisconsin QSO Party
Apr 5-7	QRP ARC International QSO Party
Apr 19-20	YL International SSBers QSO Party—Phone
Apr 26-27	Helvetia Contest
May 10	DARC Corona 10-Meter RTTY Contest
May 17-18	Florida QSO Party
June 28-29	ARRL Field Day
Aug 9-10	European DX Contest—CW
Sept 13-14	European DX Contest—Phone
Sept 13-15	Washington State QSO Party
Sept 14	North American Sprint
Sept 27	DARC Corona 10-Meter RTTY Contest
Oct 4-5	California QSO Party
Nov 8-9	European DX Contest—RTTY
Nov 9	International OK DX Contest
Nov 15	DARC Corona 10-Meter RTTY Contest

RTTY Loop

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Last month, I indicated that we were going to investigate the demodulator situation. Well, as the old saying goes, there is more than one way to lead a horse to water (or something equally non-violent). In this case, demodulators can be acquired from at least three sources. In this month's column, we will start to look at one of them.

To begin with, where can you get a demodulator and why do you need one, anyway? For those of you who just came in, a demodulator, sometimes referred to as a "terminal unit" or "TU," is a device which converts receiver output, either at audio or i-f (intermediate frequency) frequencies, into TTY compatible loop levels. Historically, there have been three waves of demodulators available. Following World War II and the Korean "conflict," large quantities of surplus Teletype® equipment found a final resting place in an amateur's shack. These beasts were usually large, power hungry, and possessed less than ideal weak signal qualities. But the price was right, and the surplus market started many of us on the Road to RTTY (apologies to B and B). As the surplus market started to dry up and as many of the defects in the "boat anchors" became apparent, more and more demodulators were "home-brewed," and a multitude of designs were published ranging in complexity from simple one-tube affairs to rack panels full of shack heaters. Now, many of us find ourselves returning to commercial units, this time made for amateurs, with all of the features one could desire, at a price to match!

This month, I will start an overview of various published home-brew designs. What I will try to show is the spectrum of what has been published in progressive amateur publications. In subsequent months, more circuits will be explored In this and other areas of RTTY. Manufactured units will be covered as information is assembled.

To begin our survey, let's go back some eighteen years, to the April, 1962, issue of *73* where Woody Davey W7CJB authored an article describing the demodulator shown in Fig. 1. Rather typical of that era's technology, this converter features a limiter stage, mark and space amplifiers, and 6AL5 diode detectors. A dual triode keyed a polar relay, which keyed the loop, necessary in many designs of the day. Interestingly, the tuned circuits used for mark and space used "TV width coils" rather than toroids. These were both more available and cheaper—then! I would not say the same thing now.

About two years later, the March, 1964, issue of *73* carried an article by Robert Corbett W1JJL which described the rather simple design illustrated in Fig. 2. This was an early use of transistors and diodes in RTTY, as may be seen by the type numbers of the parts. If only I could count how many 1N34s and 2N270s I fried in those days! This circuit has the same basic layout as the previous one, with diode limiting (the 1N34s), amplification, filtering, detection, and keying, but, as is evident, is a whale of a lot simpler.

Another tube converter surfaced later that year (tubes were far from dead, yet), in December, 1964. Fred DeMotte W4RWM graced the pages of *73* with his four-tube demodulator. Many of the same features as before are evident, but this one used a 6AQ5 to achieve unipolar keying of the loop directly, quite an improvement over the polar relay. Still used TV coils for filters, though! As is obvious from Fig. 3, certain operator conveniences now were becoming apparent, like inclusion of oscilloscope outputs and a metering jack. Incidentally, the article credits W4TJU for design of the basic demodulator circuit shown.

Transistors gradually crept into amateur gear over the next few years, and demodulators grew in ability. The January, 1967, issue of *73* presented a demodulator that featured "autostart." This is the ability of an incoming signal to turn on the receiving station's teleprinter. Shown in Fig. 4, the circuit, by W6AYZ, is a conventional demodulator to which has been added a second detector that closes a relay whenever a mark tone is detected. This relay applies power to the teleprinter motor. Although this is a rather simple approach to autostart, it works quite well on clear channels, such as VHF ASFK, where little noise is encountered. For HF or other exotic applications, or where the ability to selectively start up a machine is desired, more in the way of logic circuitry is required. This is, however, a good jumping-off point. By the way, I am not slighting W6AYZ, but his name and address were not printed over the article. I know he must have been a good guy—he used 88 mH toroids for the shift filters; yea!

Next month, a look at some more published designs, including some integrated circuit applications.

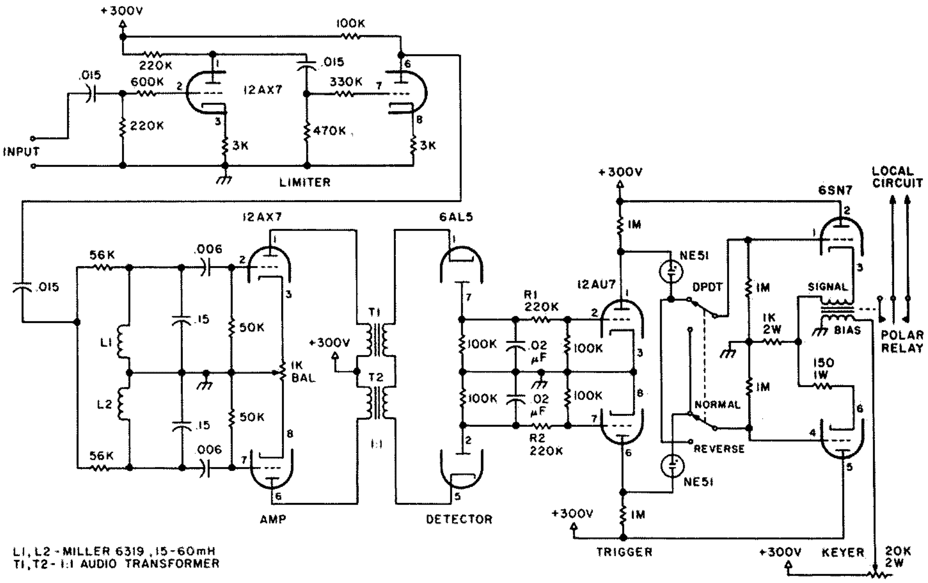

Fig. 1.

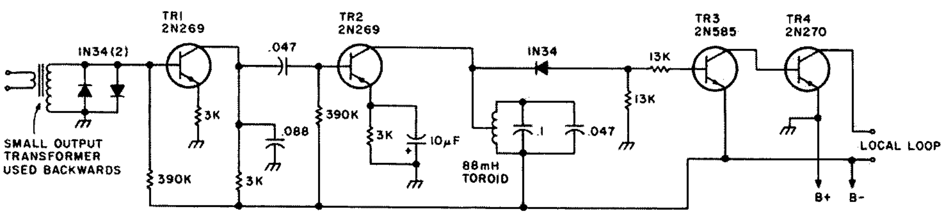

Fig. 2. 13k resistor across secondary of transformer not shown in schematic.

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LETTERS

AD INFINITUM

I have just returned from a very interesting amateur radio club meeting. Don Miller, the ARRL director, just gave the first post-WARC speech by a League official.

Miller is normally a pretty staid individual . . . but this speech was colorful, slanderous, and full of good ol' American intrigue. It appears that he was spouting the League line (i.e., Dick Baldwin's), which is designed to thrill hams about how clever the ARRL is.

I have summarized the high points of this speech.

1. When Dick Baldwin left a world conference 15 years ago, he decided the hams would go after three new bands in 1979.

2. The ARRL top brass realized that an international organization was needed, so they started the IARU and put an impressionable Canadian in charge. It is supported "under the table by the League." Its purpose is to push for development of amateur radio in Third World countries.

3. To spread their influence, the League hired Bruce Johnson, because of his skills as a linguist. For several years he engaged in nonstop travel promoting amateur radio.

4. As an example of the ARRL's effectiveness, Miller cited an incident in Nicaragua, where Somoza (a ham?) appointed a pro-ham radio delegate to WARC just days before being deposed.

5. The money lost by the League (in 15 of the past 16 years) *equals* the money spent on WARC. This is "more than $500,000." To promote ham radio at WARC, the ARRL sponsored three cocktail parties.

6. It costs $1,000 per day to keep a person in Geneva. The League had between 10 and 15 representatives there for the entire conference.

7. Wayne Green had nothing to do with the success at WARC . . . his efforts were intended to destroy ham radio . . . he is probably the lowest ham in America tonight . . . he will say that the League's victory is only luck.

8. The League managed to get a ham on almost all of the subcommittees of the frequency allocation committee.

9. The official U.S. delegation was "very poor"; the ARRL is responsible for saving all of America's frequencies.

10. The Chinese orginally wanted to use 28 MHz for land mobile. To solve this problem, the League officials took some of the Chinese delegation members to lunch and poured several bottles of champagne down them, then convinced them to retract their anti-ham stance.

11. Wayne Green is the "world's greatest magazine salesman . . . but he is not interested in the future of ham radio . . ."

12. By creating a typographical error in the final draft of a proposal that would have taken 40 meters away from the hams, the League was able to prevent the issue from reaching a vote before the end of the conference.

13. The FCC is run by a CBer.

14. The new 10-MHz band is Dick Baldwin's creation.

15. The Canadians were "bastards"; they voted against the American position. They wanted part of the 75-meter band to use for a broadcast station. The official Canadian reason was to improve communications to the Yukon . . . the real reason according to Newington is to beam a signal at Louisiana to convince them to secede when Quebec does!

16. "The Japs" don't want amateur radio (they voted against the U.S.) and we shouldn't buy their gear. Because of this, the League will revoke Okino Torishima's DXCC status. The only reason it got approval in the first place was an attempt to be friends with the JARL before WARC!

17. The presence of imported two-meter gear has caused it to be used by Latin American countries for commercial use (illegal according to international law) . . . this is another reason not to buy it.

* * * * *

Don is more realistic when you talk to him individually. The speech covered a number of other incidents about WARC. It sounded like the League had all the answers for the world, and that outside of the U.S. and Europe, everyone is a "cannibal or chink." Basically the ugly American approach. Needless to say, this version of ham radio had Dick Baldwin being the man responsible for saving amateur radio from Wayne Green and the cannibals.

At the end of his sermon (which included no less than a dozen pleas to join the ARRL), Miller said the future of ham radio lies in home-brewing . . . not traffic handling, CW, or DX . . . and that is hardly the standard ARRL line.

Miller promises to give the Board of Directors no peace until a lobbyist is installed in Washington. He claims it is being stonewalled because of cost . . . about $100K a year. Apparently the League is running on money saved up during World War II.

Someone asked Don about NBVM. He says the League support was all Baldwin's idea. Dick's lack of technical background caused him to be suckered by Tom Lott. The directors went along with the NBVM scheme as a "shot in the dark" proposal to boost the League. Miller, who has a PhD in Electrical Engineering, says that the system will work fine in the lab, but that's about all it will do. He said that we won't be hearing about NBVM anymore.

This was the first time I have heard such a rampant attack on Wayne Green or so many stories about how conniving the ARRL is. I don't think Miller really has any grudges; I think they are coming from Newington.

All in all, it was an interesting evening. Somehow I now have a greater appreciation of where your editorials are coming from.

Name and address withheld by request

Hmmm. There do appear to be a few minor inaccuracies in the Miller talk which might be noted. I'll tackle them by the numbers, since, if history repeats itself, clubs may be hearing much the same talk from most directors.

1. I think the ITU conference in reference here was in 1971, nine years ago, not 15, the one where the League represented us at Geneva and lost every microwave satellite frequency above 500 MHz for us . . . and about 90% of those below 500 MHz. It was a total loss of over 138,000 MHz and it changed the future of amateur radio totally. The three new bands first came up when Prose Walker got to be the Chief of the Amateur Division of the FCC. I visited him at the time and he explained how he had looked over the shortwave allocations and had found three small bands which might eventually be vacated by commercial interests as they shifted to satellites and cables. Baldwin may have decided to go after them, but it was Prose Walker who came up with the idea and proposed it to the FCC.

2. Ask any old-time ARRL member when the IARU started. It's been around for a long time . . . certainly way before Baldwin ever thought of working for the League. The poor support of the IARU, while insisting upon maintaining control, has long been a bitter pill for the European amateur societies. Miller is right that Baldwin did put an impressionable Canadian in charge. Members of the Amateur Radio Manufacturer's Association heard from Mr. Eaton and drew their unfavorable opinion of him and IARU. I think I reported on that sometime back, including the double-talk from Baldwin at the same meeting. Someday my tapes of these meetings may be valuable historical documents . . . for it is all there on tape.

3. According to Eaton, only countries where there were member societies of the IARU were visited in Africa . . .and then it was on a lower level. I think all members of the League would like to see a full report on the countries visited by Johnson and the investment involved. I can recall no time in history where the League ever permitted members to have any detailed information on money spent toward "saving our frequencies."

5. Being, essentially, a nondrinker, perhaps I am not a good one to comment on the cocktail

Continued on page 148

Microcomputer Interfacing

Christopher A. Titus
David G. Larsen WB4HYJ
Peter R. Rony
Jonathan A. Titus

Our past columns have concentrated upon the 8080 central processing unit (CPU), and our interfacing and software examples have all been developed for 8080-based computer systems. A new processor, the 8085, is now available with all of the capabilities of the 8080, but with a few additional features that make it worthwhile.

One of the main features of the 8085 is that it is software-compatible with the machine codes for the 8080. Thus, a 303 is a jump (JMP) instruction in both systems. The 8085 has two additional instructions that will be discussed later. Basic 8080 systems generally include a clock generator and a status latch circuit for external control of the 8080. These functions are now provided for, within the 8085. A simple RC network or a crystal may be used directly with the 8085 for the generation of the clock pulses needed by the system. Many of the control signals that are needed by external devices are now generated in the 8085 chip, further reducing the amount of external logic that is required.

There is a price to pay for this, though. The 8085 uses one set of eight lines to transmit both data and address information. In some systems, it may be necessary to latch the address bits (A7-A0) so that they are readily available for use in the system. An Address Latch Enable signal (ALE) is output by the 8085 to control such a latch circuit. You may recall that this type of bus multiplexing was also done in the 8008, the first general-purpose eight-bit microprocessor chip.

Another feature of the 8085 is that there is a family of 8085-compatible devices that makes small computer systems rather easy to design. These chips include the 8155 read/write memory and the 8355/8755 read only memory devices. Since these devices require both the address and data information that is multiplexed on a single eight-line bus, they are set up to internally demultiplex the necessary data. The ALE signal is distributed to all of the 8085-compatible devices to control these internal functions. A typical latch circuit that will demultiplex the address and data is shown in Fig. 1.

The 8085 provides the high address bits (A15-A8) on eight output pins. These signals have no other purpose and they are not multiplexed. They are equivalent to the A15-A8 lines in an 8080-based computer. Some of the other 8085 inputs and outputs such as interrupt (INTR), interrupt acknowledge ($\overline{\text{INTA}}$), RESET, HOLD, Hold acknowledge (HLDA), and READY operate as they do in 8080 systems. There are also two new outputs from an 8085: CLOCK OUT, a TTL-compatible clock signal of one-half the system clock frequency and RESET OUT, a signal that may be used to reset other system components. The RESET OUT signal is derived from the reset input to the 8085.

The 8085 uses three control signals to manage the flow of data to and from memories and the CPU and to and from I/O

Continued on page 149

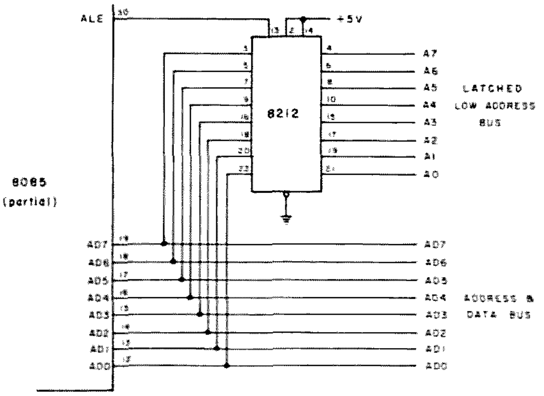

Fig. 1. Use of a latch to demultiplex the 8085's low address bits.

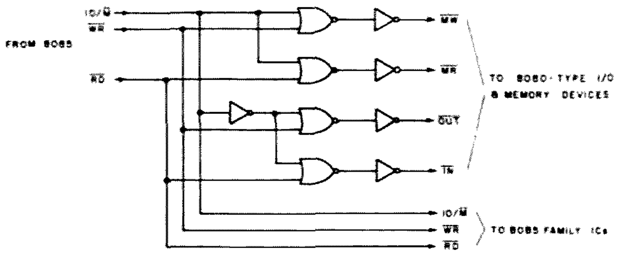

Fig. 2. Necessary gating to generate 8080-compatible control signals in an 8085 system.

NAME	RESTART ADDRESS	CHARACTERISTICS
TRAP	000 044	Highest priority of all interrupts. Non-maskable, always "on." Both edge and level sensitive.
RST 5.5	000 054	Maskable, logic 1 sensitive
RST 6.5	000 064	Maskable, logic 1 sensitive
RST 7.5	000 074	Maskable, positive edge sensitive

Table 1. Internal 8085 Interrupts.

SIM, Set Interrupt Mask 060

ACCUMULATOR BITS	FUNCTION
D0 RST 5.5 Mask	Mask Bits for RST inputs on 8085 Chip*
D1 RST 6.5 Mask	0 = Enable
D2 RST 7.5 Mask	1 = Disable
D3 Mask Enable	Must be a logic 1 to allow masks to be changed
D4 Reset RST 7.5	Logic 1 clears an RST 7.5 interrupt request*
D5 Not used	
D6 SOD Enable	Logic 1 loads SOD data to SOD pin (pin 4)
D7 SOD Bit	

*All masks are disabled by an external reset

RIM, Read Interrupt Mask 040

ACCUMULATOR BITS	FUNCTION
D0 RST 5.5 Mask	
D1 RST 6.5 Mask	Reads the status of the current masks
D2 RST 7.5 Mask	
D3 Interrupt Enable	Enables RST 5.5, 6.5, and 7.5
D4 RST 5.5 Input	
D5 RST 6.5 Input	Reads any pending interrupt requests
D6 RST 7.5 Input	
D7 SID Bit	Reads data in from SID input

Table 2. The SIM and RIM Instructions.

Leaky Lines

Dave Mann K2AGZ
3 Daniel Lane
Kinnelon NJ 07405

A tap-tapping, but unlike Poe's bird,
He needs no "midnight dreary" to be heard,
Nor chamber door on which to rap,
He's heard across the whole darned map.
On ev'ry band, from dusk to dawn,
The gross intruder carries on.
I'd love to swat that lousy gremlin,
But who can get into the Kremlin?

This small piece of doggerel, rude and rotten though it may be, points up a problem that has been plaguing us for lo, these many moons. There have been all sorts of overtures made to the Soviets to try to persuade them to take this intruder off the bands, but to no avail. We don't even really know what type of device this Russian "woodpecker" may be, but we have a notion that it is some sort of a scanner. What purpose can it serve? Surely there are more important communications for the Russians to snoop into... matters that relate to politics and international affairs. What can possibly interest them, for example, in monitoring the 8Z4 expedition as they did for hours on end? Up and down the DX bands they slide, inflicting the spectrum with their unwelcome presence.

They zero in on any frequency occupied by anyone who may be trying to work DX. If it is the Russians' intention to irritate, then they are doing a remarkably good job of it. But I cannot quite grasp the logic behind the tactic. Of what earthly use is this constant jamming of amateur radio?

They might well contemplate this: that the common belief is that this device of theirs serves no other purpose than making mischief through annoyance... that this may make it difficult for us to take them seriously in all other respects. The guy who thought up the "woodpecker" must be related to that other clown who claimed that the Russians invented "beisbol." The woodpecker is a childish idiocy that will win nothing but contempt and scorn for the Soviets.

* * * * *

Some politician recently had the effrontery to suggest that far too much electric power is being wasted through amateur radio and that the energy consumed would be much better utilized in the heating of homes and the running of factories.

I've got a hot news flash: If he really wants to accomplish something worthwhile, he should figure out some way to store all the hot air that is generated by politicians, and then perhaps we wouldn't need to use any other source of energy at all!

* * * * *

Word is out that Donny Osmond, of the Donny and Marie Show, has gotten a Novice ticket and has joined the amateur fraternity. We wish him well, together with all other newcomers to our ranks. *73* once published an article which listed all the celebrities who hold ham licenses, and perhaps it might be a good idea to upgrade that piece, for many, like Donny, have become licensed since, and some old-timers have become inactive, while quite a few have gone on to join that Old Brass Pounder in the sky.

One guy that nobody ever hears anymore is Arthur Godfrey K4LIB. The trouble was that every time he came on the air, hundreds who recognized his distinctive voice would break in and the poor guy couldn't have an uninterrupted QSO. The same thing always happened to the redoubtable Jean Shepherd K2ORS, who had a veritable army of fans who wouldn't let him come on the air without constant breaking.

Speaking of Jean Shepherd, I must tell you about a brainstorm of his.

Years ago, a group of us used to hold nightly rag chews on 20 meters. These used to run well into the wee small hours of the morning. Jean and I, together with Dave Sohmer W2DJE, Jim Meyle K2PXX, Jack Powers W2JIA, Fred Arakelian W2MQI, and several others, would congregate on about 14.260 (old-timers will recall that in those days, about 1963 or so, we were still operating under the so-called "gentlemen's agreement," reserving the lowest end of the phone portion for AM users). Discussions were generally frivolous, covering the broadest possible spectrum of subject matter. Rarely did we get involved in anything serious ... it was all fun and games.

One night, Jean began talking about the culture and growing of beards (it was just about the time that the hippie movement was surfacing, and guys were showing up all over the place with hirsute facial adornments). He announced that the net, which he called "The Bearded Network," was having its annual drive for new members and that anyone monitoring could join simply by writing in and requesting membership ... no initiation fee or membership dues.

I don't know what possessed him... it was strictly spontaneous and unexpected. The rest of us picked up his cue at once, and from that time on, each night's session would begin with a discussion relating to beards... famous historical figures who had worn them, such as Abe Lincoln, Robert E. Lee, H. W. Longfellow, Walt Whitman, the Smith Brothers, the Twelve Apostles, and so forth. Jean announced that we had a kit available which would speed up the growth process for young men, and Dave offered a bottled remedy for "beard lice." Jack raised the question of sleeping with the beard under the sheets while sleeping, or outside of them. We observed Roberts' Rules of Order... all very proper, just like a Madison Avenue corporate board meeting.

All this nonsense took place night after night throughout the long winter. All sorts of mail arrived in response... none of which was answered, of course. Whenever anyone broke in to complain about not having received his membership card, he would be advised that there was a six-week delay due to the unprecedented response.

So it went on and on, and we must have developed a listening audience of several hundreds. God knows what this meant in terms of absenteeism in schools and on the job, for the sessions never broke up before at least 4 am.

Sooner or later it was bound to happen. During the Washington's Birthday Sale down at Harrison Radio, Dave Sohmer was browsing around, looking for bargains. He was wearing his QCWA pin, as all good members of that organization do, thus exposing his callsign to view. All at once a young fellow in naval uniform accosted him. "What are you trying to pull?" he thundered. "Why, you're nothing but a phony. You don't even wear a beard! No wonder I never got that membership card," he added. "Someone ought to knock hell out of you." Fortunately, this guy was all mouth and no action... he walked away in a towering rage. Dave told me that at the moment he thought the fellow was about to tear him apart.

"The Bearded Network" finally petered out. But it had been fun while it lasted.

Somehow, you don't hear this sort of thing anymore. People seem so all-fired serious on the bands nowadays. There's no room for humor and high spirits anymore. If that's called progress, I'll cheerfully take hemlock! Relief is just a swallow away!

Ham Help

I need to obtain both the construction and operation manuals for an Eico 722 vfo kit. Also, I need an operating manual for a Hallicrafters HT-40 transmitter. I will pay copying costs or copy myself.

Bill Danielson
3428 South Court
Palo Alto CA 94306

I badly need a schematic and alignment instructions for a National NC-300 receiver. I will pay to have a copy made.

Bob Amos
607 North Madden
Shamrock TX 79079

I would like to start a net on 80 or 40 meters to experiment with the active-participation, role-playing game, Traveller.

David Martin
1605 Singletree Lane
Bowling Green KY 42101

New Products

RADIO SHACK PLUG 'N POWER WIRELESS REMOTE CONTROL SYSTEM

The new Radio Shack Plug 'n Power Wireless Remote Control System provides instant plug-in remote control of from one to 16 lights, appliances, or other ac-operated devices with no wiring or installation required.

The compact 4¾" x 3½" x 3½" remote control center is simply plugged into any ac outlet in your home, office, or business. The lamp or appliance, such as a TV, stereo, coffeepot, or security system, is plugged into a switch module which then plugs into an ac outlet.

Each lamp dimmer switch module will control any incandescent lamp rated up to 30 Watts, turning it on, dim, bright, or off. Appliance switch modules will control appliances rated up to 15 Amps or incandescent lamps up to 500 Watts.

An easily installed switch module is also available to replace wall switches for control of incandescent lights up to 500 Watts. Its functions include on and off by remote or local control, and bright and dim by remote control.

Sixteen "house code" settings on the control center and switch modules are said to permit the use of several systems in the same area without interaction, or to control up to 256 individual circuits. Any number of switches may be operated on a single circuit as well. The remote control center has buttons for "all-on" and "ail-off" that can be used in case of an emergency.

The Radio Shack Plug 'n Power Remote Control System is available from participating Radio Shack stores and dealers. *Radio Shack, 1300 One Tandy Center, Fort Worth TX 76102.*

NEW 2 KW ANTENNA TUNER KIT IS UNVEILED BY HEATH COMPANY

A new 2 kW antenna tuner in kit form has been introduced by Heath Company, world's largest manufacturer of electronic kits. Featuring a built-in balun, the Heathkit SA-2040 antenna tuner can be used with any type of balanced or unbalanced feedline. It tunes continuously between 3.5 MHz and 30 MHz.

Incorporated in the SA-2040's design is a continuously variable inductor said to give an infinite number of impedance settings for precise antenna matching. Inductor settings are indicated by a counter on the front panel. By noting settings on the erasable front panel, the operator can return quickly to a specific frequency, especially helpful for net operations or contesting.

This antenna tuner features silver-plated straps and roller contact assembly for minimal rf loss at high frequencies. Its large ceramic feedthrough insulators are designed to withstand high voltage rf. The tuner is capable of handling up to 2000 Watts PEP on sideband and 100 Watts on CW.

The SA-2040 kit includes a detailed Heathkit instruction manual and can be built in two evenings. Upon completion, the antenna tuner can be personalized with the operator's own callsign using stick-on numerals and letters included with the kit. The unit is housed in a black and gray metal cabinet measuring 5-5/8" H x 14-13/16" W x 13-15/16" D.

The SA-2040 antenna tuner, and nearly 400 other electronic kits you build yourself, can be seen at Heathkit Electronic Centers or in the latest Heathkit Catalog. A free copy may be obtained by writing *Heath Company, Department 350-110, Benton Harbor MI 49022.* Reader Service number 303.

CLUTTERFREE MODULAR CONSOLES

In the frantic world of electronics merchandising, manufacturers and users of equipment often overlook the obvious—like what to set it on! Even the most diligent reader will fail to find more than a tiny handful of furniture manufacturers in the hundreds of equipment ads which support the pages of a major hobby magazine like *73*.

Fortunately, at least one capable woodworker recognized the importance of rugged quality, professional appearance, and reasonable cost: Clutterfree Modular Consoles, a divison of Cloverleaf Products.

I was privileged recently to have the opportunity to assemble one of Clutterfree's excellent equipment consoles and was very impressed with what I had when I finished.

While it would be possible to manufacture a cabinet made from solid hardwood, it is far more economical to use thick particle board with a natural-looking finish. This is the philosophy behind manufacturing these equipment desks. The finish laminate is made from decorative Plyocite®, a highly-resistant covering which offers protections from solvents, stains, cleaners, and even burns.

The Clutterfree is available in a number of options. As shipped, a face board is provided for custom cutout to receive the components of the ham station. While the customer may wish to exercise the care required to make a good fit, he may send measurements to the factory before shipment and skilled craftsmen will make the cutouts for him at a slight additional cost.

Once fitted, the sloping front panel provides comfortable access to the operating controls of your equipment. Or, as shown in the photograph, the optional front panel may be omitted entirely and the equipment set in place. This is especially handy for those of us who can never make up our minds as to what equipment we are planning to keep and what we are going to swap at the next hamfest!

Tabletop room is quite spacious: nearly five feet wide by 2½ feet deep. Cabinet room in the pedestals is voluminous, too. Plenty of space for books, logs, QSL cards, spare components, and whatever else might be needed at the operating position. A drawer model is

Plug 'n Power Remote Control System from Radio Shack.

Model SA-2040 antenna tuner from Heath.

now available at additional cost, making the console a beautiful piece of office furniture as well.

Height of the tabletop will accommodate a wide range of users' knees and permit leg-crossing, too!

The upper shelf is quite rigid when securely locked down by the mounting screws; a vertical divider doubles as a center brace. This shelf is a logical place to put a clock, lamp, speaker or any other light appliance or paraphernalia.

Because of the substantial weight of the hefty console, it is a good idea to examine carefully the component packages upon arrival from the shipper. The finished wood is well packaged, but shippers have a tendency to find the weak spots! In our particular case, a tell-tale hole showed that a talented fork-lift operator took careful aim before skewering our console! Our replacement met the same fate and was refused upon delivery. Needless to say, we are now using a different shipper! It's heartbreaking to see a fine piece of carefully-made furniture become a battleground for war games.

Your console will consist of three packages. Final assembly is easy. The two pedestals are fully assembled already. After they are spaced appropriately apart, you simply set the tabletop in place, insert the screws provided, and tighten up. The upper shelf is also a snap to complete; members are already slotted for a sure fit. Average assembly time is less than an hour. When the job is finished, you will be proud of your product. It is handsome, modern, durable, practically designed, and reasonably priced.

Clutterfree Modular Consoles are $169.95 and are available from *Cloverleaf Products, PO Box 5103. Tacoma WA 98405.* Reader Service number 476.

Robert B. Grove
Brasstown NC

CHECKING OUT THE MACROTRONICS M650 RTTY INTERFACE UNIT

If you're a ham and own a home microcomputer, you'll want to read up on a way to get on the air on RTTY and CW using your computer. The Macrotronics M650 interface unit is designed to convert the PET™ computer to a first-class RTTY and CW terminal.

Radioteletype (RTTY) is a rapidly-growing form of amateur radio communications, especially in its most advanced "digitized" form. Electronics has taken RTTY out of the woods, so to speak, by enabling compact, state-of-the-art electronic terminal equipment having few if any moving parts that replace bulky and noisy mechanical teleprinters.

One can easily get on RTTY today by three means: (1) buying surplus mechanical teleprinter equipment—the classic method; (2) buying or building a "dedicated" RTTY system, examples being the type of gear sold by HAL Communications and Microlog; or (3) building or purchasing a home computer interface unit.

I chose to go the third route for reasons of economy and simplicity, having already purchased a PET, and being unwilling to devote $600-700 or more to a single-purpose dedicated RTTY system. I was immediately attracted by the Macrotronics ads for the PET and Radio Shack TRS-80 interface adapters that began to appear in the ham magazines last spring. I was sold on the PET M650 interface as a way of almost instantly getting on the air on RTTY.

My "instant" conversion to RTTY dragged out to nearly six months due to production problems encountered in gearing up the interface units for sale. What finally arrived was surely worth the wait—a very professionally wired-and-tested "black box" complete with debugged software and an extensive instruction manual. All that was necessary was to add my own AFSK (audio frequency shift keying) unit and connecting cables for it, required to modulate the transceiver's SSB input to produce the FSK tones by which RTTY is transmitted over the air. Let's look at some of the features of the M650.

RTTY Features and Capabilities

The system produces a three-level split screen display on the PET's video monitor. The transmit buffer is displayed on the top 6 lines of the display and the receive buffer is presented on the bottom 12 lines. The middle 2 lines display "real-time" characters as they are being transmitted over the air. With this buffered system, you can type ahead into the transmit buffer while you are receiving an incoming message, which allows you to have full editing and correction control over what you compose. When it's your turn to transmit, you enter the send mode (by depressing a particular key on the computer's keyboard); the transmit buffer will begin to send what's stored in it. You can continue to type ahead into the transmit buffer, which will be displayed at the top of the screen. Instant replay of received messages is also possible, so that you can send a received message back to the originating station. Incoming messages can be saved on the computer's built-in cassette recorder and played back at a later time—an excellent feature for traffic handlers.

The M650 RTTY system works with 110-baud ASCII coding or standard teleprinter Baudot code at speeds of 60, 67, 75, or 100 words per minute (wpm). Received signals may be *inverted* from the keyboard, useful in deciphering stations sending upside down (mark and space tones reversed). The unit also has provisions for sending the FCC-required CW identification (ID) in Morse code at the end of each transmission, then automatically transferring to the receive mode. The ID message is keyboard programmable. In addition, there are eight message memories available,

Continued on page 144

Clutterfree Modular Console from Cloverleaf Products.

Macrotronics' M650 computer interface is sold wired and tested for $210. "Select 1" and "Select 2" switches are for future accessory installation and are temporarily in use by the reviewer for transmitter switching functions.

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Charlotte NC 28211

Good-Bye to Autopatch Hassles

—low-cost remedies to common problems

Quite often when a repeater group starts to install an autopatch unit on its repeater, it encounters a few problems. These include coming up with a practical way to monitor and log the patches and how to get everyone's tones set to the right level. While most of the other problems associated with autopatch can be solved through proper education of the users, those two problems have simple solutions with a minimum investment in equipment.

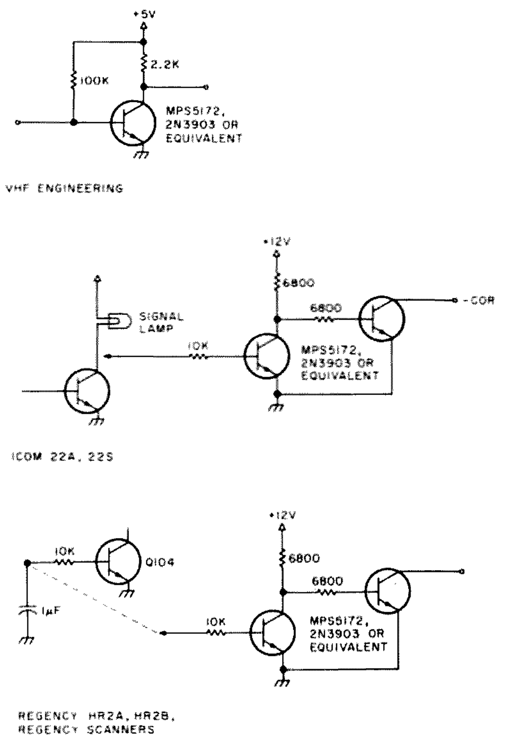

Fig. 1.

The vast majority of patches use some means of tape-recording the calls for the logging requirements. The big professional machines with the 10½" reels and 1-7/8 ips speed may be great for time-between-tape changes, but they fall a bit short when one wants to review the tapes without shutting the system down. Those machines are a bit costly without insisting on two of them.

A more practical device is the lowly cassette recorder. These are cheap, readily available, and most adaptable for this operation. For our particular system at WR2ABS, in Binghamton, we use a $30 model obtained from Radio Shack. It has an automatic volume level circuit, is ac or dc powered, and has a jack from which we can control the machine's starting and stopping. We use 120-minute cassettes. Each cassette is good for around 30 calls per side. We use about 45 cassettes for a year of logging. A careful watch of bargain stores such as Olsen Electronics, in Akron, Ohio, can yield some excellent prices on voice-quality cassettes. We purchased ours as needed in just big enough lot sizes to qualify for discounts, as we didn't know how many tapes we would eventually need.

A lot of groups are under the impression that the recorder must be at the repeater site. This is probably one of the poorest choices

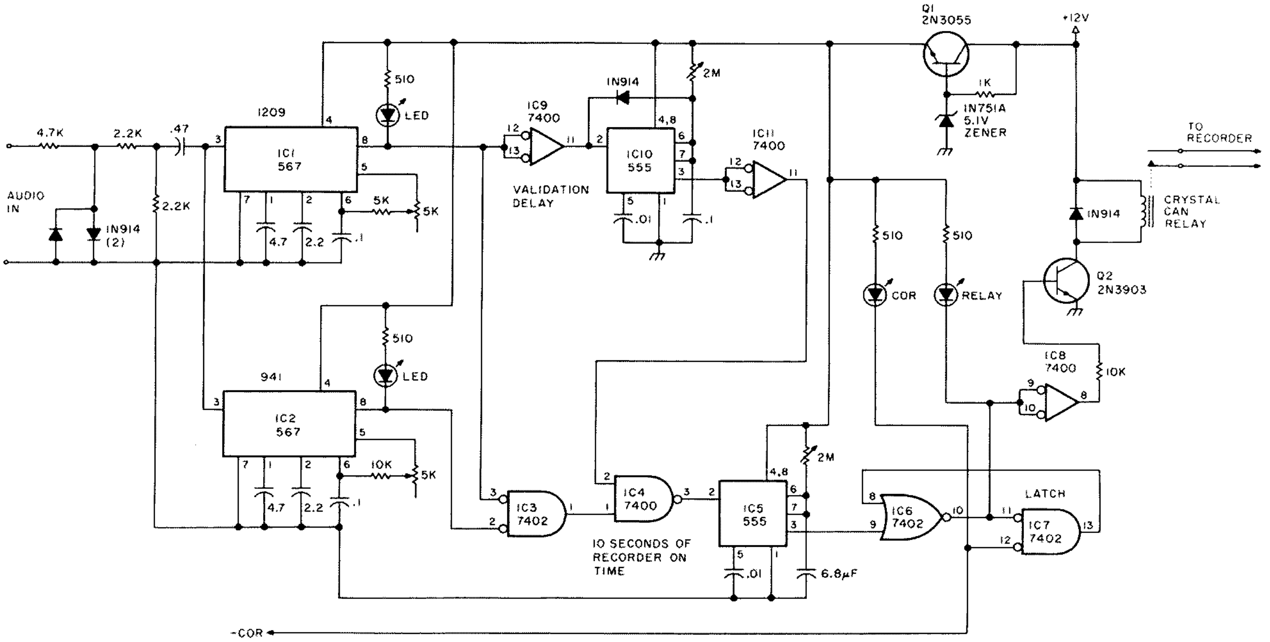

Fig. 2. Tape-recorder control.

for the location of the recorder. The best place is in someone's house—preferably the house of someone who is home often. By teaming up the recorder with a receiver capable of receiving the repeater full quieting, the combination can be housed anywhere. And by placing the combination in a residence, you eliminate worries about electricity, accessibility, temperature variation, and supervision. The lucky custodian need only glance at the recorder periodically to ensure an adequate supply of tape, or flip over the cartridge, or put in a new one. As this occurs only every few days, it is no great hardship on anyone.

The receiver chosen for this task need not be fancy or super-sensitive. A little scrounging often can turn up an old scanner, or someone's old fire monitor, or even an old out-of-service rig. We ended up using the receiver designated as our lockout receiver for those days when it was required.

The only modification to the receiver is to install a COR circuit. All other attachments are made to the existing circuitry of the receiver. Fig. 1 illustrates a number of COR circuits that can be adapted to almost any receiver having a squelch circuit. The main idea is to connect to that point in the squelch circuit that drives the audio gate. A parallel circuit is added so that when the gate is opened by the presence of a carrier, a logic down level appears at the COR terminal of the added circuit.

The next step is to construct a circuit that activates the tape recorder in the same manner as the one that activates the patch. Since most patches use the * up, # down access, this is the circuit that will be described. In those areas where nerds abound, forcing one to go to a multidigit access, one must then substitute the same access circuit used for the patch and substitute it in the circuit to be described below. The basic philosophy involved is that the tape recorder is to activate when the patch comes up and go down when the patch goes down.

Please look at Fig. 2. The AUDIO IN terminals are connected across the speaker terminals of the monitor receiver. The 5k-Ohm input impedance will not load the speaker circuit at all. If the audio level is too loud, the two diodes will start conducting and limit the audio level into the phase locked loops, ICs 1 and 2. R1 is adjusted by placing a frequency counter on pin 5 of IC1. Adjust R1 until the counter reads approximately 1180 Hz. This phase locked loop is to be set to trip when it sees 1209 Hz. Setting the loop about 30 cycles low seems to allow faster lockup, especially in the presence of another tone. This method is not supported in the literature, but it works.

By the same method, set R2 so that the counter on pin 5 of IC2 reads 910 Hz. This will allow IC2 to respond to a 941 Hz tone. Thus, when a * is sent, both phase locked loops will activate, satisfying the AND condition of IC3. Since the phase locked loops react very quickly, voice peaks can trip this circuit. IC10 is used to generate a one-second delay which is ANDed with the output of the two phase locked loops. The result is that not only must both tones be present, but they must be present for the length of the time delay. This will prevent random voice signals from tripping the recorder.

ICs 9 and 11 serve only to provide the proper polarity in and out of the delay circuit. IC5 is a variable delay that will apply a set pulse to the latch circuit made up of ICs 6 and 7. The latch being set will activate the tape recorder. The latch is a "set over reset" type, or the latch will remain set independent of the reset pulse as long as the set line is active. The delay circuit of IC5 is used to keep the recorder on for about 10 seconds. This allows the recorder to pick up attempts to access the patch and will keep the recorder on long enough to allow it to come up to speed. The reset to the latch is the COR line from the circuit described previously.

The idea behind this is that while the patch is active, the repeater carrier is up continuously during both sides of the conversation. With the repeater

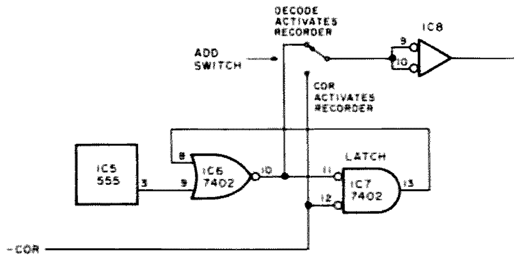

Fig. 3. A switch is added to activate the recorder, either by the COR or by tones.

carrier up, the COR line will be at a down logic level. This will allow the AND condition of IC7, allowing the feedback circuit of the latch to be complete and locking up the latch. When the patch is finally dropped, either by control or by one of the timeout functions, the repeater carrier will drop and the COR line will go up, resetting the latch and turning off the recorder. The latch is coupled to the tape recorder by means of IC8, Q2, and the relay. The relay contacts are wired to the remote control jack of the tape recorder. Q1 serves as a voltage regulator to generate 5 volts for the logic circuitry.

One modification to this circuit is shown in Fig. 3. With the addition of one switch, the tape recorder can be activated by the autopatch access tones or it can be set to turn on each time the COR is activated. There may be those times when it is desirable to record everything on the repeater, not just the patch. For example, it is extremely useful to record an emergency exercise. A full scenario is recorded in time sequence for later examination and critiquing. We managed to locate and remove from the air waves a "Good Buddy" type whose "hot" radio had some neat push-buttons that dialed a telephone. By recording the struggles of this poor sap and decoding the phone number he was trying to dial, a reverse phone book gave us his name and address and he was squelched. He never did figure out how to work the patch.

It is often instructional to play a 12 midnight to 6 am kerchunk tape at the club meeting. While this is not a permanent cure for the kerchunk problem, it does prove that the number of kerchunks between midnight and 6 am is exceeded only by the number of furlongs between here and Venus.

One source of irritation can be eliminated by setting everyone's touchtone™ pads to the proper level. Every 2m FM rig has a limiting circuit in the modulation chain that is used to prevent over-deviating. This circuit usually consists of a couple of diodes, and they tend to clip modulation peaks. It's this clipping action that puts the kibosh on many perfect dialing records. The clipping action generates harmonics that fall within the audio passband of the tone decoder. It seems that Ma Bell's decoders get hyper if there are any signals louder than 20 dB less than the level of the tones. This means that if there are any extraneous signals present along with the tones, the decoder may refuse to recognize the tones. Since most people cannot even tell that any distortion exists on the tone signals, let alone what the relative level between the high tone and low tone is, it is absolutely ludicrous to attempt to set your pad level by ear. This usually results in constant on-the-air trial and error testing, irritating those monitoring and frustrating the poor operator who bats only .375 in successful phone calls. There is a better way.

In anticipation of these types of problems, we at WR2ABS installed a simple relative-deviation-level meter on our autopatch recording receiver. We set all tone pads by meter reading, eliminating all of the guesswork and the bother.

There is no real reason why we installed the meter on the autopatch recorder receiver except that it was convenient and we didn't have another receiver lying around. The two sets of circuitry are not related to each other and may be installed on two separate receivers at two totally separate locations.

As this meter circuit, shown in Fig. 4, is purely a relative indicator of deviation, the correct settings must be determined by trial and error. But, once found, the meter can be declared "the golden standard" and can be used to set everyone's tone pads consistently. The input of the meter circuit is connected to the output of the discriminator circuit. The easiest point is usually on the hot side of the volume control. The meter circuit must be connected before the squelch gate and before the volume control. We want neither the squelch control nor the volume control position to affect the meter calibration in any way. The discriminator output is fed to an operational amplifier through a 15k pot which serves as a gain control. The amplified audio is rectified by the full-wave bridge, the peak output of which is applied to the meter. The meter will respond to peak deviation of either polarity. To calibrate, the 15k pot is set so that the meter reads full scale when no signal is present. The background noise level will indicate more strongly than a modulated signal, and by setting it to full scale on the meter, it will provide a repeatable upper level in case recalibration becomes necessary.

Normal audio levels will run from 50% to 60% of full scale. The specific setting for the autopatch will need to be determined by trial and error, as each repeater setup will vary. The meter is not a linear device, so unless it is calibrated with another device of known accuracy, remember to use the readings as strictly relative—repeatable, but relative.

The touchtone signal consists of two sine-wave audio tones. The low group representing the rows are 647, 770, 852, and 941 Hz, respectively. The high group representing the columns are 1209, 1336, and 1477 Hz, respectively. Ideally, the proper tone consists of a high tone and a low tone and nothing else, including such things as harmonics from clipping, voices, noise from less than full-quieting signals, and music. Any other noise must be at least 20 dB lower in amplitude than the tones or the Ma Bell decoders will hiccup. The two tones must add in a linear manner. So, if one tone is louder than another, it may show the same peak amplitude as one with totally different individual amplitudes but with the same sum amplitude. For this reason, it is important to set the pads up by looking at the individual tones, as Ma Bell also is fussy as to their relative amplitude. The low tone should be equal to, or less than, the high tone, but no more than 4 dB lower. Determining this condition by ear is impossible, as is sensing the distortion levels. For a greater insight,

check the excellent article, "Inside Ma Bell," by Spenser Whipple, Jr., in the May, 1975, issue of *73 Magazine*, page 61.

To produce a single tone with most pads, push the two adjacent buttons in any row or column to produce the tone for that row or column. Example: Pushing the 2 and the 5 together will produce the 1336-Hz tone, and pushing the 4 and the 5 together will produce a 770-Hz tone. These two tones just happen to be near the middle of the tone range and therefore serve well for test purposes.

To calibrate your system, find someone who has a pad with the low tone slightly less than the high tone and who can adjust the pad volume quite easily. By experimentation, set the pad to the point where it just will access the phone system without misdialing. Take careful note of the meter levels of the 5 tone, as well as of the window. Repeat this test, and this time set the pad just below the point where misdialing occurs on the high amplitude side. Again, take careful note of the readings of the same items as before. This will represent the high level of the window. Pads should be set so that the single-tone levels fall within the center of the window. In our situation, the tones are set to read about 40% of full scale, with the dual-tone reading about 60% of full scale. This will vary with every setup. It is interesting to note that most problems involve tones that are too loud, including the much more subtle problem (one that the Golden Ear boys can't spot) where the low tone is much louder than the high tone.

By setting everyone's tones in the window, misdialing is practically eliminated, and on-the-air trial and error testing is gone. There will always be the HT boys attempting access to the patch from 50 miles out, since they hear the 200 Watts erp of the repeater full quieting and they can't figure out why 1.5 Watts into a rubber ducky (.5 Watts erp) won't make it back. Education is futile at that point.

One more problem area is with surplus Western Electric and ITT pads. One of the reasons they may be surplus is that the tones are off frequency. Another is that one out of the three or four tones won't fall within specifications. You must be within ±1.5% in frequency. The frequency can be adjusted with the cores on the rear of the pad. If one of the three or four tones does not fall within specifications, dump the pad, as it is unfixable and not worth the grief. For those pads that will not generate single tones, adjust them with the 5 tone by bringing the level from "too low" up to the proper level for a dual tone. This keeps it out of clipping. Occasionally, you will find a rig with the clipping level too low. The operator will be suffering from misdialing and low deviation—he will be bassy. He must crank up the clipping level (often referred to as deviation-limiting) until he is as loud as everyone else and back his mike gain down so that only 10% of his peaks will hit clipping. Then he can set his pad level.

The uniform setting of pads and the easing of the recording of logging information will take most of the burden out of running an autopatch. This leaves out the frustration and makes for a less formal and stiff operation. We also publish a series of rules which is sent to everyone new who pops up on the air. It is part of our Welcome Package, which contains a sheet about the repeater, a sheet on the club, one on the patch, a list of members, a repeater directory of the state, and a sheet of emergency phone numbers suitable for hanging from the sun visor. A sincere welcome, coupled with instant education, has proven to be one of the major factors leading to the lack of autopatch problems.

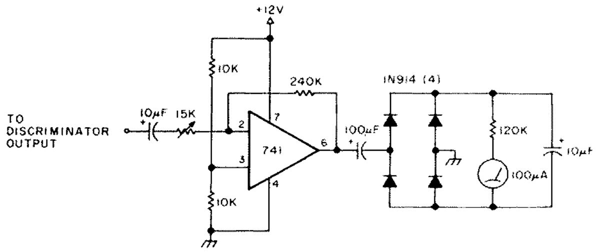

Fig. 4. Deviation-detector circuit.

With a wide-open patch that has been up for two years and has averaged 180 calls a month, we have never had an incident that would cause us to install safeguards. The unrestricted and informal attitude has never prompted challenges. This is not to say that we have not had our share of testers of the grey areas of the rules, but a friendly off-line discussion of the rules and their interpretation, using *73*, *QST*, *HR Reports*, and other publications as visible references as to how the FCC is viewing different matters, has usually solved any differences.

Obviously, in the larger urban areas where there lie greater nerd concentrations, reason is not always an effective tool. I can only offer sympathy to those areas, as the answers to their problems defy solution. But to the group just contemplating autopatch, fear not; usually there are not 1000 nerds waiting in the woodwork just anticipating the day they can bolix things up. Give your group a chance; most of our foreboding "what ifs" never came to pass. If everyone knows everyone else, as do those in most smaller communities, friendly informality works well. If there are factions, cliques, rivals, etc., this attitude may not work, but it is futile to sit and generalize—each group is best qualified to evaluate its individual problems.

The elusive point that should not be avoided by beating around the bush is that autopatch is a tremendous convenience as well as a public service. The expressions on the faces of one of our local chiefs of police and the reporter standing next to him were enjoyable to watch when an HT was pulled out of a pocket and used to dial up the chief's phone. The patch has been used to call the State Police so often to report accidents that all of the dispatchers are using "over" and other familiar techniques. If you want to start a near-riot at a CB coffee break, whip out the ol' HT, tickle the keyboard nonchalantly, and watch the eyes bug out on the first ring. That alone is worth 5 guys at the next Novice class. Autopatch is the major factor that increased our club membership from about 130 to 240. It's worth the trouble.

I hope that this article has taken some of the mystique out of the subject of autopatch and will lead some groups reluctant to install a patch to think more kindly about it. Who knows, you might save someone's life by your ability to report some emergency directly and immediately. ■

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Baudot-ASCII Converter Follow-Up

—add a FIFO buffer for typing ease

The 5885 code converter[1] was conceived in response to the increased availability of Model 33 and 35 Teletype™ machines in Canada. With the converter you can use an ASCII-coded TTY machine to communicate in Baudot code in the amateur bands.

Because of the response to the 5885 converter, we decided to refine the system by adding a buffer, regulating the output rate, and providing better control for the tape reader.

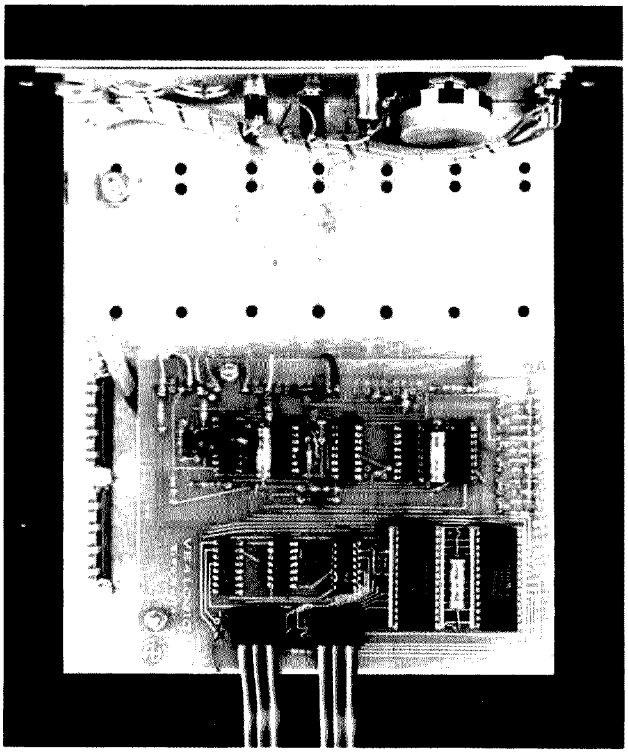

Photo A.

The 5885 converter can be used as is, but there is one disadvantage. When typing, the operator has to keep in mind the automatic insertion of shift characters and has to type slowly and evenly to avoid loss of a character. The buffer will eliminate this. A person can type as fast as he can without having to worry about the insertion of shift characters. Also, the output rate of the buffer can be controlled so that a regular stream of characters goes on the air while you type in spurts. This way, it gives you time to think what to say next, while the buffer is still pumping out data. For those who have heard a UT-4 in operation, this unit works in a similar fashion.

It was decided the buffer should have the following features: one-line buffering, power-on reset, preload, reader control, buffer-contents indicator, and variable output speed with buffer full override.

Controls

Four controls have been brought out to the front: reset, preload, output rate, and fast runout.

The reset clears the counters and FIFOs and initializes all the flip-flops. It is used primarily if you have something in the buffer and it is no longer valid, or a number of mistakes have been made.

The preload is used to type a string of characters into the buffer and hold it until you are ready to send it out. You can start typing while the other party is still transmitting to you. Then, when you turn off the preload switch, your characters will begin to flow out of the buffer.

The output rate is set by the output-rate potentiometer. With the values indicated in the parts list, the rate can be varied from 2 char/sec to full speed. It should be set for your average typing speed. That means that the override should hardly ever start up, nor should it be set so fast that the buffer-empty LED is on most of the time.

The fast runout is used when you are finished typing but have a large number of characters in the buffer and want to give it

to the other party. When this control is pushed, the buffer will empty at full speed. The buffer-empty LED will come on when it is finished.

Character Storage

The buffer consists of a pair of 33512 Fairchild 40- x 9-bit FIFOs, giving a full line of buffering—actually, 79 Baudot characters—unless there are several shift characters, which will make it less. The FIFO is an "elastic" memory between subsystems. It will take the data and expel it at greatly different rates. The data exits in the exact same order as it was entered, without any external control.[2,3]

Power-On Reset

When the buffer is turned on initially, the control logic in the FIFOs will have their preferred turn-on condition, and it can happen that the indication is that valid data is available. To make sure this does not happen, NOR gate 4C is used as a delay.

When power is applied, the voltage on pins 8 and 9 of U4C is low and will start rising to +5 volts. After a short while, the voltage will be enough so that it equals a logic high and the output will go low. This clears the counters and the UARTs. The inverter signal is used to reset the FIFOs and set the reader-control flip-flop. The input can be brought out to the front panel also, in case manual reset is needed.

Data Flow

The data is strobed into the FIFO by the signal CS (Character Strobe) coming from U4B pin 6 on the converter board. At the same time, it increments the counter.

When one or more characters have been shifted into the buffer, the OR (Output Ready) output goes high indicating the buffer has valid data on its output.

The OR signal is presented to the J input of the output strobe flip-flop, U8A. When its reset input is high, the $\overline{Q}$ output will go low for one clock period. When this happens, the data on the output of the FIFO is strobed into the Baudot output UART and, at the same time, the counter is decremented.

Variable Output Rate

The 74123A monostable is used to set the output rate of characters from the FIFO It is triggered on the

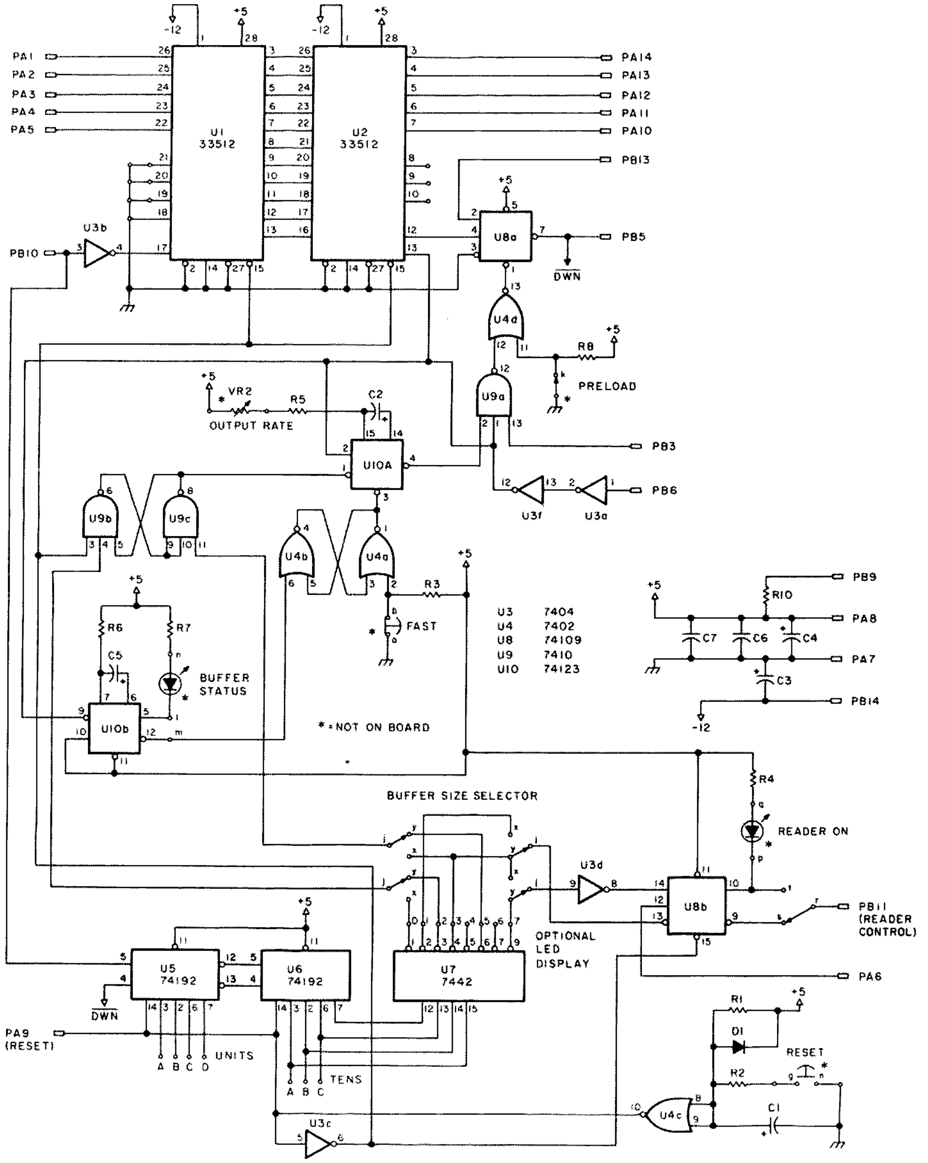

Fig. 1. 5150 buffer.(Design by John Delaive VE4YD and Gary Mills VE4CM; board by Bert Franz VE4BF; design box and drawings by Fritz H. Hellmuth VE4XD.)

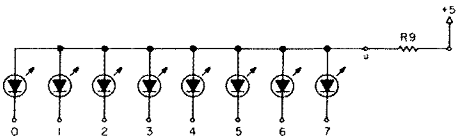

Fig. 2. LED display.

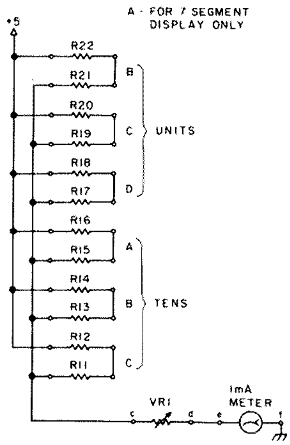

Fig. 3. Analog display.

negative-going TBMT (Transmitter Buffer Empty) signal from the Baudot UART. The $\overline{Q}$ output goes low for a period which is set by the time constant on pins 14 and 15 of U10A. The low output also resets the strobe flip-flop and prevents it from strobing until U10A has timed out.

Connected to pins 1 and 3 of U10A are two RS flip-flops. These override the time selected by the operator when they are set.

During power-up or manual reset, the reset line goes low momentarily, and this resets the RS flip-flop (U9B and U9C) connected to pin 1 of U10A. Now the delay is set by the time constant of U10A. When the counter has reached 60, the output on pin 6 of U7 goes low. This sets the flip-flop and the output of U9C goes high. Also the monostable U10A will be disabled, and the output rate now is as fast as the UART can shift out the characters.

As the characters are shifted out of the FIFO and the counter is decremented, pin 3 of U7 goes low at the count of 29 and the flip-flop is reset. At this point the output rate is again determined by the delay of U10A.

Connected to pin 3 of U10A is another RS flip-flop. It is set by opening the runout switch connected to pin 2. This sets U10A and again the output rate is high. One input of the NOR RS flip-flop is connected to the $\overline{Q}$ output of U10B. This monostable is used as a missing pulse detector. When no more characters are strobed out, it will reset the flip-flop after a short delay.

Reader Control

The reader is controlled by the second half of the 74109 (U8B). At turn-on, the reset signal will set the flip-flop so the reader is on.

When the count reaches 70, pin 9 on U7 goes low. This is inverted and presented to the J input and on the next clock pulse the reader will be turned off. Then the buffer will empty as the characters are shifted out, and when the count goes below 40, pin 4 goes low, and with a low on the $\overline{K}$ input, the reader will be turned on again with the next clock pulse.

Buffer Status Indication

The simplest indication is the reader LED. This will go off when the count has reached 70 and will come on again when the number of characters in the buffer has dropped to 39. The buffer-empty LED will stay on when the FIFOs are completely empty.

There are provisions for three alternatives for buffer status indication. The first one consists of 8 LED indicators (Fig. 2). With no contents in the buffer, no. 1 is lit; when the count reaches 10, no. 2 lights, etc. With only one LED on at a time, the anodes may be connected together and go via a 390-Ohm resistor to +5 volts. The second method involves a meter indication

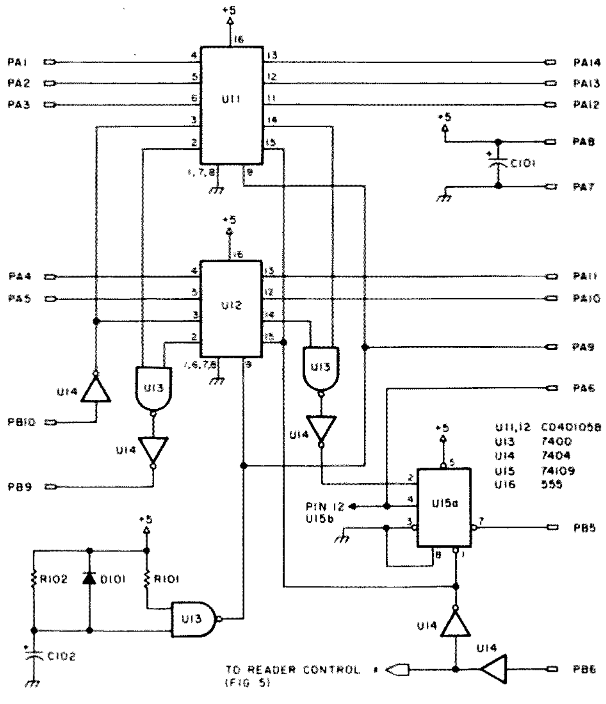

Fig. 4. Alternate buffer.

5150 Buffer Parts List

C1	100-uF, 10-V electrol. cap.
C2, C5	50-uF, 10-V tant. cap.
C3	25-uF, 15-V electrol. cap.
C4	25-uF, 10-V electrol. cap.
C6, C7	0.01-uF, 50-V cer. disc.
D1	1N914 or similar diode
R1	10k Ohms ¼-W
R2	10 Ohm, ¼-W
R3	2.7k Ohms ¼-W
R4, R8, 10	2.7k Ohms ¼-W
R5	7.5k Ohms ¼-W
R6	30k Ohms ¼-W
R7, R9	330 Ohms ¼-W
R11	7.2k Ohms ¼-W
R12, R18	3k Ohms ¼-W
R13	16k Ohms ¼-W
R14	2.4k Ohms ¼-W
R15	33k Ohms ¼-W
R16, R22	3.9k Ohms ¼-W
R17	43k Ohms ¼-W
R19	82k Ohms ¼-W
R20	10k Ohms ¼-W
R21	180k Ohms ¼-W
U1, U2	33512 40 x 9 FIFO Fairchild
U3	7404 TTL DIP
U4	7402 TTL DIP
U5, U6	74192 TTL DIP
U7	7442 TTL DIP
U8	74109 TTL DIP
U9	7410 TTL DIP
U10	74123 TTL DIP
VR 1	2k Ohms, ½-W PC board trimmer
VR 2	50k Ohms, potentiometer—output rate
1	SPST switch, toggle—preload
1	SPST switch, NC push-button—fast
1	SPST switch, NC push-button—reset
2	Indicator LEDs, 10-15 mA
8	Indicator LEDs, 10-15 mA, for optional LED display
1	1-mA meter for optional analog display

Simple Buffer Parts List

C101,C102	100-uF, 10-V electrol. cap.
C103	5-uF, 10-V electrol. cap.
C104	0.01, 50-V cer. cap.
R101	2.7k Ohm, ¼-W resistor
R102	10k Ohm, ¼-W resistor
R103	1k Ohm, ¼-W resistor
R104	15 to 25k Ohm, ¼-W resistor (see text)
R105	470 Ohm, ¼-W resistor
U11, U12	CD 40105B 16 x 4 FIFO Motorola
U13	7400 TTL DIP
U14	7404 TTL DIP
U15	74109 TTL DIP
U16	555 timer

and is a digital-to-analog conversion (Fig. 3). There are six sets of resistors used in the conversion. This is not for accuracy but to smooth out the variations in the meter indication. The values shown are for a 0- to 1-mA meter. The 2k-Ohm variable resistor is for calibration. The range is wide enough to set the scale at 80% or 100% full scale for a count of 80.

It also is possible to display the actual count of characters in the buffer with a pair of 7-segment displays. This method is not incorporated on the board, but the connections are made available. For this system, two decoders, two drivers, and two displays are needed.

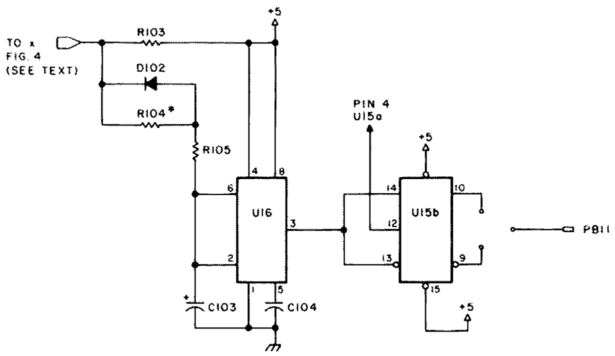

Fig. 5. Tape reader control.

Simple Version

For those who do not need a complicated circuit but just some buffering to take care of the up- and down-shifts, Fig. 4 shows how to do it. It uses two inexpensive 16- x 4-bit-wide FIFOs. Another nice feature of these is that only a single supply is needed, which can be from 3 to 18 volts. Also, no modifications have to be made to the converter board.

Operation of this circuit is similar where applicable to the main circuit. If a tape reader is available, see Fig. 5—a reader control circuit. It uses a 555 timer which is controlled by the TBMT output of the UART. This is set by R104 to shift in between 5 and 10 characters before it stops and then waits for the buffer to empty.

There might be a slight hesitation in printing when the buffer is empty and before the reader starts up again, but this can be noticed only at 100 wpm.

Construction

A board was designed for the buffer[4] and a number of units have been built and are in use now. No board was made up for the simple version; since the circuit is quite simple, it can be constructed on Veroboard.

Power supply requirement for the converter-FIFO combination is +5 volts at 750 mA and −12 volts at 150 mA.■

References

1. J. G. Mills VE4CM, "Baudot to ASCII Converter," *73 Magazine*, September, 1977, pps. 80 to 85.
2. George Landers, "FIFO First In First Out," Fairchild Semiconductors.
3. Doug Farrar, "Understanding the FIFO," AN-332, Fairchild Semiconductors.
4. 5150 double-sided PC board with plated-through holes and two 6-inch connecting cables can be obtained from VE4 Logic, PO Box 77, Dugald, Manitoba, Canada, R0E 0K0, at a cost of US $19.50, prepaid USA and Canada.

CB to 10

—part XXII: more talk power for the TRC-11

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If you are one of the many hams who purchased a Radio Shack TRC-11 CB unit, this article will tell you how to increase its modulation considerably. Another ham and I bought a pair of TRC-11s when Radio Shack was selling them out at half price. The TRC-11 is a 6-channel, 5-Watt, 12-volt transceiver.

After replacing the crystals with 10 meter crystals, the receiver was realigned with a signal generator. The transmitter was then adjusted for maximum output. Our units had about 4-1/2 Watts output and worked fine over short distances, but the modulation was very weak even when yelling into the microphone. On a meter, the maximum modulation was 80% and the average was a small 40%.

After inspecting the schematic, it was decided that the microphone amplifier gain (also the audio amplifier gain) could be increased by bypassing R40 on Q8 or R44 on Q9. A 100-uF, 15-V electrolytic was tried, but it oscillated on Q9. On Q8, things looked good. The capacitor is simply paralleled with R40 (see the schematic with the radio). Now the maximum modulation was still 80%, but the average was now 70%. Any electrolytic capacitor 50 to 150 uF and above 15 volts should work.

A few of these radios are being used on the Civil Air Patrol frequency of 26.620 and I am sure this modification would benefit these operators. Look for us on 28.9 and 29.0 MHz AM.

Thanks to Wayne W4TZB for technical assistance and to Ed KB4GH who helped with on-the-air testing. ■

The L With It

—an alternative to the variable inductor

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A friend of mine who had decided to build himself a transmatch recently called me on the phone. He acted as if he had just discovered inflation. "Do you know how much they are asking for a rotary inductor?"

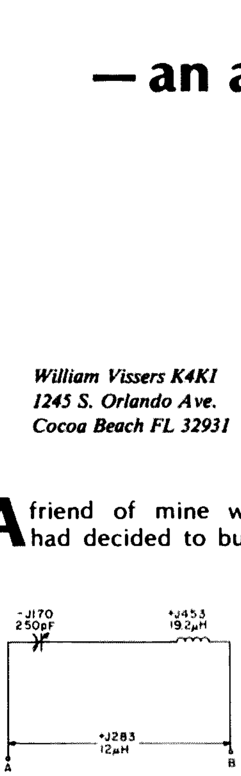

Fig. 1.

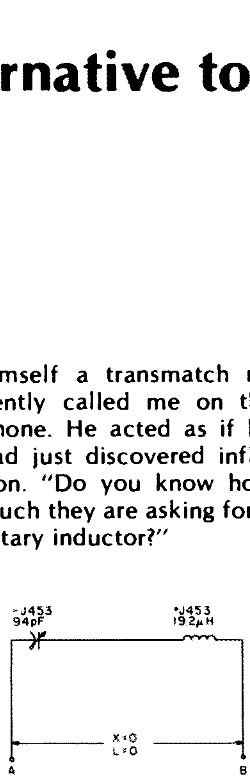

Fig. 2.

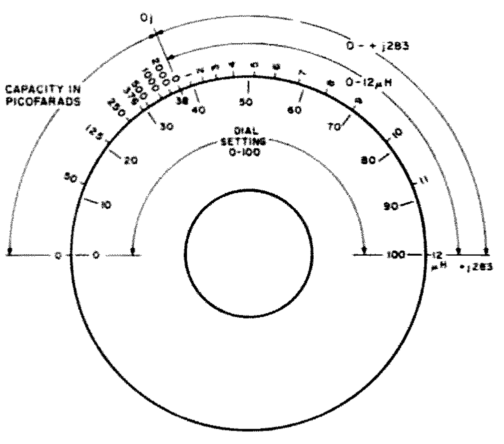

Fig. 3. For 19.2-uH fixed inductance, 3.75 MHz.

Well, after he told me that he just couldn't afford that kind of money, especially after he had figured in the cost of the turns counter, he said, "The L with it!"

Believe it or not, that's what gave me the idea. Yes: "The L with it." A little thinking about basic theory, and I came up with an idea that shows that the rotary inductor can easily be replaced with a small fixed inductor in series with a variable condenser. I've tried it in several different applications, and it worked perfectly every time.

The theory used is merely a simple application of some of those equations I memorized to pass my FCC exam and thought I'd never use again. So, we'll not only learn to save money, we can renew an acquaintance with basic circuitry calculations. There also is an extra bonus that I'll keep as a surprise until later in this article.

Circuit Theory

Let's start right in and say we want a 0-to-12-microhenry variable inductor for use at 3.75 MHz, which is the middle of the 80-meter band. Although I've started with a fixed frequency, we'll see later on that the technique to be described will work for all bands and all frequencies.

It's easy to calculate the maximum inductive reactance. It is nothing more than $X_L = (2)(\pi)(F)(L)$, where π is equal to 3.14, F is in MHz, and L is in microhenrys. Then, $X_L = (2)(3.14)(3.75)(12) = 283$ Ohms.

Now let's say that we rummaged in our junk box and found a variable condenser with a capacity of 250 picofarads. The reactance of this condenser at 3.75 MHz is $X_c = 1{,}000{,}000/(2)(\pi)(F)(C)$, where C is given in picofarads. Thus, $X_c = 1{,}000{,}000/(2)(3.14)(3.75)(250) = 170$ Ohms.

Now all we have to do is to draw the simple circuit shown in Fig. 1, where we take our variable con-

denser and place it in series with an unknown value of fixed inductance.

Using the commonly-accepted nomenclature, that capacitive reactance is −J and inductive reactance is +j, all we do now is to put in the numbers we have already calculated. The value of reactance for the condenser is −j 170, and the value of reactance for the variable inductor we want to obtain is +j 283 Ohms. We shall put in the value of +j 283 Ohms between terminals A and B. From basic circuit theory, we see that the value of fixed inductive reactance required is X_L = +j 283−(−j 170) = +j 453 Ohms.

Calculating the value of the fixed inductance in microhenrys, we find it to be $L = X_l/(2)(\pi)(F) = 453/(2)(3.14)(3.75) = 19.2$ microhenrys. This value of inductance is also shown in Fig. 1.

It is now necessary to find the value of capacity that will give a net value of zero reactance at A−B. All we do is to reduce the capacitance value until its reactance is equal to the reactance of the fixed inductance, which we have calculated to be 453 Ohms. The capacity value is found by solving for C. $C = 1{,}000{,}000/(2)(3.14)(3.75)(453) = 94$ picofarads.

As the reactance between terminals A−B is zero Ohms, then the inductive reactance and the inductance will also be zero. So, we have developed a method to obtain an equivalent variable inductance of from 0 to 12 microhenrys. The circuit and results of the calculations are shown in Fig. 2.

Generally, most variable condensers in amateur usage are linear with respect to dial setting. If we assume that we are using a dial with graduations from 0 to 100, it is easy to find the dial setting corresponding to 94 picofarads. The dial setting is (94)(100)/250 = 38. The dial is shown in Fig. 3, where the values of inductance and their corresponding dial settings also are shown.

The Big Bonus

Now that we have seen how easy it is to obtain a variable inductive reactance equivalent to a variable rotary inductance of 0 to 12 microhenrys, let's look a bit further into circuit theory.

If we decrease the value of capacitance of the variable condenser below 94 picofarads, our net reactance will be capacitive between points A−B. As a numerical example, assume that the condenser is set to 30 on the dial. The capacity at this dial setting will be (30)(250)/100 = 75 picofarads. Calculating the capacitive reactance of 75 picofarads, we find that $X_C = 1{,}000{,}000/(2)(3.14)(3.75)(75) = -j\ 566$ Ohms.

Representing this value in Fig. 4, it is seen that the equivalent reactance between points A−B is +j 453 −j 566 = −j 113 Ohms.

Calculating the equivalent capacity between points A−B it is found that $C = 1{,}000{,}000/(2)(3.14)(3.75)(113) = 376$ picofarads.

The variable condenser that we have in the circuit has a maximum value of only 250 picofarads. Yet, in our circuit of Fig. 4, it is seen that with a setting of only 75 picofarads we actually end up with an equivalent capacity of 376 picofarads across A−B. It seems almost like magic! But it isn't magic. It's only using a bit of simple math—and it really works!

Using the same method of calculation, it's easy to show the equivalent capacity for various dial settings between 0 and 38. This is shown in Fig. 3 for convenience, and a closer look at

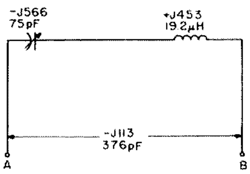

Fig. 4.

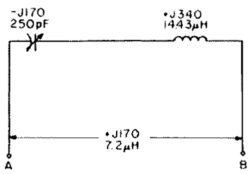

Fig. 5.

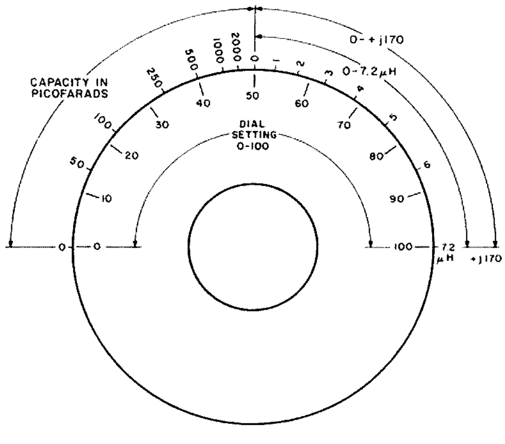

Fig. 6. For 14.43-uH fixed inductance, 3.75 MHz.

Fig. 3 shows a remarkable feature. With a single variable condenser, it is easy to obtain both an equivalent variable inductor of 0-12 microhenrys, and an equivalent variable condenser of between 0 and a couple of thousand picofarads. And it's all done with a 250-picofarad variable condenser and a small fixed inductance!

General

By this time, a number of questions will have arisen. The most obvious one is, what is the equivalent variable inductance maximum at the band ends of 3.5 and 4.0 MHz? Naturally, the equivalent inductance will vary somewhat with frequency, but, because the ratio of bandwidth to center frequency numerically is only 4.0−3.5/3.75 = .133, our equivalent inductance variation also will be close to that figure. In addition, the zero inductance dial setting will vary slightly. These small variations are really of no consequence, however, because for operational purposes we are interested in an easily-controllable reactance variation. We are not particularly interested in what the actual inductance or capacity is for any dial setting as we vary the frequency over our band limits. The actual calculated values for Fig. 3, for the fixed inductance of 19.2 uH, are: (1) for 3.5 MHz, an equivalent inductance of 11 microhenrys and a zero inductance dial setting of 43; (2) for 3.75 MHz, the two values are 12 and 38, and (3) for 4.0 MHz, they are 12.9 and 33.

Because the ratio of bandwidth to center band frequency is greatest for the 80-meter band, the variations will be relatively smaller for the other bands from 10 through 40 meters.

A second question that merits examination, is how accurate the value of the fixed inductance has to be. (The figure of 19.2 uH was carried out to three places so that anyone repeating my calculations would have an easy reference check.) The best way to answer this question is to vary the value of the fixed inductance and see what

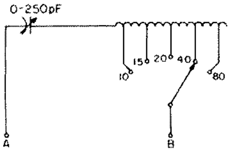

Fig. 7. Variable reactance unit.

actually happens. To kill two birds with one stone, I decided to place the zero inductance point at 50 on the dial. A repeat of the previous type of calculations for this new condition can be seen in Figs. 5 and 6. Here, it is seen that the maximum effective variable inductance value is only 7.2 uH. This, however, corresponds to an inductive reactance of 170 Ohms. For practical purposes, that amount is large enough for general amateur usage. Another thing noted in Fig. 6 is that this spreads out the capacitive part of the dial from 0 to 50 on the dial at 3.75 MHz.

By now, the question arises as to what values of fixed inductance would be needed for the other bands. The results are shown in the following table for a desired variable maximum inductive reactance of 170 Ohms for all bands:

3.75 MHz	14.43 uH
7.15 MHz	5.77 uH
14.175 MHz	2.42 uH
21.225 MHz	1.50 uH
28.85 MHz	1.06 uH

Two sets of calculations have been shown for the 80-meter case to show the versatility of the basic method. Further calculations could be carried out using other values of capacitance rather than the 250 picofarads originally selected. The only thing we would find would be differing ranges for the maximum variable inductance and different zero inductance locations on the dial. The basic method and calculations stay the same.

The problem of having a different fixed inductance for each band is easily solved by the common method of using a single tapped coil as shown in Fig. 7. Coil dimensions and turns have not been shown, as the size of the variable condenser used, the variable inductive range desired, and variations in coil sizes used by different amateurs will vary. My own personal experience has shown that the amount of inductance required for the fixed inductance is very easily determined experimentally. The advantage of doing it experimentally is that you can then determine the optimum operating performance for the reactance range required for your own needs.

One last thing that should be mentioned is that the zero inductance dial setting will become less as the operating frequency is raised. In the extreme case, at the frequency for the last-shown table of fixed inductances, at a frequency of 28.85, the dial setting will be 11.5. The only operational problem this might pose is that the change in capacitive reactance between 0 and 11.5 will be fairly rapid. In my own experience, however, this has not proved bothersome. This crowding can be easily eliminated by using a smaller size of variable condenser and calculating the fixed inductance size to give you the variable inductive reactance range you desire. For example, for 28.85 MHz, the use of a 50-picofarad variable condenser and a fixed inductance of 1.55 microhenrys will give the equivalent variable inductive reactance maximum of 170 Ohms that we had used previously. The zero point will be moved to 39 on the dial. This example was shown to illustrate the versatility and trade-offs that are possible using this method as described.

Uses

The first use that suggested itself to me was to build a truly versatile matching unit. An L tuner, using the circuit of Fig. 7 for each leg, performed extremely well. Its ability to allow each leg to have either a capacitive or an inductive reactance gave it an almost universal range. As a matter of interest, it was used to tune up a short 80-meter inductively-loaded vertical antenna that was resonant at the low end of the band, and we all know how sharp those verticals are. Well, this tuner allowed me to obtain a 1:1 swr anywhere in the band with no problem. The friend of mine who owned this antenna was a bit flabbergasted! My own present 80-meter open-wire dipole tunes up perfectly now on all bands.

Other uses will suggest themselves. I'm already breadboarding up an impedance bridge that shows great promise. The fact that this method allows the obtaining of both a variable capacitive reactance and a variable inductive reactance on a single dial will undoubtedly be found useful for many applications.

As in all multiband rf circuitry, efforts should be made to keep all distributed capacities as low as possible to avoid internal resonances.

The demonstrations I've already given of the technique described have aroused a great deal of interest among my friends, and I'll be glad to answer any questions you may have. Just send along a self-addressed stamped envelope.

Now you, too, along with me, can say, if you don't have a variable inductance, "The L with it!"■

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Future Rig and Rigamarole

—are you ready for faster-than-light propagation?

In buoyant spirits the other evening, I devoted my efforts to the noble task of extracting a couple of extra functions from one of the dedicated ICs in my all-silicon rig. Dedication notwithstanding, the sophisticated chip made several futile attempts to comply with my desires, then bit the dust without the glowing anode, hot smell, or audible stress signals which have reliably guided my experimental endeavors throughout all these many years of hamming. Well, so be it! Never had I been one to remain idle very long when aflame with the passion to experiment.

I quickly transferred my creative urges to some experiments in high technology I had long intended to perform. Gathering together a couple of servicemen's signal generators, my ancient-vintage oscilloscope, and a handful of junk box components, I was off to the races.

Soon I was observing endless variety in the display of all manner of geometric patterns. These danced across the 'scope screen in almost hypnotic gyrations, and my main task was to hold some of them sufficiently steady for evaluation. Call such activities merely electronic doodling if you wish, OM, but please be assured that I was never one to use the meager time allotted to us in frivolous fashion. Indeed, the phosphor's green glow harmonized appropriately with the greenbacks I envisaged some large firm would fork over for exclusive rights to a rapid method for generating artistic designs for neckties, wallpaper, and for improving the esthetics of the environment in general. (In lieu of your initial reaction, OM, I trust a more considered judgment will recognize the goal-motivated nature of this research project.)

One thing leading to another, it happened that I accidentally, or synergistically, injected into a diode circuit a signal of several kHz together with one of several tens-of-kHz, whereupon I monitored a fairly nice amplitude-modulated waveform. However, because of the inadequacies of the 'scope sync system, and surely because of the haywire aspect of my lash-up, I couldn't quite stop the display. The modulation drifted slowly from left to right across the screen and the carrier cycles contained therein drifted in the same direction, but at a livelier rate. This provided the illusion that the carrier cycles were "walking through" the modulation envelope (see Fig. 1). If, OM, you now agree that one thing is going to lead to another, your intuition is right on the beam!

As if in a trance, I felt this fascinating display eradicate my fantasies of millions of polyester shirts bearing frozen Lissajous patterns at a penny royalty for each. Rather, I began to think of my pattern generator as a tutorial aid to *technical instruction* courses! Here, for example, was an excellent depiction of the concepts of group-velocity and phase-velocity in the propagation of radio waves; even though the carrier waves were zipping along at their own merry pace (phase-velocity), they did not determine the rate at which the information in the modulation envelope was trans-

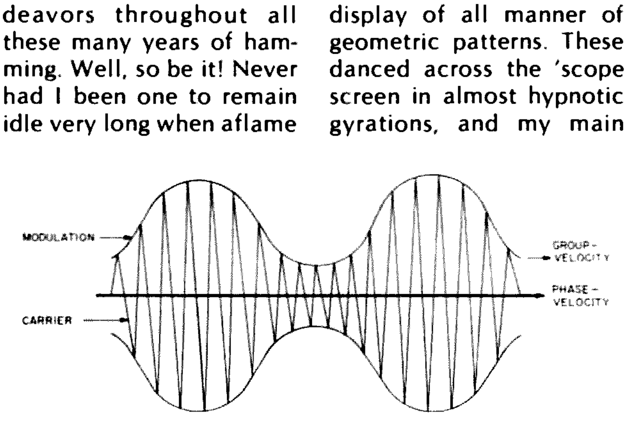


Fig. 1. The unexpected scope display—a good graphic simulation of group- and phase-velocity. When the phase-velocity of the carrier cycles exceeds the speed of radiation in free space, the carrier will "walk through" the modulation envelope. The modulating information, therefore, can progress only at the slower group-velocity. (In free space, the phase- and group-velocities are the same.)

ferred "from transmitter to receiver," i.e., from the left to the right side of the oscilloscope screen.

This phenomenon is particularly interesting because phase-velocity can exceed the value of c, the speed of light in free space! And Einstein's postulates are not violated, we are told, inasmuch as phase-velocity in excess of c cannot carry matter, energy, or information with it. In a sense, phase-velocity is a mathematical abstraction; it is not directly detectable by any device or circuit. It is a tantalizing notion, however, that a school of thought proclaims the possibility that matter and information *can* have super-c speeds. If so, its speculations allow for speeds from c to infinity, but not *at* c. We are reminded of supersonic aircraft—once having penetrated the sonic barrier, their speeds are no longer limited by the speed of sound.

In another sense, this faster-than-light entity, phase-velocity, serves various mundane purposes. Whenever light travels from one medium to another, we find that its action is precisely described by considering not one, but two, speed components—group- and phase-velocity. More relevant to the antics of hams, DX communication by means of skip is a case in point. In Fig. 2, we see a long-distance QSO that obviously is based neither on ground waves nor on line-of-sight. Rather, the radio waves enter the ionosphere, are refracted therein, and return to a distant QTH. Refraction is but another term for bending—why is the path of the waves bent? The ionosphere is a transmission medium containing free electrons of increasing density as the radio waves enter it. An energy interaction occurs, and the top portion of the wave fronts is speeded up relative to the lower portions. You can think of the differential in your car if you like, OM; the turning or bending of the wave path is the logical result. The top of the wave fronts traverses the ionosphere at a phase-velocity greater than c, but merely "walks through" the modulation envelope. So our audio modulation gains no time in getting to the receiving site, no matter how long the radio waves spend in the ionosphere. Thus is the axiom complied with that information can be conveyed only at group-velocity, which can attain c but often is somewhat less.

Adding a few more points of info to your recall, OM, radio waves do propagate at speed c in free space; both group-velocity and phase-velocity are then equal to c. Under other circumstances, such as when the rf is being conveyed from your rig to the antenna, the group-velocity in the transmission line may be only around 60% of c. In air, the group-velocity is very slightly less than c. In general, group- and phase-velocities have inverse relationships—a group-velocity below c tends to be accompanied by a phase-velocity above c.

Admittedly, OM, all this business about radio-wave propagation and modulation-transit time came up in a roundabout way. If I continue to pursue it in its pedagogic details, nothing greater will be accomplished than a cure for a few cases of insomnia. Instead, I cordially invite you to direct your attention to some rather strange events which just happen to relate to much that has been hitherto discussed. And I promise not to bore you with further allusions to

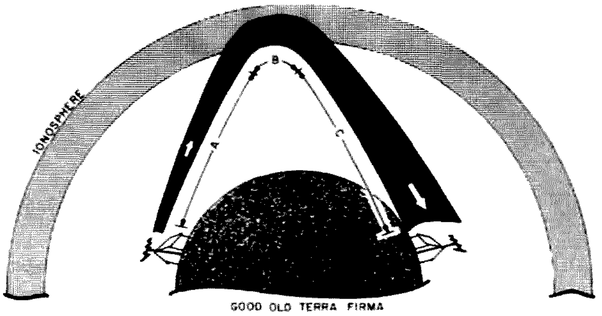


Fig. 2. DX via skip involves wave speeds greater than the speed of light in free space. (A) The speed of propagation does not exceed c, the speed of light in free space. (B) Top portions of wave fronts exceed c, thereby causing bending of the propagation path. (C) Once out of the ionosphere, the situation is again as in Region A.

my oscillographic teaching aid. Despite its money-making potential, its challenge to the imagination pales into insignificance alongside the electronic marvel you are about to encounter.

My relevant and, I hope, believable experience commenced a couple of months ago while driving on one of those long, straight, and scenery-less roads connecting a series of small towns. To relieve the boredom, I had fired up the mobile rig and was busy rag chewing on 40-meter SSB with a ham in the big city several hundred miles due south. For a time, all went well. Our mutually S8 signals were unencumbered by either QRM or QRN, but, with the passage of time and miles, I began to notice a diminution of his signal strength. Then, within a period of, say, ten minutes, it rapidly became impossible to copy him; the QSO was abruptly and inadvertently terminated.

Now you might contend that there need be nothing out of the ordinary in such an occurrence. OM, you just may be as right as apple pie, but allow me to cite the following strange phenomena which accompanied this fade-out.

- The increased distance between us during those ten minutes was, percentagewise, trivial.
- It all happened between two and three o'clock in the afternoon, so there was no dawn or dusk transition.
- All the time his signal was becoming weaker, mine was reported to be getting progressively stronger. In fact, his last discernible comment was,"Hey, OM, it sounds like you are right smack on top of me now!"
- Other frequencies scanned on 40 meters were dead, as were also the 20- and 80-meter bands.
- The car radio delivered a lot of noise, but responded to no broadcast stations.

While my befuddled mind was trying to resolve this very eerie package of propagation anomalies, the first traffic light in thirty miles abruptly shattered the continuity of my thoughts. And it was as red as the grid of an overdriven linear. Obeying its command, I came to a stop and made ready to greet the green light with the usual great leap forward. But this beacon of the highways was in no hurry to accommodate my impulses. Indeed, it exhibited a downright sadistic behavior, obviously enjoying its prolonged red glare while I fidgeted and gnashed my teeth, to say nothing of my nearly mashing a few gear

teeth in anticipatory but quickly halted starts. "Shoulda brought my camping equipment," I recall muttering.

Perceiving the utter futility of contention with my source of annoyance, I wisely decided to relax and practice the time-honored virtue of patience. Observing the countryside around me, my attention was attracted to a small bungalow-like place of business slightly recessed off the road and about fifty yards ahead. Adjoining it was a parking lot with several late-model, luxury-type cars. (Compared to mine, this might include almost anything, OM.) I found myself pondering the nature of the wares or services sold so far away from a business community. Surely, OM, you can fathom the uninhibited conjectures that came into my mind! "What a snazzy ham shack and antenna farm I could make out of that combo!" I fantasized.

But this was no ham shack, for large signs on the gabled roof clearly delineated the operations therein performed. This was the abode of one Madame Z, who purported to possess inordinate insight into the past, present, and future—for a fee. A small sign conveyed the additional information that the stated fee was payable in *this* time domain, the present.

"What a bunch of balderdash, baloney, and blarney!" I declared to imaginary seekers of ultimate wisdom. At the next moment, I dug out in response to the long-awaited green light. But this is where the karma of my life (or, perhaps, a past existence) asserted itself, for if there was one thing the ancient buggy did not take kindly to, it was acceleration. Amidst the coughing, wheezing, and misfiring of the uncooperative engine, I had ample time to notice that Madame Z had opened her front door and was staring at me as if in retaliation for my rather uncomplimentary attitudes about her alleged faculties.

Time seemingly slowed down, and I felt the pangs of remorse best known to reprimanded schoolboys. (Practical-minded readers certainly have the right to attribute the slowdown to the Edsel.) Time distortion or whatever, OM, I clearly saw that this pert young seeress was a mini-skirted eyeful—quite the converse of the stereotyped witch we may tend to associate with this profession. Being basically an open-minded sort, I found myself acknowledging the vast strides modern science has made in parapsychology. Indeed, had I not been on the way to a business appointment in the upcoming town, I would have stopped by for an objective discussion of psychokinesis, ESP, and other occult manifestations such as the attraction between oppositely-polarized entities. Suffice it to say, OM, I don't think the "other" traveling salesmen ever beheld such a farmer's daughter as this!

Inasmuch as my perverse clunker refused to break down or run out of gas in this vicinity, I finally arrived at my destination—not, however, without the observation that the bands became mysteriously alive again, once Madame Z's facilities were out of sight.

Well, OM, far be it from my intent to bore you with the details of my business activities at the thriving metropolis of Hicksville—pop. 549. Nor shall I indulge in naïveté by pretending that you have not jumped the gun on my unraveling tale. Obviously, I was destined to visit Madame Z on my return trip. Let us just say that I was overwhelmingly intrigued with the halo of rf shielding surrounding her "ham shack." And so it was—I parked the flivver on her "antenna farm," jumped out, and proceeded up the several steps leading to her door.

There was no need to knock, for the door magically opened, revealing the very shapely shape of the madame! I found myself being more than cordially escorted to a chair alongside a small table. I couldn't still the strange feeling that my entry at that very instant was *expected*—or was it planned? In any event, I assured her that I had no problems whatsoever in either the fecundiary or the fiduciary domains. The whole atmosphere was dreamlike, OM, and Madame Z chose to ignore my prevarications. We seated ourselves on opposite sides of the table. On the one hand, I felt trapped. On the other hand, I felt enraptured with the pulchritude of this very delightful oracle!

"I feel that you are a person with much technological insight, and that you are immersed in a fascinating hobby having to do with an applied science," cooed the seeress.

I reflected on her probable observation of the transmitting whip on the flivver, to say nothing of my call letters written all over the place.

"You must learn to relax your hostilities," she admonished, much to my embarrassment. "Are you an amateur operator?" came the inevitable question.

I nodded in affirmation. I also thought that she should be telling me, rather than asking me things, if she expected our tête-à-tête QSO to culminate in enhancement of her material well-being in this present existence. But all vestiges of suspicion, opposition, and unease speedily evaporated as a consequence of her next deduction. That she was endowed with a truly uncanny insight into the occult I could no longer doubt.

"Radio amateurs are greatly esteemed by the psychically sensitive. None in this incarnation possesses a more positive mix of the ultimate virtues. These include intelligence, achievement-oriented behavior, self-policing morality, impulsion for high adventure, and wisdom beyond attainment in our systems of formal education."

Silently, but graciously, I accepted her eerie deduction of facts well known to hams anywhere and everywhere, but not always recognized by those outside the realm.

In addition to revealing these truths about hams in general, Madame Z unraveled a lot of nice things about this particular ham—things that were buried even beyond my own conscious knowledge. But, OM, what really will be of interest to you is not what she said, but what happened then and there, right before my own two eyes. For while the seance was proceeding, a giant crystal ball materialized a couple of inches above the table. For sure, OM, there was nothing on the table when we initially sat down!

So I found myself beholding this levitated sphere. It was about two feet in diameter, and was slowly rotating about an unseen axis inclined about 45 degrees with respect to the table top. Because my sensual acuity had been strangely awakened to a degree unimaginable in everyday life, I perceived a heck of a lot more than the

globular entity, which I have only superficially described, OM. For this was no mere fortune-telling gadget. Rather, it was an intricate, highly complex system of silicon circuits—a huge IC chip, if you will!

Arranged in various planes were quivering PN junctions suggestive of the organs of a living creature. The innermost structure was composed of a junction concentric with the ball itself; this junction was being bombarded by the emanations of a cluster of radioactive atoms at the very center of the ball. This, OM, was the power supply for the entire system. You see, OM, I was being accorded a preview of the ham transmitter of the future!

The boundary between the outer surface of this sphere and the air was pinkishly aglow. I noted that the glowing aura appeared to rotate counter-directional to the "transmitter." In any event, here was the only visual evidence of power transfer to distant reaches of the universe. In other words, the outer shell was, among other things, the radiating element (charmingly referred to in primitive phases of the radio art as the "antenna"—named after the feeler organ of insects). Also, the outer shell, because of its piezoelectric property, constituted the microphone of this FB xmtr. OM, if you are still with me, please remember that I am normally a guy who is mighty quick to question the veracity of things that can't be duplicated, weighed, and measured in the scientific lab. But, maybe I wasn't my normal self during this peer into the future; maybe, too, Madame Z wasn't exactly what you would call scientific.

Whilst contemplating this unbelievable spectacle, I received an ESP message from Madame Z directing me to say something. Obligingly, I responded with, "Hello, test, one, two, three, four, helloo, test!" As I spoke, the envelope of ionized air surrounding the crystal rig varied in intensity and color. Surmising that the deep purplish hue was indicative of over-modulation, I repeated in a more subdued voice level. Then, from what I can describe only as a fourth-dimensional locus in the time-space continuum, came the retort:

"That's much better, W6HDM—always glad to contact minor planets in inconspicuous galaxies; it beefs up my cosmic DX record!"

Now, OM, please don't partake of this with a tongue-in-cheek attitude, for that is not the way I am relating it. I am telling it like it is, or rather, *will* be!

Allow me to explain things a bit. That pink plasma engulfing the spherical rig was caused by super-duper high-frequency rf entering the ether (grudgingly "rediscovered" in the 1980s). Propagation is near instantaneous at phase-velocity. As you know, OM, radio emissions of our era had been doomed to propagational speeds at the mere speed of light because they radiated at group-velocity. Phase-velocity beautifully solves the DX problem for the celestial domain, for it can so greatly exceed the speed of light that many constellations and island universes may be incorporated in near-delayless communications links. Moreover, OM, one may re-establish contacts with long-bygone fists who spend eternity QSOing between galaxies on freqs which make X-rays look like dc—a sort of happy hunting ground for those

hams who abided by FCC rules during their brief earthly incarnation!

I can well anticipate your question, OM, as to how the modulating information could be propagated at phase-velocity—was it not pointed out somewhat earlier that this is a scientific no-no? The answer is at once simple and complex. It is simple because this futuristic rig imparts the modulation to the very medium in which the rf develops its high phase-velocity—that is, to the aura of ionized air. Complexity then enters the picture—at least from your viewpoint of the '70s, OM, because receiving methods for super-c radiation were then unknown. Those of you who have investigated ESP are acquainted with the proposition that such communication appears to be instantaneous. Trouble is, OM, there was no way to prove it in your time.

Because this exposé concerns itself with the rig of the future, further detailing of detection techniques must await the outcome of my next seance. Suffice it to say, OM, no receiver other than the human mind is needed for detection of such super-c message-bearing radiation.

Lest credulity be stretched too far, OM, I now will bring this tale to its well-deserved finale. As you undoubtedly have deducted, I wound up dating Madame Z, who is quite sincere in her conviction that a knight on a white horse is all the more a prospect if his hoss sports a transmitting whip. And that's about it, OM, except that my fantasy about a rural ham shack and antenna farm just might materialize one of these fine days! ■

Gone But Not Forgotten

—supermods for the HW-2021

Phil Salas AD5X
707 Auburn Drive
Richardson TX 75081

The Heathkit® HW-2021 two-meter walkie-talkie didn't stay on the market very long, yet it was quite a bargain when you consider the accessories that came standard with it. The nicad pack, flex antenna, and charger would add $50 to $75 to the basic price of any other walkie-talkie, not to mention the money saved by having to buy only one crystal per channel instead of the usual two.

What other features would you like this unit to have? How about easily-added external charging for mobile and fixed operation? Or a BNC antenna connector, mating BNC flex antenna with an inexpensive magnetic mount? And, of course, +600-kHz transmit offset and an external handset? Read on and see how to convert this unit into a *Super* HW-2021.

First, consider external charging. I was interested in assisting the rig from the car battery while operating mobile. This external charging is easily accomplished through the two unused pins on the present power connector. First dissassemble the charger plug and solder a red and black wire to the inner two pins. Next, cut the charger cable and install a 4-pin molex™ connector on the new 4-conductor cable. Install a mating molex connector on the cord at-

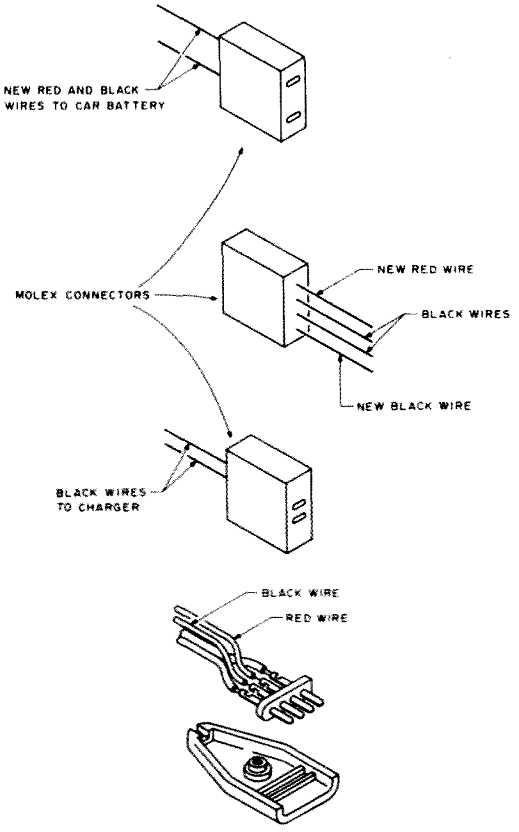


Fig. 1. Power cable wiring details.

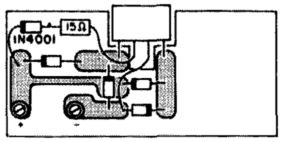


Fig. 2. Battery connector PC board modifications.

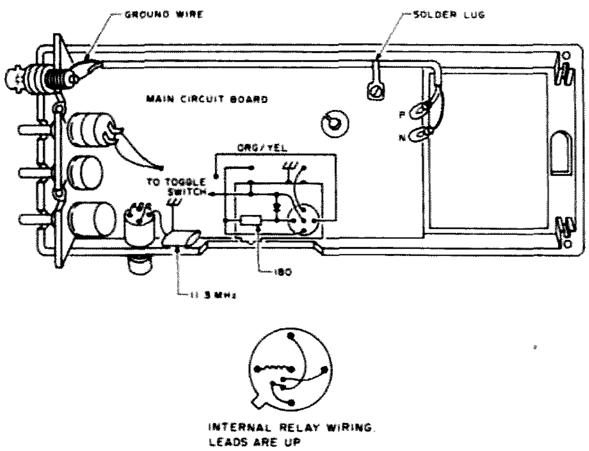


Fig. 3.

tached to the black wires on the new 4-conductor cable. Make up a second power cord of red and black wires and install a mating molex connector on this so that the pins on this connector mate with the pins attached to the red and black wires on the new 4-conductor cable. You now have the option of easily snapping on either the charger or the cable attached to your car battery. Fig. 1 gives the cable wiring details.

Now that you have external power and ground coming into the unit, you need to do something with it. Refer to Fig. 2. On the battery-connector PC board, connect a 1N4001 diode in series with a 15-Ohm resistor from the positive battery connector to the input pin corresponding to the external positive supply. The anode of the 1N4001 should be towards the external power pin. The resistor limits the battery-charging current to a safe rate. Finally, connect a piece of insulated wire from the external power ground pin to the negative battery clip.

A BNC antenna jack would be more convenient for mobile operation and would also help clean up the wiring mess of the present external antenna jack. To do this, remove the rubber ducky and external antenna connectors. With a thin-bladed pocketknife, cut out an additional 1/8 inch (approximately) of the bottom edge of the hole that the rubber ducky antenna connector was mounted in. Thread the BNC retaining nut on the BNC jack and solder a ground wire to the shell of the BNC jack near the center conductor pin. Refer to Fig. 3. The BNC jack can now be mounted in the hole and the nut tightened sufficiently to hold the jack snug while epoxy is poured around it for a permanent bond. After the epoxy has set up, route the antenna coax from the BNC jack to the antenna pins on the PC board, as illustrated. Note the solder lug added under the PC board mounting screw to help keep the antenna coax fixed. Solder the cable shield to the ground pins on both ends of the board and also to the ground wire on the BNC jack.

The rubber ducky antenna can be modified easily to take a BNC plug. First, mount the antenna base-side-up in a vise and, preferably using a drill press, carefully drill a small hole in the center of the base. Sand off the plating around the hole and insert a piece of #22 wire (size not critical) into it. Solder this connection. Now, clip the wire to 0.6 inches and solder the BNC plug pin to it *after* putting a small piece of insulation around the wire. Take a ¼-inch rubber grommet and trim off one of the lips. Place this grommet over the antenna base and check to see that the antenna and pin fit into the BNC sleeve easily. Refer to Fig. 4. Now add a small amount of epoxy to the insulated wire between the pin and antenna base and assemble the antenna to the BNC plug. Stand the antenna vertically and weight it as shown in Fig. 5. Apply epoxy to the BNC sleeve/antenna-base interface and allow it to set up. This completes the BNC connector modification.

One local repeater requires the +600-kHz offset, three other repeaters are on the standard −600-kHz offset, and 146.52 MHz is a popular simplex frequency for long mobile-to-mobile rag chewing on the way home from work. Others have recently described methods of adding the +600-kHz offset to this rig.[1,2] I'll contribute my modification so as to give another choice in the matter.

All of the switching is performed with a SP3T miniature rotary switch available either from RCL Electronics, Inc., Manchester NH 03103 (type SW-281-1), or from Daven Division, Thomas A. Edison, Inc., McGraw Edison Co., Manchester NH 03103 (type 18-KB-3-C500M). This switch fits perfectly into the hole left by the removed SPDT slide switch. However, before this switch can be added, R89 must be replaced with another 1000-Ohm, ¼-Watt resistor—only with longer leads—so that the resistor can be laid flat on the PC board. This allows the necessary room for the switch. Also, sleeving must be added to the three bare wires which went to the old switch in order to keep from shorting any of them out against the new switch. Refer to Fig. 3 for the switch wiring details.

The +600-kHz offset crystal is an 11.3-MHz HC-18 type which I ordered from Jan Crystals. Wrap this crystal with a layer of tape and position it horizontally between the PTT switch and the rotary switch. One lead is soldered to the circuit board ground and the other is soldered to the rotary switch, as shown in Fig. 3. Next, exchange the simplex (10.7-MHz) and −600-kHz offset (10.3-MHz) crystals. A small knob for 1/8-inch shafts can now be added to the rotary switch. You will now be able to switch between −600-kHz, simplex, and +600-kHz transmit combinations.

Since I like to operate mobile quite a bit, I wanted an external handset, as it is inconvenient to have to hold the HW-2021 all the time. Any surplus handset will do fine as long as it has a PTT switch. I found mine through Fair Radio Sales. First, though, you need to mount a mi-

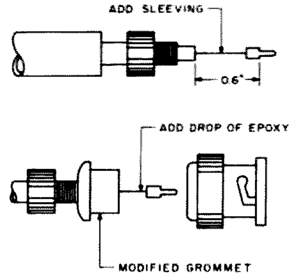


Fig. 4.

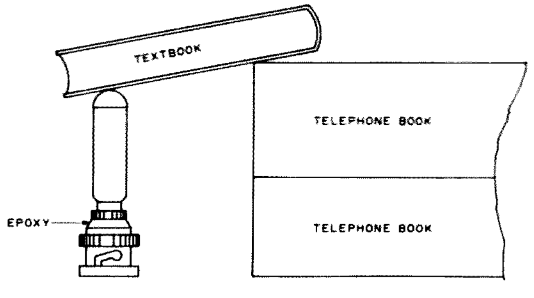


Fig. 5.

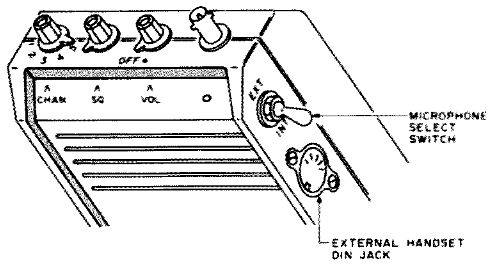


Fig. 6.

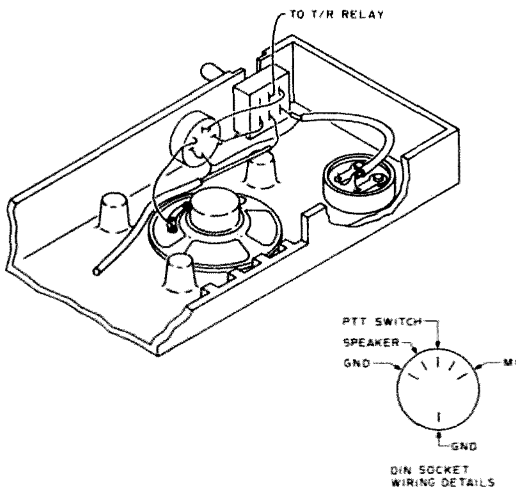


Fig. 7.

crophone jack on the HW-2021. I used the regular CB-type DIN plug and jack sold by Radio Shack for about one dollar each. The DIN jack requires a 5/8-inch mounting hole which can be made with a Greenlee chassis punch. Be careful not to crack the plastic case when using this punch. Make several small cuts at different rotational angles with the punch before trying to go all the way through the case. Fig. 6 shows the location of the DIN jack.

I also mounted a miniature DPDT switch in the hole formerly occupied by the external antenna jack. I use one section of this switch for selection of either the microphone in the handset or the one built into the HW-2021. Incidentally, use a replacement Heathkit microphone element (part no. 480-69) for the handset microphone. It costs $6.00 through Heath and keeps the audio similar between handset and case microphone. I used the second section of the miniature toggle switch to defeat the PTT in the handset when the case microphone is used. This was a simple way for me to determine that the handset microphone was selected without having to look at the switch. The handset speaker was simply tied in parallel with the HW-2021 speaker. You may want to add a dropping resistor depending on the handset speaker used. The DIN socket and DPDT switch wiring details are shown in Fig. 7.

In order to use the external handset, you will need to use a relay to perform the T-R switching function instead of the present PTT switch. I used a miniature SPDT relay made by Teledyne (type J411-6WL). This is a TO-5 case-style relay and operates off 6 V dc. I added a 180-Ohm dropping resistor and a transient suppressor diode across the relay coil. I then rewired the PTT switch so that it actuates the new T-R relay. I mounted the relay on top of the PTT switch with a small amount of epoxy. The wiring details are shown in Fig. 3. Note that the handset PTT wire is connected between the T-R relay and the DPDT switch is mounted on the other half of the case.

The last task was to build a cheap magnetic antenna mount. For this, you will need a vise for bending aluminum and a nibbling tool for cutting the magnet mounting holes. Refer to Fig. 8. First

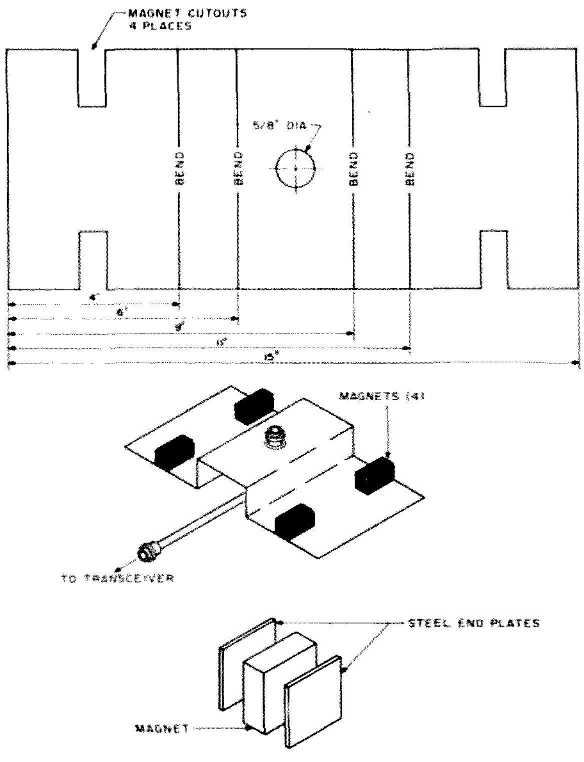


Fig. 8.

drill a 5/8-inch hole in the center of the aluminum sheet. This hole will be used for either a BNC bulkhead feedthrough connector or a regular BNC jack if you are willing to solder the coax to the antenna mount. The magnets are rectangular types available from Radio Shack and cost 15¢ each. You will need to cut out two 1/16-to-1/8-inch steel plates with approximately the same outside dimensions as the large flat sides of the magnets for each of the magnets. Place one plate on each side of a magnet and observe how well the magnet will now stick to any steel surface when mounted vertically.

After bending the sheet aluminum as shown, cut out slots for the four magnets so as to completely clear the magnets. Next, find a flat steel surface, put a sheet of newspaper over it, and place the aluminum mount over it—weighted so as to keep it flat. Place the magnets and end plates in the slots provided for and make sure that they stick firmly to the steel surface under the newspaper. Now apply epoxy liberally to the aluminum mounting plate/magnet interface points. When the epoxy cures, you will have a magnetic mobile mount that will stay on your car to at least 75 mph. For the antenna itself, I simply use the rubber flex antenna from the HW-2021. It is more than adequate for most mobile-to-repeater usage and always ensures that you will have your flex antenna with you.

The Heathkit HW-2021 has all the room necessary to add all of the desirable functions you could want in this hand-held rig. In addition, a mobile magnetic antenna mount has also been described which can be used with any other hand-held rig.■

References

1. "Improving your HW-2021," *73 Magazine*, March, 1978, p. 130.
2. "Improving Heath's HT," *73 Magazine*, October, 1978, p. 54.

Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

BLACKSBURG VA
MARCH

Virginia Polytechnic Institute and State University Department of Chemistry will hold three short courses in March, 1980, at the Virginia Tech campus, Blacksburg, Virginia. The first workshop, entitled Digital Electronics for Instrumentation and Automation, will be held on March 10-11, 1980. The second workshop, entitled 8080-8085-Z80 Microcomputer Interfacing, Design, and Software, will be held on March 12-14, 1980. The third workshop, entitled TRS-80 Interfacing and Programming for Instrumentation and Control, will be held on March 17-18, 1980. These programs will be directed by Dr. Jonathan A. Titus, Dr. Paul Field, Dr. Christopher Titus, and Mr. David G. Larsen. These are hands-on workshops with the participants having the opportunity to retain the equipment. For more information, contact Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg VA 24061, or phone (703)-961-5241.

CHRISTIANA DE
MAR 2

The Delaware Valley Amateur Radio Society will hold its Winter Fest and Computer Show on March 2, 1980, from 10:00 am to 4:30 pm at Christiana Memorial Hall, Rte. 273 and Old Baltimore Pike, Christiana, Delaware. Events include a transmitter hunt (Freedom Foundation Fox Hunters Sanction Number 80-1) and a frostbite tailgate section. Tables, food, and free parking will be available. Dealer inquiries are invited. Talk-in on 146.52, 223.36/224.96, and 146.355/.955. For information and advance tickets, write to DVARS, PO Box 426, New Castle DE 19720.

MANCHESTER NH
MAR 8

The Interstate Repeater Club will hold its annual Auctionfest on Saturday, March 8, 1980, at the Sheraton Wayfarer Convention Center in Manchester, New Hampshire. Door prizes and refreshments will be part of the fun. Activities start with equipment check-in and review beginning at 7:00 am and the auction starting at 10:00 am. Admission is 50 cents for adults; children under 15 are free. Talk-in on 146.25/.85 and 146.52. For more information, send an SASE to IRC Auctionfest, PO Box 94, Nashua NH 03061, or phone Gary Delong KA1BCA at (603)-434-5872.

LAFAYETTE LA
MAR 8-9

The Acadiana Amateur Radio Association, Inc., will hold the 20th annual Lafayette Hamfest/Banquet at the Scott Lions Club Building, Lafayette LA. Exit south from I-10, go 6/10 miles, and turn right on Lion Road. Doors open at noon on Saturday and at 9:00 am on Sunday. There will be commercial displays on both days. The flea market is on Sunday only; $2 per table. There will be ladies' activities on both days, with a ladies' tour leaving at 9:00 am Sunday. There will be hourly prizes and much more. The annual banquet is at 7:30 pm on Saturday (Cajun happy hour is 6:30 to 7:30 pm). Banquet tickets are $10 per person, limited to first 200 reservations. There is no admission fee. Talk in on 147.81/.21 or 146.22/.82. For further information or to make your banquet reservations, write AARA, PO Box 51174, Lafayette LA 70505, or call (318)-367-3901.

COLUMBUS GA
MAR 8-9

The Columbus Amateur Radio Club will hold its hamfest March 8th and 9th at the Columbus Municipal Auditorium, US Routes 27 and 280. Free admission. Prize tickets are $1.00 each; table rental is $5.00 per day. Free outside flea market. Campers may stay free on grounds overnight. Friday night setup available. Plenty of free parking. Advance tickets: N4ATI, 263 Logan Ave., Ft. Benning GA 31905. Table rentals: K4RHU, 2701 Peabody Ave., Columbus GA 31904; phone: (404)-322-7001.

STERLING IL
MAR 9

The Sterling-Rock Falls Amateur Radio Society will hold its 20th annual hamfest on Sunday, March 9, 1980, at the Sterling High School field house, 1608 4th Ave., Sterling, Illinois. Advance tickets are $1.50; door tickets are $2.00. Over $2,000 worth of prizes will be given away. A large indoor flea market will be restricted to radio and electronic items only. There will be plenty of free parking, lots of bargains, and plenty of good food. Talk-in on .25/.85 (WR9AER). For tickets, write Don Van Sant WA9PBS, 1104 5th Avenue, Rock Falls IL 61071.

MIDLAND TX
MAR 15

The Midland Amateur Radio Club will hold its annual swapfest on Saturday, March 15, 1980, from 12:00 noon until 7:00 pm, and on Sunday, March 16, 1980, starting at 8:00 am, at the Midland County Exhibit Building east of Midland, Texas, on Highway 80. There will be door prizes. Pre-registration is $4.50 or $5.00 at the door. Talk-in on 146.16/146.76. For more information or to pre-register, write the Midland Amateur Radio Club, Box 4401, Midland TX 79701.

MARSHALL MI
MAR 15

The Southern Michigan Amateur Radio Society, the Calhoun County Repeater Association, and the Amateurs of the Marshall Schools will hold their 19th annual "Michigan Crossroads" Hamfeast on Saturday, March 15, 1980, at Marshall High School, Marshall, Michigan. Doors will open at 7:00 am for exhibitors and at 8:00 am for the general public. Admission is $2.00 at the door and $1.50 in advance. There will be free parking, unloading help, and food service available, plus door prizes. Talk-in is on 146.52 and 146.07/.67. Table space is $.50 per foot. Featured will be forums, displays, and special programs for the ladies. For information and table reservations, contact SMARS, PO Box 934, Battle Creek MI 49016.

WINCHESTER IN
MAR 15-16

The Randolph Amateur Radio Association will hold its 1st annual hamfest on March 15-16, 1980, from 8:00 am to 8:00 pm, both days, at the National Guard Armory, 700 Western Ave., Winchester, Indiana. Featured will be door prizes, food and drink, and a program of speakers for both days. The cost per table, or an equivalent space, is $3.00. Tickets are $2.50 at the door or $1.50 in advance. Talk-in on 147.90/147.30, 223.30/224.90, and 146.52.

JEFFERSON WI
MAR 16

The Tri County ARC hamfest will be held on March 16, 1980, at the Jefferson County Fair Grounds, Jefferson, Wisconsin. Advance tickets are $1.50. Reserve tables are $2.00 in advance and a 6-ft. space $1.00. Send an SASE to Glenn Eisenbrandt WA9VYL, 711 East St., Fort Atkinson WI 53538.

HAZEL PARK MI
MAR 22

The Catalpa Amateur Radio Society will honor Dusty Dunn W8CQ on the celebration of his 60th year as a ham on Saturday, March 22, 1980 (Dusty's birthday), at the Stephenson Club, Hazel Park MI. The cost of the banquet is $12.50 per person. A cash bar opens at 6:30 pm and dinner begins at 7:30 pm. Reservations must be made by March 12, 1980. Talk-in on 146.55 simplex. For tickets, make checks payable to Charles Master W8OU, Box 294, Clawson MI 48017, or call (313)-646-3367.

VERO BEACH FL
MAR 22-23

The Treasure Coast Hamfest will be held on March 22 and 23, 1980, at the Vero Beach Community Center. Prizes, drawings. QCWA luncheon. Admission will be $3 per family in advance or $3.50 at the door. Talk-in on 146.13/.73, 146.04/.64, and 222.34/223.94. For information, write PO Box 3088, Vero Beach FL 32960.

FORT WALTON BEACH FL
MAR 22-23

The Playground Amateur Radio Club will hold its 10th anniversary swapfest on Saturday and Sunday, March 22-23, 1980, from 8:00 am to 4:00 pm each day, at the Okaloosa County Shrine Fairgrounds, Fort Walton Beach, Florida.

WAUKEGAN IL
MAR 23

The Libertyville and Mundelein Amateur Radio Society (LAMARS) will hold its annual hamfest on March 23, 1980, at the J-M Club, 708 Greenwood Ave., Waukegan IL. Doors will open at 7:00 am. Large indoor facility. Plenty of food and drink. 7-ft. tables available at $4.00 each. Great prizes and goodies. Tickets will be $2.00 at the door or $1.50 in advance. Write for tickets or tables (include SASE) to: LAMARS, PO Box 751, Libertyville IL 60048.

Continued on page 152

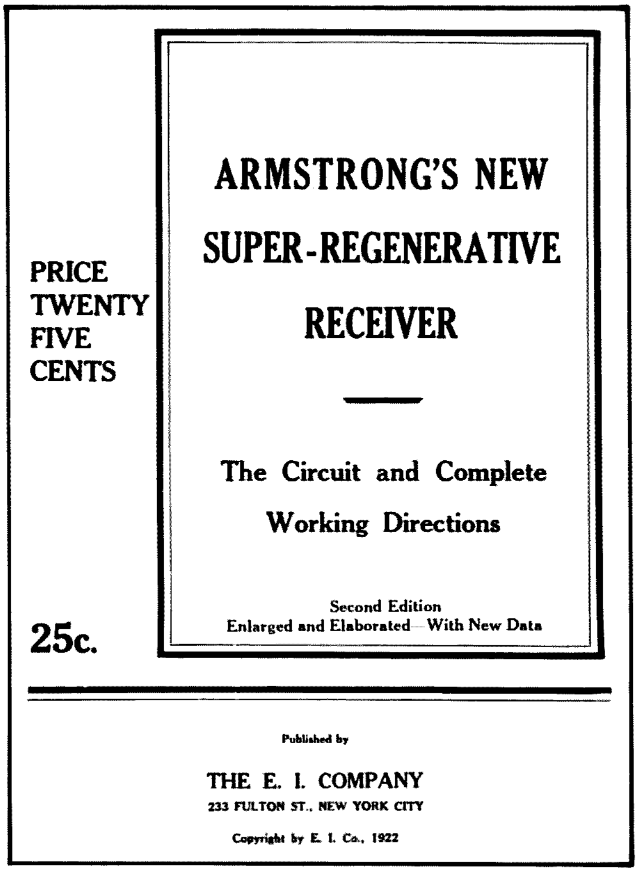
Eric Shalkhauser W9CI
527 Spring Creek Road
Washington IL 61571

The History of Ham Radio

—part XI

Reprinted from QCC News, a publication of the Chicago Area Chapter of the QCWA.

The post-WWI years from 1920 to 1927 found the mushrooming radio industry still in its infancy, but struggling to find a foothold—very much in need of direction. It was a new technology still in relative obscurity awaiting a Midas touch!


ARMSTRONG'S NEW SUPER-REGENERATIVE RECEIVER

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Radio did not have a definite pattern by which to gauge its destiny. From the very beginning it was partially inundated with revolutionary inventions and new developments, many of a questionable nature. There existed no guidelines to follow in this new field.

The introduction of numerous bills in Congress to update the 1912 Wireless Act merely aggravated the situation. The end of hostilities, the conversion from a war to a peace climate, resulted in the creation of many new companies, large and small, seeking to take advantage of this developing, growing industry. Here existed a "made-to-order" opportunity for questionable financial interests to inundate a lucrative market with investment stock schemes. An unwary public remained confused, except for the wide-awake radio amateur, to whom these conflicts meant very little. His interests were directed toward testing all the new gadgets flooding the radio market and experimenting with the numerous circuit arrangements that were perpetually introduced through dealer folders and pamphlets. In general, this game of wireless had him spending many hours at the Morse key, exchanging messages via the established relay routes and frequently exchanging radio signals with neighboring and foreign countries.

Outstanding researchers and inventors, personalities of the stature of Major Howard Armstrong, for one, and men on the technical staff of the ARRL—John Reinartz and S. Kruse, among others—introduced circuit designs under such names as "regenerative," "heterodyne," "neutrodyne," "superheterodyne," and "reflex," all of which provided the amateur with endless hours of experimental activity.

The 1923 Challenge Across the Atlantic

During the winter of 1922, our radio amateur had succeeded in spanning the Atlantic Ocean with his wireless signal operative on 200 meters, but only in one direction—from the

United States to the British Isles. He did not have to be encouraged to tackle the two-way spanning. Active steps were taken by the ARRL to accomplish this feat, this time giving all amateur radio stations an opportunity to participate in the effort. The results which the experimenter was having with the wavelengths below 200 meters, going down to 150 and even down to 100 meters, provided renewed activity and a desire for some real DX. All the planning and the cooperation soon produced astonishing results.

On November 17, 1923, there was a headline banner across the amateur radio horizon. For the first time in history, the Atlantic Ocean was bridged by amateur radio in two-way contact with an exchange of messages. Distance records were quickly attained via two-way phone contacts with stations in Hawaii and Alaska, Japan and Australia, and the American continent. This was a year of jubilation.

The Language Problem

With the crossing of the Atlantic and the contacts now possible with foreign countries, there arose a request on the part of many to solve, in some way, the language problem for better exchange of messages. The question was how to do it. There was immediately suggested an International Language, an IL, for short, to facilitate common understanding. At the beginning, such a proposal was regarded as indispensable. A well-established Esperanto system of word and sentence construction was in use in many countries and was extensively used at conventions and other gatherings with considerable success. Esperanto was considered to be valuable as a rapid means of common understanding. However, the use of the synthetic language proved too "burdensome" and "uncommon" to the majority of amateurs and, through neglect, was soon forgotten.

Solving the Call Letter Identity Problem

The early assignment of call letters among United States amateurs was simple: The district number was followed by either two or three letters of the alphabet. But, as Canadian and foreign stations with similar and often identical call letters were contacted, confusion arose unless an additional first character was added. To correct this problem, the ARRL initially suggested that the United States amateur simply use "de" and the Canadians the letter "v" before giving their call. This soon proved inadequate and gave way to an assigned alphabetical letter as follows to which all agreed and used.

A—Australia
C—Canada
F—France
S—Spain
U—United States
G—Great Britain
I—Italy
M—Mexico
R—Argentina
Z—New Zealand
N—Netherlands
O—South Africa
P—Portugal
C—Cuba

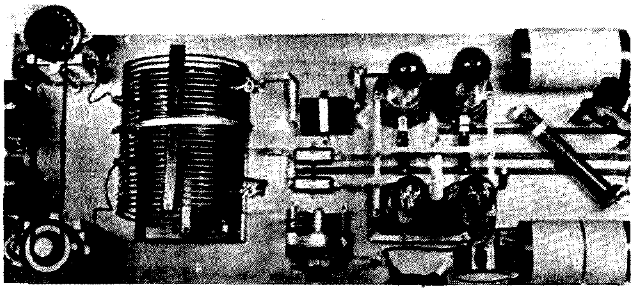
These letters, however, did not conform to those assigned by the countries' respective governments. This plan was first adopted as of December 15, 1922. Additional letters were required from time to time and assignments were made by the ARRL Operating Department. Several two-letter prefixes were needed toward the termination of this method of call-letter designation, i.e., FN—Finland and CH—Chile. The letters were used for a time by all amateurs except in Britain, where such permission was not granted.

John L. Reinartz and the set at 1QP-1XAM.

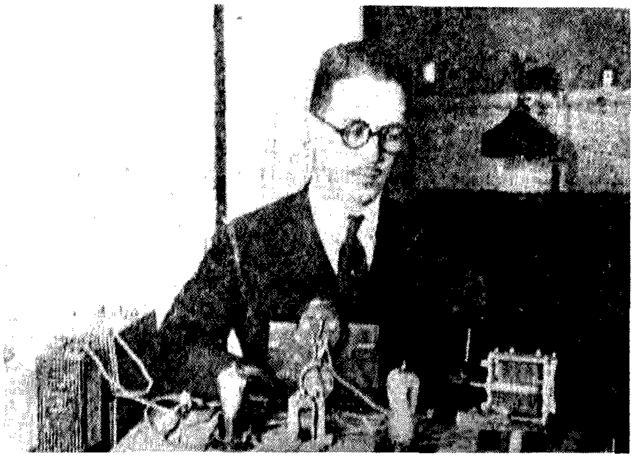
Worldwide Amateur Radio — A Reality In Fact

As more and more international amateur radio contacts were consistently and regularly logged, serious consideration was given toward an international radio amateur organization, eventually to be affiliated with the American Radio Relay League. In the making was a relay circling the globe, thus involving amateurs worldwide linking all continents! This was the ultimate challenging thought for amateur radio. No sooner was this idea proposed than the ARRL board of directors commissioned its president, Hiram Maxim, to call together all interested foreign amateurs for an early meeting. The United States and Canadian amateurs, with years of experience and with an established organization nearing 20,000 members, were expected to provide leadership and guidance toward making an international amateur radio relay league a challenging asset for world communication.

So, on March 12, 1924, in Paris, France, the amateur representatives of nine different countries—France, Great Britain, Belgium, Switzerland, Italy, Spain, Luxembourg, Canada, Denmark (absent), and the United States—sat down together, deliberated for several days, and formulated the beginning of the *International Amateur Radio Union*. Appointed at the meeting was a tem-



The transmitter at 1MO-1BHW which, under the call 1MO and on a wavelength of 110 meters, was the first American amateur station to connect with a European amateur. This set was built in accordance with the scheme outlined by John L. Reinartz of 1QP-1XAM.



1MO and his "hay-wire" receiver with which he worked F6AB.

porary Committee of Organization to select and approve a permanent name, a constitution, and operating procedures. During Easter, 1925, the IARU was officially declared a permanent organization, with Hiram Maxim as its first president.

The Wavelength Breakthrough for Amateur Radio

For a number of years, and especially during 1923, desire and hope were on the minds of the amateurs for expanded operation on the lower wavelengths. Many experiments conducted in trials and contacts proved convincingly that the higher frequencies could be depended on to provide consistent DX. Again through the efforts of the ARRL, the Department of Commerce, during the summer of 1924, issued the following letter directed to all supervisors of radio:

Department of Commerce
Bureau of Navigation
Washington

July 24, 1924

All Supervisors of Radio
Sirs:

Effective this date you are authorized to issue general and restricted amateur radio station licenses to permit the use of any one or all of the following bands of short wavelengths: 75 to 80 meters, 40 to 42 meters, 20 to 22 meters, 4 to 5 meters, in addition to the band 150 to 200 meters, provided application is made by the owner of the station, which station must be prepared to use the wavelength, or wavelengths, requested.

The use of continuous wave telegraphy only will be permitted on wavelengths other than 150 to 200 meters, and the antenna circuit must not be directly coupled to the transmitting circuit.

Silent hours will not be required of amateurs while using the wavelengths within the above bands below 80 meters except where the transmitting station is so situated as to produce objectionable interference with other services.

Hereafter, special amateur stations will not use wavelengths above 200 meters. They may be authorized to use the bands of wavelengths from 105 to 110 meters in addition to the wavelengths within the bands authorized for general and restricted amateur use, where the special amateurs are engaged in conducting tests with government or commercial stations.

General, restricted, and special amateur stations will be permitted to use the entire band of wavelengths from 150 to 200 meters employing pure CW, spark, and modulated forms of transmission.

It should be made clear to the amateurs that the authority granted above is necessarily tentative because of the rapid development taking place in radio communication, and the bands of wavelengths authorized may be changed whenever in the opinion of the Secretary of Commerce such change is necessary.

With the assignment of the five new wave bands, amateurs enthusiastically entered a new radio communications era. Regular licenses had to be modified by district supervisors. No longer was the amateur confined to the selection of one or maybe two frequencies as specified on his former license permit. From now on, the operator had greater flexibility in choosing desired operating frequencies.

Amateurs were requested by the department to make immediate use of these broadened privileges so that the bureau could gather vital information and determine practical usage in this spectrum. The new bands were made available on an "until further notice" basis. To assist in reducing broadcast listener interference, specific types of carrier modulation and types of power supplies at the transmitter were prohibited, i.e., spark, phone, and ICW modulation were declared out. The "silent hours," stipulated at lower wavelengths, were cancelled for the higher frequencies. The 150- to 200-meter band was opened up for any and all uses.

These newly assigned wave bands materially broadened the operating range for the amateurs. They had been clamoring for ether space and were anxious to readjust their experimental circuits and antennas for a go at these higher frequencies. A calibrated wavemeter became vital. Still required by all radio amateurs was an operator's as well as a station license. A code speed requirement of 10 words per minute prevailed.

The 1924 White Bill, HR 7357—and Others

On February 28, 1924, Congressman White, Chairman of the Subcommittee on Radio, introduced a new bill to abrogate the old Wireless Act of 1912, declaring that the original law had outgrown its usefulness.

The White bill was aimed at vesting all administrative powers pertaining to radio in the hands of the Secretary of Commerce. He was to classify all radio stations as to wavelength, licensing, hours of operation, type of equipment,

and power. In short, the Secretary would have complete jurisdiction over all radio activities and facilities. As the general hearings on the bill proceeded, it became evident that the radio amateur, especially the ARRL, would be negative about the overall stipulations in the bill. They felt that such broad discretionary powers in the hands of one individual would be too dangerous. Other interested parties at the hearing expressed similar negative views on the bill.

By May, 1924, the structure of the White bill, as it had initially been presented, had gone through a series of changes and maneuvers. Provisions were combined with a similar bill, the Howell bill, S 2930; it was considerably modified again, but in the end remained the White HR 7357 document, as an acceptable paper in line for ultimate passage. In its final form, it incorporated appeals against unfavorable decisions in the issuance of licenses and other activities. Throughout the hearings, amateurs received favorable consideration.

At this stage in time, however, the conditions surrounding all radio communication in the United States required extensive exploration and far more research and legislation. Secretary of Commerce Hoover stated that eventually radio broadcasting would of necessity have to be considered within the field of public service and divorced from private enterprise altogether. Hoover proposed sending a bill to Congress outlining his views. The evidence was clear—a National Radio Conference was in the offing. ■

Frank Butscher W6SZS
6850 Westmoor Way
San Jose CA 95129

CB to 10

—part XXIII: the Sears Roadtalker 40

Affecting all things, change brings us into the future, where a venerable old name like Sears, Roebuck and Co. is simplified to Sears, and where amateur radio sports new terminology such as microprocessor, phase locked loop, etc. The ham bands have changed their makeup in the past 25 years. The AM heterodyne alleys of 20 and 40 meters now ring with the cacophony of sideband and automatic computerized CW IDers. Even the 10-meter band (the one revered by most hams because of its uncongested spectrum, leisurely operating pace, and surprisingly low-power DX capabilities) now bustles with new activity: incessant DX beacons, fully-quieted FM signals passing through intercontinental repeaters, the doppler shift of CW tones as satellites whiz by, and the chatter of channelized QRP rigs rising in a crescendo as sunspot activity moves steadily toward peak 21 and beyond.

Photo by Daniel B. Smith, Jr. K6PRK

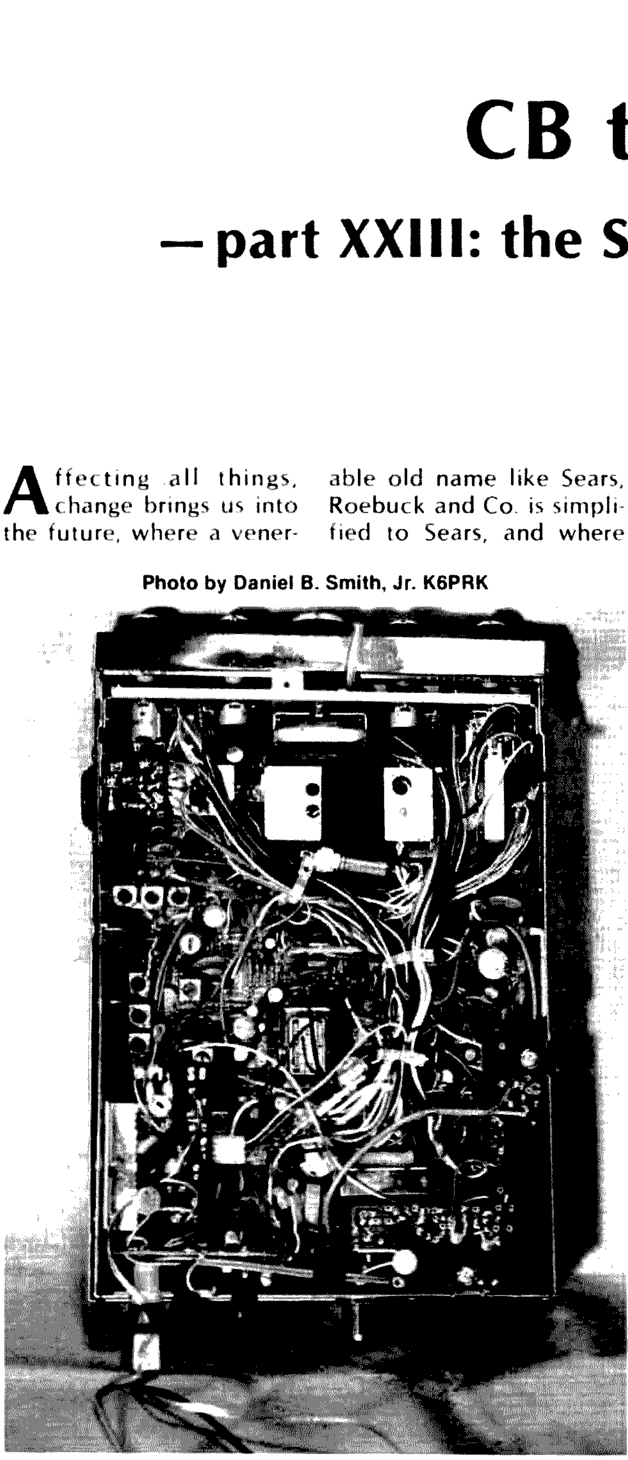


Fig. 1. Bottom view of the Sears Roadtalker 40 showing component layout.

When Sears and Roebuck together were a household name in the early fifties (and before), operating on the 10-meter band was a lot simpler. A ham in those days could afford to build his own rigs, or he could modify, for his needs, a wide variety of WWII surplus hardware. Working all over Europe in one morning with 50-Watts AM was, as remembered 25 years later, quite a surprise, as well as a very rewarding experience.

Recently, several surprises and rewarding experiences accompanied my modification and use of a 40-channel phase-locked loop CB transceiver purchased from that venerable old company, Sears. In an age where building from scratch is cost-prohibitive, the Sears Roadtalker 40, model 3826, AM-SSB rig was purchased new and sight-unseen for under $80.00 during a recent sale. Upon opening the box, the manual and accompanying schematic were immediately perused for the electrical details of conversion. Also, the bottom cover was removed to examine the physical problems concerned with the changeover—see Fig. 1.

The "doghouse" containing the reference oscillator is in the upper center of the chassis. This oscillator is the key to the conversion. The articles listed in the References are excel-

lent in their statement and solution to the conversion problem. Fortunately, the Sears rig has an almost identical PLL circuit to the rig in Reference 1.

Fig. 2 shows the Sears model 3826 block diagram; the key to the conversion is the vcxo, Q701. The vcxo's third harmonic is mixed with the vco (Q707) frequency in Q703, is filtered by LPF1, and is fed into the PLL controller. For channel 1, this frequency is 1.28 MHz. In this PLL, the vco will *automatically seek the correct frequency* to achieve a 1.28 MHz difference with the vcxo reference oscillator.

In order to move the rig's operation into the 10-meter band, the X701 frequency has to be increased. For example, to move the CB channel 1 operating frequency from 26.965 to 28.510, the vco has to be increased by 1.545 MHz. To achieve this, the X701 frequency should be increased from 12.320 to 12.835 MHz. This increase of .515 Hz is one third the vco frequency increase required. The reason for only the 1/3 increase is that the 3rd harmonic is mixed with the vco.

So much for theory; now let's discuss the actual conversion details. A 13-MHz HC-18/U-style crystal was purchased at a local surplus parts house to get the rig tuned to the 10-meter band. With this crystal, channel 1 is 29.005 MHz. It was decided to tune the receiver and transmitter to channel 1 while hoping that the tuned circuitry was broadbanded enough to cover 40 channels above, as well as below, 29.005 MHz. As it turns out, this was a good choice of a tune-up frequency. The crystal and socket (shown in Fig. 1) are taped to the outside of the metal doghouse because of its

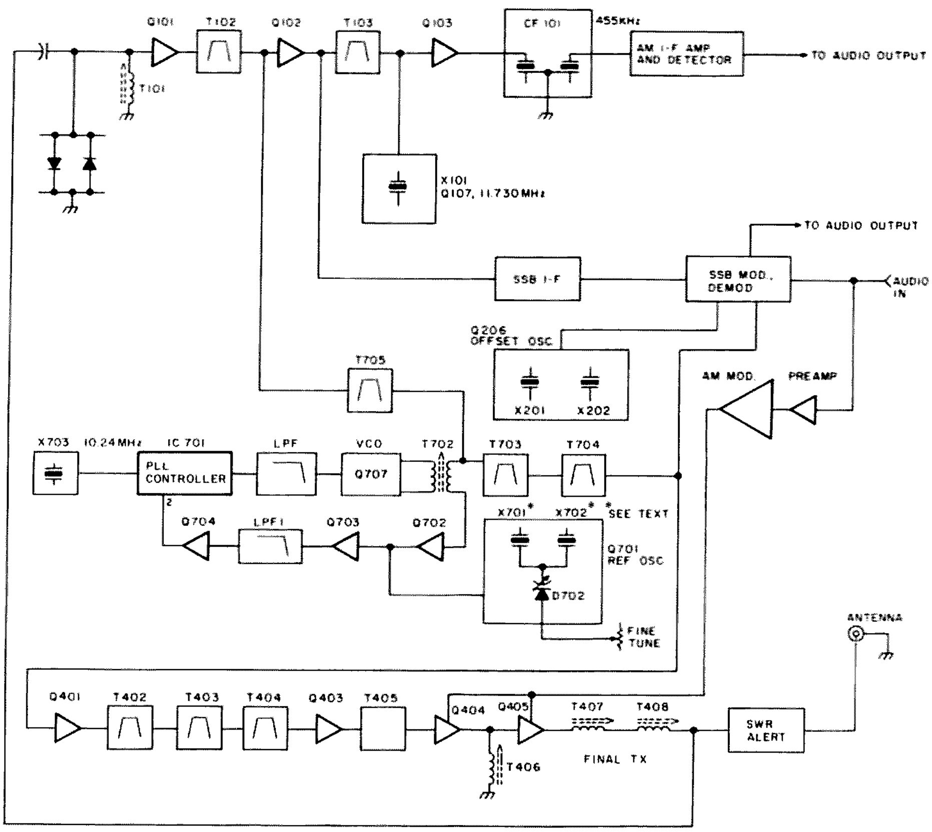


Fig. 2. Sears Roadtalker 40, model 3826, simplified functional block diagram.

large size. The crystal socket allowed easy crystal changes to check the bandwidth of operation for a single vco-tuned circuit setting.

In order to unsolder the 12.320 crystal, the bottom of the doghouse has to be unsoldered from the sides. A solder wick was used with a 45-Watt soldering iron to remove the solder bonds. It was easier to unsolder the circuit board ends of the three doghouse posts to gain easy access to the bottom cover than to unscrew the three doghouse flange attachment screws. These soft metal screws were cemented in place and I stripped the Phillips head slots while attempting to remove them.

After the crystal and socket were added, the doghouse was set in place and one post was soldered to the PC board. The doghouse assembly was pressed into the bottom cover. Since it was a tight fit, no sides-to-bottom solder bonding was applied. This would facilitate easy removal for future performance improvements which require changes to this reference oscillator circuit. These changes will be discussed later.

The next step was to remove the sealing wax from the top of all the transformer tuning slugs. This was accomplished easily by scraping the wax out with the chisel end of a small jeweler's screwdriver. All transformer slugs shown in Fig. 2, except T103 and T406, were cleaned. T701, the tank-circuit inductor (located in the small PC-board-mounted metal enclosure to the left of the reference oscillator doghouse—see Fig. 1), had the most sealing wax applied to the top of the transformer. With the vco cover removed, it was discovered that the circuitry inside was completely covered with sealing wax, probably to prevent parts movement during vibration.

After securing a suitable alignment tool for the small square hole in the slugs, the moment of truth had arrived. It was time to tune up on 10 meters. With the channel selector set on channel 1, a three-foot piece of antenna wire attached to the antenna jack center conductor, and 12-V dc power applied, the T702 slug was turned slowly clockwise. In about a half turn, a sideband signal was heard signing a W9 call. Pin 2 on IC701 was checked with a Heathkit® frequency counter. A stable 1.28-MHz frequency readout was observed. Next, T102 was turned clockwise, and in less than one turn, the level of the noise was peaked. T705 and T102 were easily noise-peaked in less than one turn. That's it

for receiver adjustment.

Next, an inline, inexpensive CB power/vswr meter and dummy load were attached to the rf output connector. Transformers were peaked with the rig in the AM position on channel 1 for max rf output in the following order: T703, 704, 402, 403, 404, 408, 407, and 405. The reason for this broken sequence is that T405 was not easily located. Although the transformer numbers are silk-screen printed on the top of the PC board, the parts are tightly packaged, making identification difficult without bright lighting. The numbers are more easily read if a flashlight is used to locate and decipher them.

By the time T405 was peaked, the power output read 5 Watts. Not bad. With the mode switch in the USB position, a whistle was directed into the microphone. The wattmeter read 7.5 Watts. With the three-foot piece of wire connected to the antenna jack, a beat note was heard in the speaker, indicating an AM signal. With the mode switch in AM, JH7XJJ was heard! Shades of the "48" sunspot peak: "All you need is a piece of wire hanging out of the window!" Probably, if the three-foot wire was matched, I would have tried to answer his CQ; instead, I not-so-calmly connected up to a two-element beam. DX fever was coming on.

He came back with a 5/6 signal on an FT-101. He was running 15-Watts output. This was beginning to feel like that one spring morning 25 years ago! The next contact was with a W1 in Boston on AM. I thought I would try sideband. Bingo! A WB4 in South Carolina was heard. Adjusting the fine-tune oscillator brought him in nicely. He was most interested in this converted rig for a blind ham acquaintance of his. I happily gave him all the info I had on the rig and its conversion.

Before the band died abruptly at 7:45 pm, many stations were heard while the set was checked with other crystals. The lowest 12-MHz rock I had brought the operating frequency down to 28.255 with the same vco setting as for 29.005. When I shut off the light in the shack and secured for the night, I had the same good feeling I felt on that spring morning in the early fifties.

Other improvements have also been implemented. The between-channel operation conversion is the simplest of all the changes. First, replace X702 (LSB Ref. Osc. crystal) with a crystal identical with the X701 that was previously replaced. X702 can be netted 5 kHz away from X701 with CT702. Next, power will be applied to D220 through R236 when the mode switch is in the LSB position. This diode will keep the USB-AM offset crystal, X201, switched on for all modes. The LSB position becomes a second set of USB frequencies placed between those set by X701 in the USB-AM position. The total frequency change by the fine tune will be approximately 5 kHz. Cut the green wire coming out of the plug on the left side of the mode selector switch about one inch from the plug. (This switch can be seen in Fig. 1 to the right of the reference oscillator doghouse.) Strip a quarter-inch of the plug end of the green wire and connect it to the orange wire terminal next to it inside the plug.

The next change to implement is fine-tune tracking on transmit. Remove R702 and short out R711, which connects the bottom end of the fine-tune control, RV701, to ground. Disconnect the red wire from the top end of the fine-tune control. Connect the top end of this control to a regulated voltage source that is always present for all operational modes such as regulator bus BB. This bus can be found in many places on the circuit board.

The extra set of wires coming out of the transceiver to the bottom left of Fig. 1 is the 12-volt control for a relay that switches in an 80-Watt, solid-state linear on transmit. It should be mentioned that American Crystal Supply Co. has a conversion kit which expands the number of channels.

When the band is open, CW signals are heard very low in the background. This occurs because the image rejection is not quite as good as with your TS-520 or FT-101 rigs. This background activity is much less objectionable than noise. With the ranks of QRP rig owners growing, one only has to mention during the QSO that he/she is running QRP and you will be surprised at the W1 or W2 breaking in to ask details of your rig.

For the price, the satisfaction of successfully completing your own conversion, sharing your conversion details with others, and regularly discovering a DX station on one or more of your 40 channels and working him stirs the imagination and brings back the pleasure of hamming with an excellent low-cost rig. This, to me, is well worth it in this age of one grand ham rigs. ■

References

1. Welsh, "CB to 10—Part XII: Convert a Kraco PLL Rig," *73 Magazine*, October, 1978, pp. 254-255.

2. Cann, "CB to 10—Part XVI: A CW Conversion," *73 Magazine*, January, 1979, pp. 56-57.

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Neat Readout for the 2036

—displays frequency on S-meter face

Breathes there a ham with soul so dead, who never to himself has said,

"Now that I have a brand new rig,
How can I modify this thingamajig?"

One of the few problems many owners of the popular Heathkit HW-2036 experience is not knowing what frequency the rig is tuned to when in a dark car. Many operators have replaced the S-meter with a digital readout. Not wanting to eliminate the meter (it impresses CBers), and not liking the hang-on type displays many have used, I went looking for a good spot on the cabinet to mount a display. Yecch! There wasn't any! Then, in my infinite wisdumb, I realized that the back face of the signal meter is translucent and that was the answer. With an LED readout mounted in back of the meter, the display shines through the meter face, superimposed on the meter scale.

Construction Details

I made this circuit on two printed circuit boards, one for the driver circuit and one for the display. The driver board mounts behind the speaker, and the LED-readout board mounts against the meter. An independent three-terminal 5-volt regulator is mounted to this chassis.

Driver circuit board: The driver board contains only the three 7447 integrated circuits and the current-limiting resistors. It is made long and narrow to fit behind the speaker. Mine wound up being about 1-1/4 inches by 3 inches. The foil pattern for the driver board is shown in Fig. 2. Pins 1, 2, 6, and 7 of each IC will connect to the thumb switches on the HW-2036. Pins 9 through 15 connect to the resistors.

Construction hint: One way to drill those zillion little holes in the circuit board is to get a hunk of IC perfboard (Radio Shack #276-1394). Tape this to your PC board and use the perfboard as a drilling guide. Just drop the drill bit into the hole and let'er spin. You'll have a perfectly spaced set of holes for mounting your integrated circuits and resistors. After all the holes are drilled using the perfboard template, draw your foil pattern using a resist pen.

Now that you have all those stupid holes drilled, solder in the three 7447 integrated circuits. To save space, I soldered directly to the chips, but low-profile sockets could be used. Of course, you will make sure that the integrated circuit is not inserted backwards, since the resulting smoke is hazardous to the chip's health. The next step is to to solder in the seven resistors for each driver. On the driver for the middle digit, an extra resistor is used at pin 16 (5-V supply) for the decimal point.

One more job on this board before we put it aside. Connect one end of a flat multi-conductor cable to pins 1, 2, 6, and 7 on each of the three chips. Cut them long enough to connect to the thumb switches later. Exact size can be determined at installation time. Connect one end of another multi-conductor cable, about 7 inches long, to the free end of the 22 resistors and to the 5-volt connection. These will be connected later to the readout board. Add a couple of pigtails for a ground and for the 5-volt power supply. Now put the board aside where the wife, kids, cats and dogs can't get at it.

Photo A. Complete installation of frequency display superimposed on S-meter.

Readout board: Now we have to build something to connect all those wires to. This board has only three LED chips and the interconnecting cable. The readout board is 3/4"×1-1/4", just big enough to hold the chips. Referring to Fig. 3, drill another mess of holes (that's the hardest part of this project) for mounting the LED chips and connections. Notice there are four rows of holes for each LED. The outer rows are for the LED pins and the inner rows for the cable connections. When the LED is mounted on the board, there is a nice gap between the LED and board. Our wires from the driver board will go between the LED and board, through this gap.

After locating the driver board you hid from the family, connect the free end of the dangling cable to the inner set of holes on the readout board. Just follow the schematic, Fig. 1, carefully, for pin numbers. Don't goof, since we will be covering these wires with the LED chips. Remember the decimal point connection on the middle LED digit and the 5-volt connection between the boards. Make sure there is no bare wire showing on the component side of the board which could contact a pin on the LED.

Now, mount the LEDs into the outside set of holes, spanning the wires. There is not enough room here to use IC sockets. Bend the pins against the foil to save room. Photo B shows the completed readout board with attached cable. At this point you have two boards connected by a multi-conductor cable. Plunk this assembly back in the hiding place.

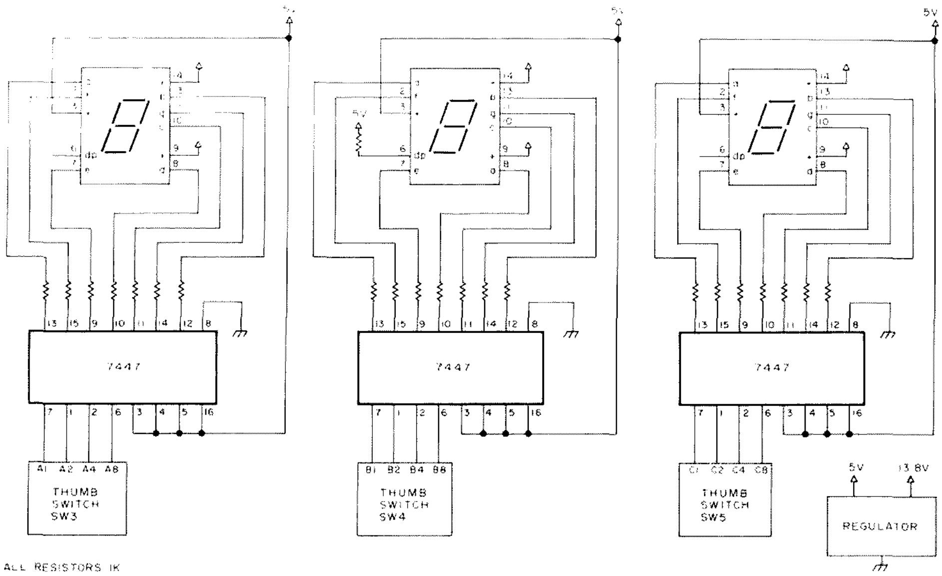


Fig. 1. Schematic of driver and readout.

Power Supply

This part is as easy as getting a CB license. To avoid overworking the built-in power supply, I mounted the three-terminal regulator on the Heath Z-shaped chassis near the mike cable clamp. (I used a mike connector and moved it to the right side of the front panel, but this is not necessary.) Run a wire between the input terminal of the regulator and the 13.8-volt supply, and that's done.

Installation

It's time to dig out the circuit boards from their hiding place one last time and wrap up the project. Depending on how ambitious you are, you can make a mounting bracket for the driver board, or if you're as lazy as I am, just wrap the board with tape and slide it alongside the speaker, between the magnet and chassis. Stick a hunk of tape to the foil of the readout board to insulate it, and thread the readout board and cable over to the meter. Wedge it between the meter and vco

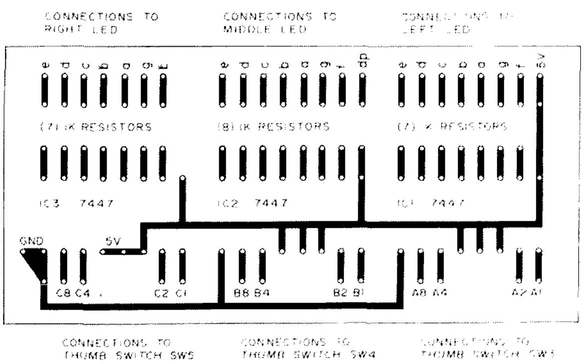


Fig. 2. Foil pattern for driver board.

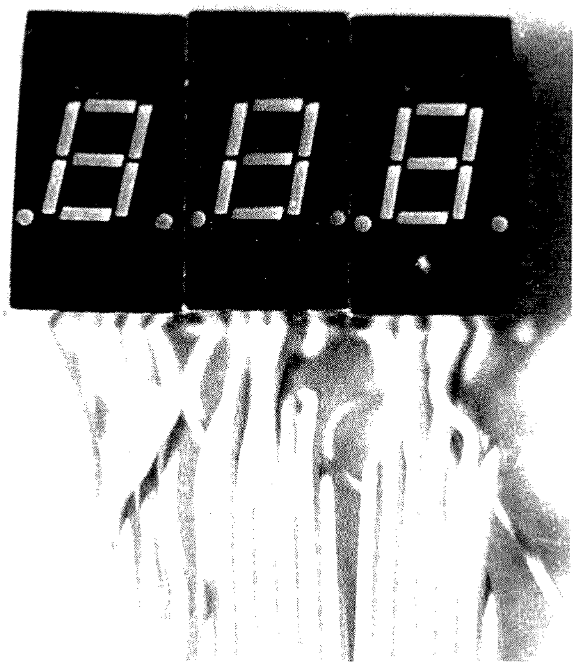


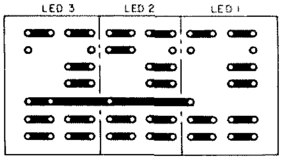
Photo B. Complete display board with connecting cable.

box. A chunk of foam tape will hold it in place.

Now for the final connections. The 12 wires from the driver board connect to the three Heathkit thumbwheel switches, SW3, SW4, and SW5. Heath even provided an extra hole in the switch for these connections. These are Heath wire numbers A1, A2, A4, A8, B1, B2, B4, B8, C1, C2, C4, and C8. Be sure to follow the schematic carefully to get the correct pins connected to the switches. Connect the ground wire from the driver to chassis and the 5-volt wire to the regulator output pin and you're ready for the smoke test.

Construction is very simple. All we've done is made one circuit board to mount and connect the LED readouts, another board to mount and connect the drivers and resistors, and hooked them together.

You now have a most unusual frequency display with no mutilation of the cabinet, no sacrifice of functions, and no messy hang-ons. And I'll bet you're the only kid on the block who has one! ■



NO PIN AT 4,5,12
NOTE PIN 6 CONNECTION ON LED 2

Fig. 3. Foil pattern for display board.

Parts List

(22)	1k resistors, 1/4-W
(3)	7447 driver/decoder integrated circuits (Radio Shack #276-1805)
(3)	.3" common-anode LED (Radio Shack #276-053)
(1)	5-V, 3-terminal regulator (Radio Shack #276-1770)

Modernize That Boat Anchor!

—older tube rigs are more fun when you give them the solid state treatment

Phil Salas AD5X
1700 Stockton Trail
Plano TX 75023

After a relatively long period of inactivity due primarily to the inconveniences of apartment living, I again became involved with ham radio. Unfortunately, the rather traumatic payments for a new house dictated the expenditure of minimal funds for my re-entry into this hobby. This being the case, I was excited to find a Gonset GSB-100 transmitter at a local ham store for $80.

The Gonset GSB-100 is an SSB, CW, AM, and PM transmitter rated at 100 Watts input (65 Watts minimum output). It covers 80, 40, 20, 15, and one MHz of 10 meters. The vfo is extremely stable (250-Hz drift maximum over a two-hour period from a cold start). The transmitter has built-in VOX and anti-VOX, receiver audio inputs and outputs, 117-V ac output for a TR relay, a switched bias output for controlling a linear amplifier, a phone patch input jack, and even a headphone jack on the front panel.

The GSB-100 uses the phasing method of SSB generation along with a crystal notch filter to give over 40 dB of unwanted sideband suppression and over 60 dB of carrier suppression. The instruction book is well written and a complete transmitter alignment can be performed in about an hour with an oscilloscope and a VTVM with an rf probe. After checking out the transmitter for proper operation, I made several changes to it which reduced power consumption, increased tube life, and eased operation.

The simplest changes were made first. These involved replacing V8, the 9006 rf detector tube, and V14, the 6AL5 VOX and anti-VOX detector tube, with silicon diodes. Almost any type of diode can be used as long as it has a reverse breakdown voltage of 50 volts or more. I used type 1N4454 high-speed switching diodes. For the 9006 rf detector tube, solder a diode between pins 7 (cathode) and 1 (anode). For the 6AL5, diodes must

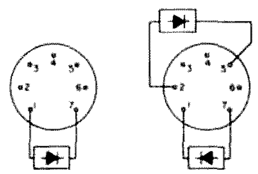


Fig. 1. V8 socket (9006), left, and V14 socket (6AL5).

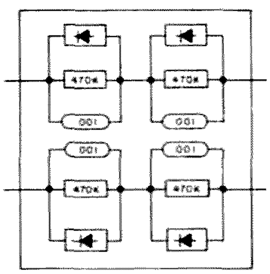


Fig. 2. Rectifier board.

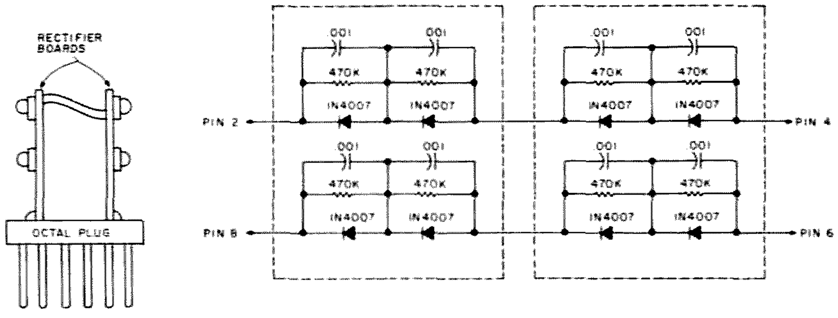


Fig. 3. Rectifier assembly and schematic.

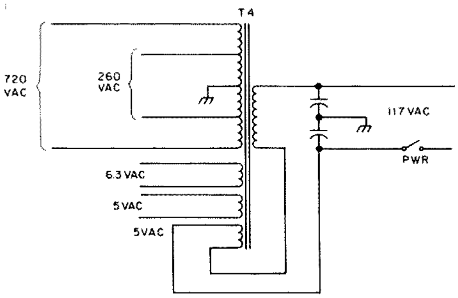


Fig. 4.

be soldered between pins 5 (cathode) and 2 (anode) and between pins 1 (cathode) and 7 (anode). Refer to Fig. 1.

The two 5U4 rectifier tubes, power transformer, and 6DQ5 final amplifier tube are all located in a small corner of the transmitter chassis resulting in quite a bit of heat being generated at this point. Replacing the 5U4s with solid state rectifiers would lower this generated heat significantly, but the decreased voltage drop of the solid state rectifiers could cause problems if not properly addressed. In this case, I found that the 5U4s have about a 100-volt drop.

I started with V15, the high-voltage rectifier. The high-voltage supply uses a choke input filter. A solid state rectifier was built on an octal tube plug. The details are shown in Figs. 2 and 3. The transformer high-voltage secondary is rated at 720 V ac rms. In order to keep from exceeding the diode breakdown voltage, the diode stack must be rated at the peak-to-peak transformer voltage of 2.8 x 720 = 2016 volts. Three 1N4007s (1000 V piv) would be sufficient. I used four so as to have two identical rectifier boards. Equalizing resistors (470k, ¼-Watt) and transient protection capacitors (0.001 uF, 1000 V) were also used. The 5-volt filament winding was disconnected and pins 2 and 8 of the tube socket were connected together with #18 bus wire.

After plugging in the solid state rectifier and applying power, I found that the high-voltage dc was now 710 volts instead of the original 610 volts. I connected up the newly freed-up 5-volt filament winding in series with the 117-V ac power transformer primary phased so as to oppose the input voltage. See Fig. 4. I suggest that when you do this, tack the wires together for the first try since Murphy's Law decrees that you will first phase the voltages to add. When this had been properly done (two tries were necessary), the high-voltage dc was found to have dropped to 670 volts. I left it at this, and now load the transmitter to 150 mA instead of the original 160 mA so as to keep the final plate power input approximately the same as it was originally. A second benefit of this change was to slightly decrease the filament voltages on all of the tubes, which should lead to increased tube lifetime. The filament voltages had been running slightly high due to the fact that the transmitter was designed for 115-V ac nominal input and the line voltage here in Plano, Texas, is between 120 and 125 V ac.

The low-voltage supply was attacked next. This utilizes a capacitive input filter to give a nominal 275-V dc key-down voltage. I soldered two 1N4007 diodes in series for each leg of the full-wave rectifier directly on the tube socket of V16. See Fig. 5. Power was applied, and a quick check of the dc voltage showed that it had risen to 360 V dc (no 5U4 rectifier drop)! Going to a choke input filter reduced this to 250 V dc (a reduction of $\sqrt{2}$, as was expected). This is slightly less than the original 275 volts. This voltage is not critical, however, and proper operation of the transmitter was still evident. The choke input filter was made by tying both sections of C15, the dual 40-uF filter capacitor, in parallel and connecting choke CH2 between the rectifier output and C15. See Fig. 6. This completes the power supply changes.

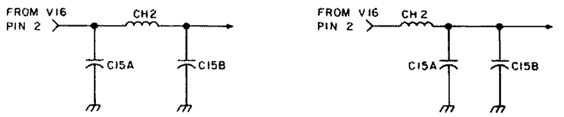


Fig. 6. Capacitive input (original), left, and choke input (modified), right.

I next made some changes so that I could use an inexpensive CB-type microphone with the transmitter.

The GSB-100 requires a high-level output microphone for proper audio drive. Instead of using a crystal or ceramic microphone, I purchased a Radio Shack CB-type power mike which periodically goes on sale for $12. This microphone comes equipped with the DIN-style plug. I purchased a DIN receptacle and replaced the original single-conductor mike jack with it. This requires the use of a 5/8-inch Greenlee hole punch. Push-to-talk was next added to the GSB-100 by simply routing a wire from pin 3 on the DIN socket (grounded on transmit) to pin 7 of V13, the control grid of the relay driver tube.

The final transmitter modification was the addition of a dc power supply for the power mike. After purchasing the power mike for what I considered an excellent price, I found that it required a $3.50 battery for power. I used the second 5-volt filament winding with a bridge rectifier to obtain the microphone voltage. This is shown in Fig. 7. In addition, the PTT switch on the power mike must be wired so as always to provide power to the microphone amplifier. See Fig. 8.

This article details a few of the things that can be done to used ham equipment to improve it. In this case, I wound up with an excellent SSB/CW transmitter with PTT and VOX and a power consumption 35 Watts less than that of the original transmitter.■

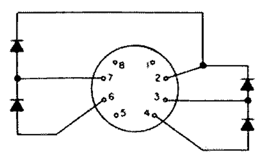


Fig. 5. V16 socket.

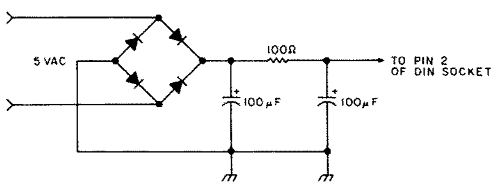


Fig. 7. Power mike dc supply.

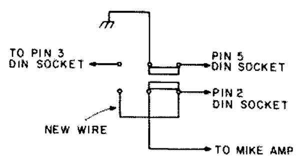


Fig. 8. PTT wiring.

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Ham Shack Numerology

—a gentle introduction to electronic math

A recent, and initially boring, session at the local radio club was magically sparked by one of those master-of-ceremony types blessed with the ability to yank the proverbial rabbit out of the right hat at the right time. In this instance, the blessed one inspired a zesty interest by asserting he could use numerology to determine any individual's bank account!

His spiel followed such lines as these: "First, figure the numerical sum of your station call letters (A=1, B=2, C=3, etc.). Next, multiply this sum by the total you get from adding up the digits in your telephone number. Finally, divide this product by the number corresponding to the month in which you were born (1-12). Voilà! The result is the number of dollars you have in your savings account." The author's ideas about numerology appear in Fig. 1.

From the audience came such exclamations as Hmm! and Wow! For all I knew, these expressions could have been confirmations of the numbers trick or sudden memories of approaching bankruptcy. We will never know, for nobody was willing to risk invasion of financial privacy by declaring this PhD of pseudo-science either right or wrong.

A few days later, while endeavoring to coax performance from a newly-designed but uncooperative circuit, I found myself immersed in thoughts about mathematics, logical thinking, and rational uses of the human mind. Surely, I speculated, no ham with a full complement of mental marbles would be taken in by that numerology stuff. Admittedly, one must bestow credit where due and willingly award plaudits for good entertainment regardless of its mode of presentation. But really, OM, how the heck can there be connections between call letters, phone numbers, birthdates, and bank accounts?

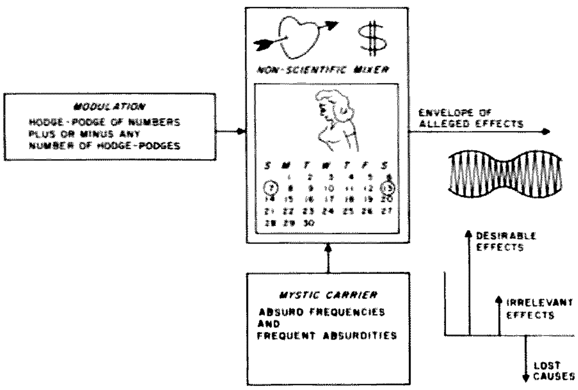


Fig. 1. Block diagram and output spectrum of numerology process. Notwithstanding conceptions of the lay public, the ham's addiction to this domain of the soothsayer's art is minimal. Except for the computation of output power, modulation index, and bandedge frequencies, numerical manipulation is rarely violated.

The best one could say here is that a ham is likely to have a low bank account. And by the same token, it is not improbable that he lags behind in his telephone payments. It might even be philosophically argued that all entities and all events in the universe are interrelated. Certainly, those seeking short-cuts to knowledge are not in short supply. They never tire of formulating cause and effect relationships, *sans* consultation with Ma Nature. Ever present in our midst are those claiming correlation of stock market prices with the height of women's skirts. We strongly suspect that P. T. Barnum rests in peace...

In contrast to such devotees of fuzzy facts, our average ham is a mathematician par excellence! For example, suppose that a designer, using academically-rigorous methods, specifies a five-Watt resistor where three Watts of dissipation are encountered. Our ham, however, is likely to come up with a ten-Watt unit. Admittedly, his achievement may result from the smouldering embers of his initially-selected ½-Watt resistor. Yet, despite the unconcealed unorthodoxy of his procedures, we can rest assured that his ultimate circuit implementations violate no laws of nature—appearances to the contrary notwithstanding!

Having now debunked the irrational and paid homage to the technological integrity of ham engineering practices, it will prove both interesting and instructive to investigate some bona-fide "tricks" with certain numbers. Perhaps you may come to share the author's conviction that the elusive line of demarkation between false and true can be exceedingly thin; "... could you but find it—to the treasure house. And peradventure to The Master, too!"[1]

Let us first consider our auld acquaintance (who should not be forgot), pi. The ratio of a circle's circumference to its diameter, pi is notorious for its

[1] *Omar Khayyam.*

appearance in equations apparently far removed from the geometry of a circle. Be that as it may, one would like to think that, because of the simplicity and symmetry of circles, pi would turn out to be a nice integral number, or, at least, one that comes out "even."

For ham calculations, we are accustomed to using the value 3.14 for pi. If you consult a handbook of math tables, you can find that pi to ten places is 3.1415926536. But even this is an approximation, in the sense that the last place has been "rounded off." In fact, pi has been calculated to at least twenty thousand places in the digital computer, and that twenty-thousandth place must still be rounded off! To make matters worse, no one has been able to discern any rhyme or reason to these endless decimal places. Suppose, OM, that you were making the initial discovery of pi by using a compass and ruler. Would you readily accept that the relationship between such elemental dimensions could be so wild? Or, would you blame your measuring instruments for pi's persistent remainder?

Although we would not fault the mathematicians for labeling pi an "irrational" number, in what follows we shall see that the endless numbers *cannot* be construed as a random fallout, as though the digits had been recklessly cast from a giant pepper shaker.

Surprisingly, pi can be calculated by merely performing simple arithmetical operations indicated by a sequence or series of numbers. And, each decimal place so calculated is accurate, except, of course, the last one, because this is rounded off. Such a number series is depicted in Fig. 2. Why should the sum of these alternate positive and negative fractions produce pi accurate to any number of dozens, hundreds, or even thousands of decimal places? As may be suspected, there are academically-acceptable answers. Whether these answers completely resolve one's natural amazement over the situation is a question on another level of consciousness. Although number series are old hat to the mathematically-versed, many have long forgotten their own gasps of astonishment when first introduced to them. Actually, we have merely scratched the surface—it will be rewarding to inspect other manifestations of such "scientific numerology."

Another constant that asserts itself whenever we use mathematics to indicate the connection between cause and effect or between states of being is epsilon, or e. This strange number, as with pi, never comes out even regardless of the number of decimal places calculated. Epsilon to ten places is 2.7182818285. Although epsilon is not simply related to a geometric figure, as is pi, there is nothing arbitrary or artificial about its value. Indeed, it is entrenched in virtually everything going on in the universe. This is because this old universe of ours is dynamic rather than static; it turns out that epsilon likes to get involved in anything that changes. Included are such measurables as temperature, radioactivity, pressure, biological aging, energy in electric and magnetic fields, and even bank interest and population growth. Again, intuition would suggest that such a universal number should be a nice simple one. But, again, nature, with her majestic overview of these processes, has thought otherwise.

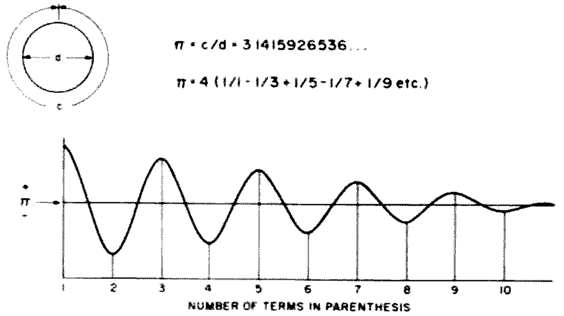


Fig. 2. Pi and the simple number series for computing its value to any degree of accuracy. The curve shows that greater and greater accuracy is approached as more terms are used.

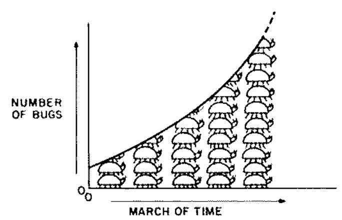
Just the same, epsilon is unique, for it, too, can be expressed as a simple number series. Now, don't invest magical qualities in these number series—they cannot be used to produce just any string of numbers. It is truly amazing that epsilon can also be calculated to any number of decimal places by carrying out the easy arithmetical operations of a certain number series!

Epsilon is most intimately associated with any process that undergoes so-called organic growth or decay. The word "organic" stems from the fact that biological species tend to modify their populations in a manner readily stipulated by some exponential power of epsilon. For example, the bugs depicted in Fig. 3(a) are reproducing in such a way that their number at any given time can be calculated by a simple "growth" equation involving epsilon. We may say that these critters are expanding straightforwardly according to $N_t = N_o e^{xt}$, where N_t is the number of bugs present at any time, and N_o is the number of bugs originally present.

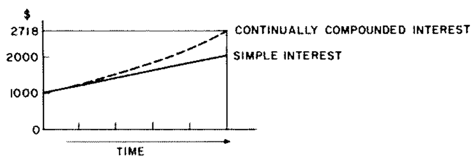
Assuming an Adam-Eve situation, we might start with just a pair of ambitious bugs. Then, N_o would equal 2. The value of x describes the effective birthrate of these bugs and determines how fast the population curve rises with passing time. Finally, t represents the time elapsing from the fall from grace of the original buglet duo. Generally, x and t have to be derived from measurement or observation. It may well be that x can be gleaned from a biological handbook covering the antics of various types of bugs. In any event, once we deduce x and t, we find ourselves able to predict the consequences of one particular entomological romance. (Such a relationship is very close to electronics, as evidenced by the inevitable appearance of "bugs" in breadboarded circuits!)

Another, and perhaps more mundane, manifestation of epsilon is shown in Fig. 3(b). Suppose you have not nearly been pauperized by inflation and manage to start a savings account with one thousand dollars. Assume that while this account draws simple interest, you patiently await the great day when your money has doubled to two thousand bucks. You propose to remove it at that time in order to buy an improved version of a two thousand dollar rig you had set your heart on when you deposited the kilobuck. (We know full well that the rig will cost four thou by then, but that is not the point.) When, at

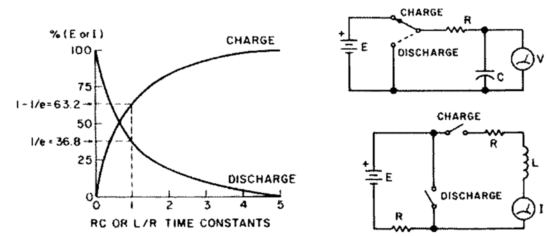
(a)



(b)



(c)



(d)

$$e = 1 + 1/1! + 1/2! + 1/3! + 1/4! \text{ etc.} = 2.7182818285\ldots$$

$$e^x = 1 + x/1! + x^2/2! + x^3/3! + x^4/4! \text{ etc.} = (2.718\ldots)^x$$

Fig. 3. Situations providing insights into the nature of epsilon. (a) Population growth of bugs whose main occupation is begetting buglets. (b) "Population growth" of dollars in two kinds of accounts. (c) "Population growth" and "decline" of electronics in RC and RL circuits. (d) Simple number sequences for determination of "population parameter," epsilon, or epsilon raised to an exponent x. Note: r is a small resistance—much smaller than R—and protects the dc source from short-circuit current.

long last, you withdraw your $2,000, the following situation will be true: Had your money been earning compounding interest at the same percentage rate, you would now be withdrawing $2,718.28! Welcome, epsilon!

OM, if you do not immediately grasp the significance of such growth, you stand in company with multitudes, for the population "explosion" on this planet likewise fails to dent the progenitors thereof.

For our ham shack mentalities, the nature of epsilon is, perhaps, displayed more meaningfully by the charge and discharge curves shown in Fig. 3(c). This "universal" graph depicts voltage and current variation in simple RC and RL circuits. The discharge curve can represent the voltage depletion across a charged capacitor which has been connected across a resistance, R.

With no mathematics at all, we know that this voltage starts at value E, the voltage of the dc charging source, and ultimately decays to zero. Note that time is shown in terms of RC time constants, rather than in ordinary "clock" units. The unit of time called the time constant is the product of capacitance (in farads) and resistance (in Ohms). Thus, the actual clock time corresponding to a time constant depends upon R and C and, of course, can vary widely according to these circuit values. Finally, the actual equation of the discharge curve for capacitor voltage, V, is $V = Ee^{-t/RC}$. Now, OM, all this has been cited just for the sake of review. Actually, we can get the "feel" for epsilon without even knowing the values of E, R, or C. Nor do we even have to be aware of the equation for V!

It happens beautifully that at the lapse of one time constant—regardless of what actual clock time that corresponds to—the voltage across the capacitor will have discharged to 36.8% of its initial value, E. Now, this might appear to be just some isolated fact worth memorizing, perhaps, and not really essential to everyday electronics life. But, the fact that the reciprocal of epsilon is also 0.368, or 36.8%, cannot be dismissed by the alert mind as a stray coincidence. For it is true that in *all* instances of the discharge of capacitor voltage by means of a resistance, 1/e of the initial capacitor voltage coincides with the lapse of one time constant!

An analogous situation prevails for the discharge of current in an LR circuit. That is, one time constant after a charged inductor has been switched from a dc source to a resistance, the circuit current is 1/e or 36.8% of its initial value. In such circuits, one time constant is the time in seconds corresponding to L/R, where L is the inductance in henrys and R represents the resistance in Ohms.

Incidentally, the author's October, 1975, CQ article, "Alice in Basic Land," explains why such combinations as Ohms and farads or Ohms and henrys obligingly enable themselves to be expressed in nice, convenient time units called seconds. All too many texts gloss over the justification for calling RC and L/R " time constants." For the moment, however, it is interesting to contemplate that bugs, bucks, and electrons can have their "population" changes described with the aid of epsilon!

The charge curve of Fig. 3(c) can represent the growth of capacitor voltage after an initially-discharged capacitor has been connected through a resistance to a voltage source, E. In such a case, we find that 63.2% of voltage E will be developed across the capacitor at the instant corresponding to one RC time constant. This percentage is equal to $1 - 1/e$. Similarly, the current in an LR circuit will attain 63.2% of its ultimate (Ohm's Law) value at the instant defined by one L/R time constant.

To say the least, a salient feature of epsilon is its assertiveness. Although all of the curves illustrated in Figs. 3(a), (b), and (c) involve e, a more encompassing statement would be that growth or decay functions involve e^x. (Actually, e is merely a special instance involving e^x, in which the value of x is one.) It is gratifying to see in Fig. 3(d) that both e and e^x can be determined for any number of decimal places by means of simple number sequences. Incidentally, the exclamation mark, !, signifies the factorial process. Thus, 1! is factorial one, or one times one=1. Factorial two, or 2!, is one times two, or 2. And, 3! represents one times two times three, or 6, etc. Even if this is brand new to you, OM, surely a mystique resides in the fact that an endless series of accurate decimal places is forthcoming from a very simple process.

Enough growth and decay situations have been cited to drive home the importance of epsilon. Suffice it to say that epsilon makes its appearance any

time the rate of change of a quantity is continually proportional to the amount of the quantity. Described in another way, epsilon tells us that the law of compound interest is at work.

At this stage, the awesome properties of certain numerical arrangements have been adequately displayed. The author, however, cannot resist mention of one more very interesting aspect of this logical, yet eerie, game of digits. Specifically, it is only natural to ponder the possibility of pi and epsilon making a mutual appearance in some kind of relationship. Inasmuch as both are deeply rooted in the architecture and dynamics of nature's universe, we strongly suspect they may not have spent these untold billions of years in a state of independent aloofness!

Consider the equation, $\text{Sinh } x = 1/2(e^x - 1/e^x)$. Whether or not it is felt that we are encroaching on the area of higher mathematics depends, of course, upon how much math was fired at us during our academic tribulations. Suffice it to say, however, that you will become quite familiar with expressions of this type if you ever succumb to the desire to calculate the happenings on transmission lines rather than to infer them from swr meter readings. Fortunately, you would not necessarily have to acquire expertise status, for such quantities as Sinh, the hyperbolic sine, and friend epsilon raised to the x power can be gotten from readily-available tables.

Or, better still, a few appropriate button-pressings on your pocket calculator will save much stress on the brain. Here's something to keep in mind, though: Although "x" represents an angle, it must be stipulated in radians rather than in degrees. This should be no cause for consternation, for it is just a matter of dealing in, say, quarts rather than pints. It happens that one radian is equal to 59.296 degrees. The nice thing about radian measure is that there are 2 pi radians in a full circle. And, even better, angular displacements commonly encountered in electrical work such as 45, 60, 90, or 180 degrees correspond to simple fractions of pi, such as pi/8, pi/6, pi/4, and pi/2, respectively. Suppose now that we substitute pi/6 wherever x appears in this strange equation. Let's see what happens:

Pi/6 = 3.141592654/6 = 0.5235987756. OK, let's write down the value of epsilon raised to this power. Now we find that e^x = 1.688091795. The *reciprocal* of this number is 0.5923858472. Performing the indicated subtraction, we have 0.592384847 subtracted from 1.688091795 = 1.095706948; and one-half of this is 0.547853474, which is, indeed, the hyperbolic sine of 60 degrees, or pi/6 radians! As you have probably inferred, the identity between the left- and right-hand members of the equation will check out for any angle—that is, any value of x. If your head is swimming, let it be reiterated that what we have done, OM, is to show evidence of the mutual appearance of pi and epsilon in one relationship.

Please be advised that *any* reaction to all this will be tolerated, except "so what!" In any event, 'tis QRT time, OM, so in the spirit of ham shack numerics, vy best 73s 'til next time. ■

COMPULOG: A Multi-Purpose Record Keeper

—whither the paper logbook?

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Access to a time-share computer system, coupled with an interest in ham-oriented applications for microcomputers, recently prompted me to investigate the possibility of developing a program for computerizing a ham log. Aside from being able to simply log my QSOs, an additional program option which I felt would be worthwhile in such a venture included the ability to search through my QSO file for a particular log entry, thereby verifying, at the touch of a few keys and with a fraction of the time it would take to manually scan the log, whether or not I had logged a previous QSO with the station in question. I also thought that an option for contest logging would be nice. In the latter, all I would have to do would be to input the call in question, and, if it were already logged, the computer would say so. If not logged, the computer would automatically enter that call, along with additional contest logging information, into the contest file. The speed of computerized contest logging would save valuable operating time by preventing duplicate contest entries and eliminating the need for using dupe sheets. The program COMPULOG, discussed in the following text, is the end result of this effort.

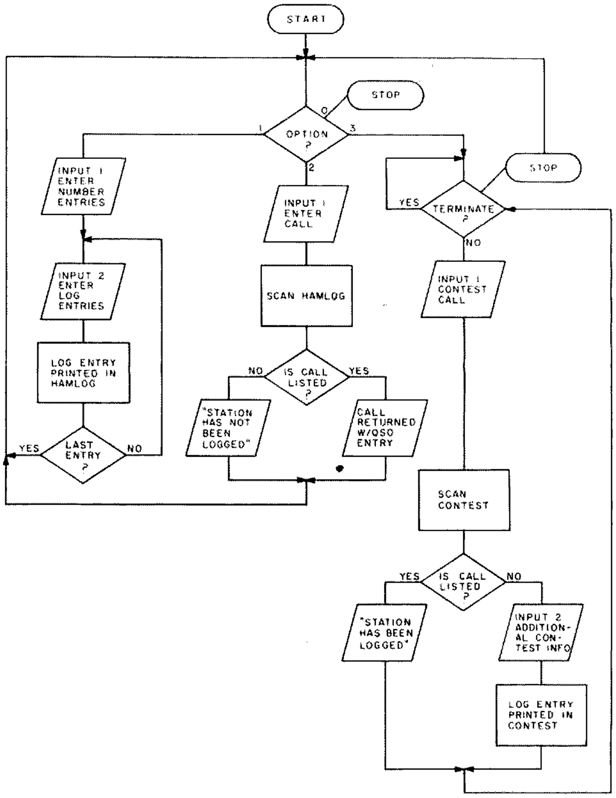

Fig. 1. Flowchart for COMPULOG.

Program Logic

The flowchart on Fig. 1 provides a synoptic view of the program logic formulating the basis for COMPULOG.

Calling up COMPULOG results in the user being given three program options. LOG ENTRY (option 1) is the center point of the program since it allows for the terminal input of a QSO log entry. Once the entry is made (format to be discussed later), it is placed into HAMLOG, the data storage file for all log entries. When the user-specified number of log entries has been made, LOG ENTRY recycles back to user option.

SEARCH (option 2) provides for the ability to scan the entire HAMLOG file at computer speed in response to a request (input as the station's call letters) to determine if a previous QSO has been carried out with the station in question. If it has been, the complete log entry is returned to the user. It should also be noted that if a logged contact has multiple listings (i.e., at different times) in HAMLOG, all of those entries are returned as well. Hence, the last as well as the first entries are instantly available. If the contact has not been previously logged in HAMLOG, then the user receives the message "STATION HAS NOT BEEN LOGGED." As

with LOG ENTRY, upon completion of the SEARCH option (in this case one scan of the entire log), program control is returned to the user.

CONTEST LOG (option 3) combines elements of LOG ENTRY and SEARCH, though in a more streamlined manner. User selection of this option results in a request for input, again in the form of call letters. Once an entry has been made, the computer will then search through CONTEST, the data storage file for this option, for any duplications. If the call has already been logged, the message "STATION HAS BEEN LOGGED" is returned. If the call has not been logged, the call letters are returned and are followed by ". . . ?", indicating that the contact is a new one and that additional logging information (according to contest format, e.g., signal reports, section nos., etc.) is required for completion and insertion into CONTEST. When this has been accomplished, the computer is then ready to accept another entry. Unlike LOG ENTRY and SEARCH, where return to user control is automatic, typing in the command STOP is necessary in the first request for input in order to return to user option control.

At any point in the entire program where the user is asked for an option number, typing 0 will cause COMPULOG to terminate.

Program Structure

The listing of COMPULOG in Fig. 2 shows a simple and relatively straightforward program that should require only minor alterations to make it compatible with most presently available minicomputer systems using various forms of BASIC. The program is divided into three main sections, and, since each section runs independently of the others, the need for subprogramming is eliminated. Program control is directed by the IF THEN statements of lines 190-220 in response to the user-selected option of line 180. Data files HAMLOG and CONTEST are terminal-format files (versus random-access files) and must be assigned file numbers, saved and empty, before initiating COMPULOG for the first time.

The applicability of terminal-format files in COMPULOG is ideal. A terminal-format file is a collection of lines, composed of numbers and/or string characters, which may vary widely in length. File entries can be typed in directly from the terminal. These files will provide for the initial storage of data which will be used as input to the program as well as storage of the data in listable form for output from the program (e.g., listing the contest log or QSO file). Lines 330-340 are all that are necessary for storing data in the appropriate file (in this case, HAMLOG). Since HAMLOG and CONTEST are defined at the very beginning of COMPULOG, further references to them at any point in the program can be made via their assigned file numbers.

Line 280 is the log entry format statement. While the type of information and the order in which it is entered into HAMLOG is largely subjective, the insertion of the call as the first entry in each string, followed by a minimum of 2 spaces, is critical to proper program operation. The reason is as follows: The search functions of options 2 and 3 are set up so that as the computer scans the data files, it reads only the first 6 spaces (cf., e.g., line 460) of each string en-

```
100 FILE #1:'HAMLOG'
110 FILE #2:'CONTEST'
120
130 PRINT 'COMPULOG OPTIONS: LOG ENTRY (1), SEARCH (2)'
140 PRINT 'CONTEST LOG (3), PROGRAM TERMINATION (0)'
150 PRINT
160 PRINT 'OPTION';
170
180 INPUT A
190 IF A=1 THEN 260
200 IF A=2 THEN 410
210 IF A=3 THEN 640
220 IF A=0 THEN 900
230
240 REM  OPTION 1 - LOG ENTRIES
250
260 PRINT 'LOG ENTRY FORMAT:'
270 PRINT
280 PRINT 'CALL(+2X)  NAME  QTH  QSO-DATE  MODE/FREQ  RST  REMARKS'
290 PRINT
300 PRINT 'NO OF ENTRIES';
310 INPUT N
320 FOR I=1 TO N
330   LINPUT A$
340   PRINT #1:A$
350 NEXT I
360 PRINT
370 GO TO 160
380
390 REM  OPTION 2 - LOG SEARCH
400
410 PRINT 'CALL';
420 LINPUT A$
430 PRINT
440 RESET #1
450 LINPUT #1:B$
460 LET X$=SEG$(B$, 1, 6)
470 IF X$<>A$ THEN 490
480 GO TO 540
490 IF END#1 THEN 580
500 GO TO 450
510 LINPUT #1:B$
520 LET X$=SEG$(B$, 1, 6)
530 IF X$<>A$ THEN 560
540 PRINT B$
550 PRINT
560 IF END#1 THEN 160
570 GO TO 510
580 PRINT 'STATION HAS NOT BEEN LOGGED'
590 PRINT
600 GO TO 160
610
620 REM  OPTION 3 - CONTEST LOG
630
640 PRINT 'ENTER NAME OF CONTEST, DATE, OPERATOR(S)'
650 PRINT
660 LINPUT C$
670 PRINT #2:C$
680 PRINT
690 PRINT 'ENTER CONTEST LOGGING FORMAT'
700 PRINT
710 LINPUT D$
720 PRINT #2:'CONTEST LOGGING FORMAT:';D$
730 PRINT
740 PRINT 'CONTEST LOG NOW OPEN'
750 PRINT
760 LINPUT A$
770 IF A$='STOP' THEN 160
780 RESET #2
790 LINPUT #2:B$
800 LET X$=SEG$(B$, 1, 6)
810 IF X$=A$ THEN 870
820 IF MORE#2 THEN 790
830 PRINT A$;'...';
840 LINPUT A1$
850 PRINT #2:A$;'  ';A1$
860 GO TO 760
870 PRINT 'STATION HAS BEEN LOGGED'
880 GO TO 760
890
900 END
```

Fig. 2. Listing of COMPULOG.

try and compares the contents of these spaces with the terminal-input entry. The first 6 spaces will accommodate the 2 × 3 calls such as WA1ZSE. Six spaces is also the minimum number necessary to allow for the duplication of call letters in 2 × 3 calls up to but not including the last letter (e.g., WA1ZSE, WA1ZSR). More importantly, however, in those cases where 1 × 2 or 1 × 3 calls are present, the 2 spaces following these entries will effectively be blank spaces so that all the computer "sees" is the 1 × 2 or 1 × 3 call. If the 6-space format is not adhered to, a scan for a 1 × 2 or 1 × 3 call will produce the "STATION HAS NOT BEEN LOGGED" message, since the computer will read the correct call plus the first letter(s) of the next bit of log information occupying spaces 5 and/or 6. Due to the 6-space maximum of the call entry format, portable and interim suffixes cannot

```
*RUN
COMPULOG OPTIONS: LOG ENTRY (1), SEARCH (2)
CONTEST LOG (3), PROGRAM TERMINATION (0)

OPTION? 1
LOG ENTRY FORMAT:

CALL(+2X)  NAME  QTH  QSO-DATE  MODE/FREQ  RST  REMARKS

NO OF ENTRIES? 1
? WA1ZSE  DOUG  W. LEBANON, N.H.  3-3-78  A1/21.4  579  QRP 5 WATTS

OPTION? 2
CALL? WA1ZSR

STATION HAS NOT BEEN LOGGED

OPTION? 2
CALL? WA1ZSE

WA1ZSE  DOUG  W. LEBANON, N.H.  3-3-78  A1/21.4  579  QRP 5 WATTS

OPTION? 3
ENTER NAME OF CONTEST, DATE, OPERATOR(S)

? 44TH ARRL INTERNAT'L DX COMPETITION  CW MODE  WA1ZSE, OP

ENTER CONTEST LOGGING FORMAT

? CALL  FREQ  DATE/TIME  EXCHANGE:SENT/RCVD

CONTEST LOG NOW OPEN

? F6??
F6??...? 21  3-??-78/1620 UTC  579 NH/589-100
? G4???
G4???...? 14  3-??-78/1623      599  /599-200
? OZ5??
OZ5??...? 28  3-??-78/1625      599  /579-070
? G4???
STATION HAS BEEN LOGGED
? STOP
OPTION? 0

*OLD CONTEST
*LIST


44TH ARRL INTERNAT'L DX COMPETITION  CW MODE  WA1ZSE, OP
CONTEST LOGGING FORMAT:CALL  FREQ  DATE/TIME  EXCHANGE:SENT/RCVD
F6??  21  3-??-78/1620 UTC  579 NH/589-100
G4???  14  3-??-78/1623     599  /599-200
OZ5??  28  3-??-78/1625     599  /579-070
*
```

Fig. 3. Sample run of COMPULOG, using all three options and including a listing of CONTEST after completion run. The format used in CONTEST LOG serves only as an illustration. Under actual contest conditions, a different format may be necessary to speed up the logging process.

be accommodated by COMPULOG. However, such information could be included under "Remarks."

Each log entry of my HAMLOG file is entered as a single string. LINPUT (versus INPUT) statements are used in HAMLOG and elsewhere throughout the rest of the program only to allow for the inclusion of such special characters as quotation marks, slant bars (e.g., mode/freq), and commas (as would separate city and state).

Lines 410-600 constitute the SEARCH option which instructs the computer to carry out a string-by-string search of HAMLOG to determine whether or not a call has been previously logged. However, the programming statements are set up to assume that the call is not listed, as would more often be the case. Lines 450-500 form the first loop of this option, which tells the computer to scan a string; if the computer does not find call letters matching the call in question, the message "STATION HAS NOT BEEN LOGGED" is returned (line 580). If, during a string scan, the computer matches the input call with an entry stored in HAMLOG, the SEARCH option enters the second loop (lines 510-570), where the log entry is printed and the scan continued to locate and print any duplicate listings described earlier. In either loop, once an entire scan has been completed, the SEARCH option terminates.

Note the use of RESET statements in lines 440 and 670. When working with terminal-format files, it is helpful to think of these files as having pointers or markers which serve as an indicator of the position in a file from which the next input (i.e., from data file to program) will be taken or, as in the case of LOG ENTRY, the position at which the next information printed to the file will begin. When HAMLOG and CONTEST are first opened, the file marker is at the beginning of the file. After each request for input by COMPULOG, the file marker is positioned just after the information input of the next string entry where information may or may not be taken. In case of a print operation (e.g., entering log entries in HAMLOG), the marker is positioned at the end of the file. If you were to subsequently ask for program input from HAMLOG, the computer would attempt to read past the last entry in the file, resulting in the termination of the program. The RESET command at the beginning of SEARCH and CONTEST LOG ensures that the pointer will always be repositioned at the beginning of the respective file following a log entry or at the end of a scan through either file.

The program statements comprising CONTEST LOG are pretty much self-explanatory in view of the preceding discussion. Lines 640-670 serve a two-fold purpose. First, they act as the first-string entry in CONTEST and the point at which the file marker is initially located. (This series of statements was not part of the original program, with the result that the first attempt to input a contest call produced an error message. The message originated from the search function, which could not find a last entry because the file was initially empty.) Second, they provide a means of identifying the output if, at the end of the contest, it is desirable to LIST it.

Using COMPULOG

While the size of my log reflects only a year or two of sporadic activity, there are ham friends of mine who index their activity by log book volume numbers. Time and an expanding log would excuse most of us from the kind of mental recall you would have to have if, on hearing or initiating a QSO, you were to suddenly wonder if that fellow on the other end was someone you should know or perhaps once worked. Unless you index your log(s) for quick retrieval of information or organize your QSOs via a number of clever schemes designed to accomplish the same, chances are you are not going to obtain the information you seek very readily. Using a computer to do your logging and subsequently your searching would provide you with a way to get this information in a fraction of the usual time.

When speaking in terms of the time element involved in retrieving the stored data, it should be obvious to potential users of this program that the efficiency of using a computer to log and search your QSOs will depend largely upon the data access time for whatever mode of data storage is used. While this may not present an objectionable time lag when using SEARCH, contest logging may present problems, since speed in logging is an essential element in keeping the contacts flowing. Depending upon the accessibility of your data, the use of this program in contests might then be ques-

tionable in terms of its efficiency. The time-share system I use gives me the ability to obtain data from my file(s) within fractions of a second after hitting the RETURN key. Such speed is beyond the capabilities for most of today's microsystems using tape or floppy discs as the storage medium.

The potential of using COMPULOG in contest logging intrigues me nonetheless, and I am hoping to use it in one of the forthcoming contests. I would appreciate hearing from those of you who decide to give it a try as well. On the surface, I can see a much smoother flow of exchanges, more contacts logged per unit of time, and less time wasted in logging duplicates or in using dupe sheets to prevent them. Furthermore, the submission of computer printouts from a contest, if properly identified and formatted, should be acceptable to the contest's sponsors.

Permutations of this logging program are limited only by the imagination. As examples, some users may wish to alter the input/output format; include program options for listing log entries according to date, mode, call area, or a whole host of other variables; create additional files and/or program options for net control operations; log SSTV, OSCAR, and VHF activity; or use specialty files for keeping track of certificate hunts.

I do not foresee the day when everyone will throw away the time-honored system of the written log for the sake of a computer, but, for those fortunate enough to have the capability, computerized logging has its possibilities and its pleasures. ■

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Computer System I/O Interface

—handles RS232, 20-mA loop, and KC Standard conversions

The interface design shown in the drawings is for a microcomputer employing RS232 I/O and user I/O combinations of RS232, TTY, and audio cassette. Minor circuit changes would easily provide various I/O combinations to suit individual needs.

The central feature of the interface is the audio cassette FSK modem. The modem utilizes an Exar XR2206 function generator modulator and an Exar XR2211 phase-locked tone-demodulator. The modem is designed to operate up to 1200 baud using a 1200-Hz to 2500-Hz frequency shift (Kansas City). Repeated read/writes at 1200 baud of a 12K byte program have been without error.

The ICs can be purchased for approximately $15 and the other electronic components usually can be found in a well-equipped hobby workshop. The complete circuit was built on a Radio Shack 4" × 4½" PC board and was installed in a small metal cabinet. The total cost for the I/O interface was less than $35.

Fig. 2 shows how user inputs produce RS232 which becomes the input to the computer. A TTY keyboard current loop of 20 mA will key the IL-74 photocoupler to produce a T^2L signal as well as turn on an LED indicator. The RS232 input also is converted to a T^2L signal by a section of the XR1489A line driver. These two T^2L signals are switch selectable so that only one of these signals is connected to one input side of the 74367 tri-state buffer. The T^2L output of the XR2211 is connected to the other input side of the tri-state buffer. When a tone is detected by the XR2211 demodulator, the carrier logic of the demodulator will automatically switch the tri-state buffer to receive FSK from the cassette player and the switch-selectable inputs will be made inactive. The XR2211 data line remains logic 1 (marking) with no tone, and remains logic 1 upon tone detection as long as the tone is marking, i.e., 1200 Hz. Breaks in the RS232 to the computer will not occur when the cassette player is put in the play-back position; thus, data reads from the cassette will not have start glitches. The T^2L output of the tri-state buffer drives an XR1488 T^2L-to-RS232 line driver to produce the re-

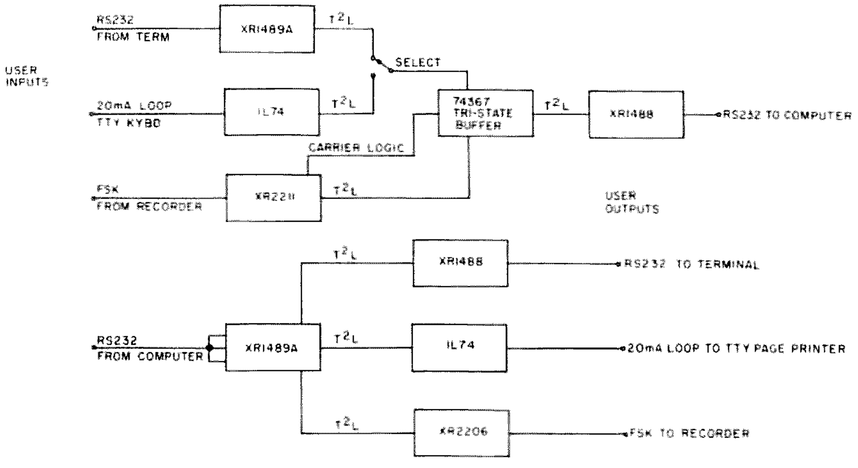

Fig. 1. Block diagram of I/O interface.

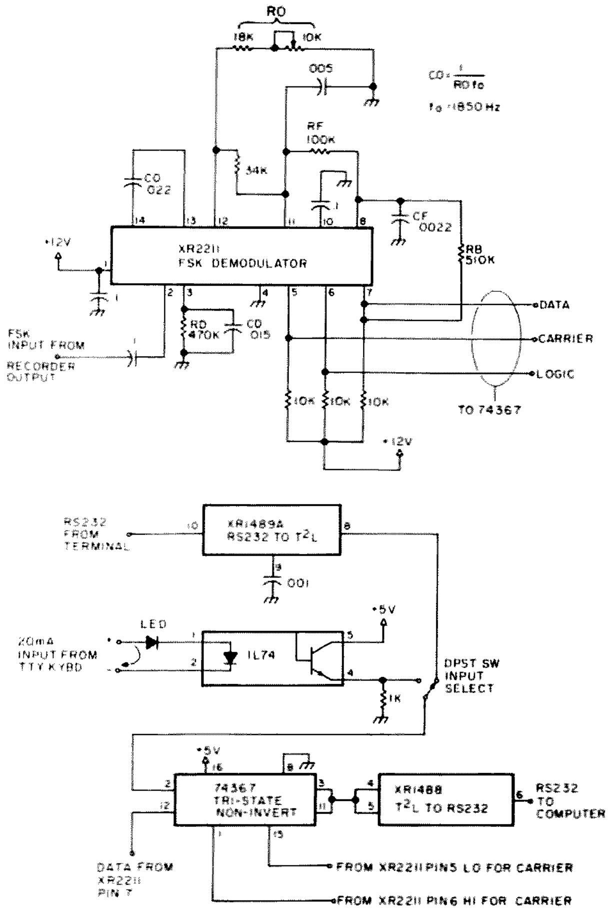

Fig. 2. Inputs to RS232.

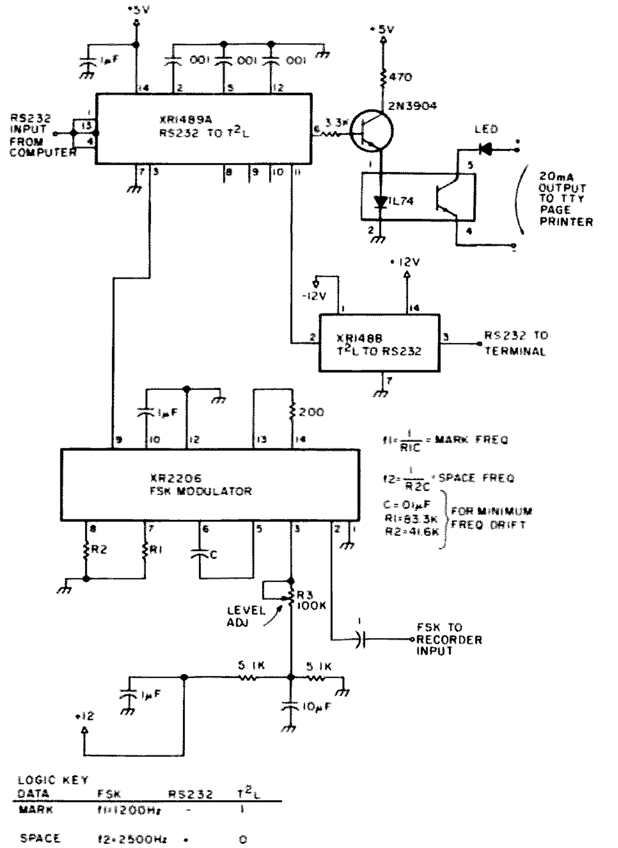

Fig. 3. RS232 to outputs.

quired RS232 input to the computer.

Fig. 3 shows how the computer RS232 output produces user inputs. The XR1489A line driver converts the computer RS232 output to three separate T²L signals. One T²L signal is used to produce a 20-mA TTY page-printer drive circuit via the 2N3904, IL-74 photocoupler, and LED indicator. One T²L signal drives a section of the XR1488 line driver to produce a RS232 user input, and one T²L signal is used to generate the FSK for audio cassette recording via the XR2206 modulator.

Adjustments

Generated FSK frequencies are set by R1C and R2C as shown in Fig 3. The FSK output level is controlled by R3 and can be set from 0.1 V to 10 V p-p. There is a dc bias on the FSK output signal and a coupling capacitor is used to isolate this dc component.

Demodulation of FSK to produce a T²L output is shown in Fig. 2. The XR2211 vco should be set midway between the two incoming tones, i.e., at 1850 Hz. R0C0 provides the tuning circuit and R0 is made partially adjustable to facilitate fine tuning. Fine tuning was not required at 1200 baud, and R0 was set manually to agree with the calculated value. If fine tuning is attempted, the following steps should be used:

1. Disconnect RB (resistor between pins 7 and 8).
2. Connect an audio generator to the FSK input and sweep its frequency from 1200 Hz to 2500 Hz.
3. Adjust R0 until the output state switches at 1850 Hz and leave R0 at this setting.

The XR2211 FSK input should not exceed 3 V p-p and it will limit with only 10 mV. There should be little problem driving this IC directly from the cassette's audio output.

No other adjustments are required, and the remaining circuitry is simple T²L and RS232.

Higher Baud Rate Operation

In order to operate the modem at higher speed, the XR2211 bandwidth must be increased. For approximation purposes, the mark frequency is made the same as the baud rate and the space frequency twice this value. For example, 2400-baud operation would require the XR2206 to produce 2400-Hz and 4800-Hz tones, and the XR2211 vco would be set at 3600 Hz. The loop filter bandwidth of the XR2211 would be doubled; therefore, CF would be halved to 0.001 uF. The loop-filter capture range is also doubled; therefore, the capture capacitor, CD, would be halved to 0.0068 uF.

Exar has excellent data sheets on their XR2206 and XR2211 ICs as well as an application note (AN-01). The data sheets provide clear design guide information for component value calculation for various baud rates. Example modem designs are given from 75 baud to 10k baud.

Operation

The interface was built exactly as shown and worked immediately without any fiddling. Scope tests show clean sine-wave generation with a smooth frequency transition from mark to space. So far, error-free operation has resulted at 1200 baud.■

Number Fun on your Micro

—explore mathematical curiosities with your TRS-80

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Occasionally, as you sit before your electronic salted peanut (mine being a TRS-80), little phrases and nuggets from outer space float through the cerebral nooks and crannies. On one such occasion, the phrases were "division by subtraction" and "multiplication by addition." Since no momentous things were transpiring on the two meter receiver making up the background sounds, I set out to revisit these two concepts.

Program listing 1 is what I came up with as an answer to division by what might be better termed "successive subtraction." It really turned out to be a chance of renewing acquaintances with the (hopefully) proper use of some of the conditional types of statements available on the TRS-80.

Program listing 2 might just make journalistic history, not for the fact that it is divided into parts, but for the fact that neither part really works. Before you sniff the page in an attempt to see what I might be high on, what is offered here is a chance for the less-than-expert programmers among us to try to get them to work. Two different starting points are shown, and each of them, as they stand, has very real but opposite problems. If you decide to tackle these program ideas on a dull day, just remember that your final effort has to handle positive and negative numbers in any mix. You will also find it easy to come up with a solution which handles integers, but fractions or decimal parts will be another story.

Let's shift gears for a bit and roll through the "Valley of the Primes." Prime numbers have always held a fascination for mathematical types down through the ages, and this same high interest seems to bite every computer buff at one time or another.

As you know, a prime number is an integer which may only be divided by itself and the number 1. All prime numbers are odd numbers by definition, since any even number is a sure bet to be divided by some factor or other. The only exception to this rule is the number 2.

The next interesting fact about primes is that their

```
 5  CLS
10  INPUT"DIVIDEND"; X
15  J = 0
20  INPUT "DIVISOR" ; N
25  X = X - N
30  J = J + 1
35  IF X/N < 0 GOTO 45
37  IF X/N > 0 GOTO 25
40  IF X < N PRINT J".";X/N: STOP
45  IF X/N < 0 THEN J = J + (X/N)
50  PRINT J : STOP
```

Program listing 1. This illustrates the process of division by successive subtraction. If you try a large division such as 1000/1, please be sure to have a good book handy as the computer tiptoes through the loop.

A

```
 5  CLS
10  INPUT "MULTIPLIER" ; B
20  INPUT "MULTIPLICAND" ; J
30  FOR N = 1 TO B
40  X = X + J
50  NEXT N
60  PRINT X
```

B

```
 5  CLS
10  INPUT "MULTIPLIER" ; B
20  INPUT "MULTIPLICAND" ; J
30  N = N + B
40  C = C + 1
50  IF C = J PRINT N: STOP
60  GOTO 30
```

Program listing 2. (a) This is the easiest listing to whip into possible working shape. In its present imperfect form, it has troubles, including not being able to accept values of B less than 1. (b) This is a toughie. Be in a good mood if you tackle it. It has the same assortment of problems as listing (a) in slightly different places. For instance, as it stands, it will not accept values of J which are less than 1.

reciprocals are endless repeating decimals. Some of these reciprocals have interesting characteristics in that the point of repetition is at exactly n−1 decimal places (where n is the value of the prime). As an example, 1/7 = .142857142857···. Notice the repeating quality of the decimal string—the repeat taking place after the n−1, or 6th, decimal place has been generated.

An example of a prime which does not follow this pattern is 13. 1/13 generates the pattern .076923076923···, which shows a double repeat within the n−1 framework. The number 19 shows a pattern like that of 7, and repeats after the n−1, or 18th, decimal place.

If you are reasonably alert, that statement should ring a small bell, and that bell is what I am leading up to. As you know, even using the (TRS-80) DEFDBL statement does not allow for more than seventeen decimal places. So how can I get the eighteen places as needed in taking the reciprocal of 19?

Program listing 3 is the little gem which will allow your TRS-80 to spit out decimal places until the cows come home. It is very possible (if you have a great deal of patience) to take the reciprocal of the prime number 499. You can probably watch the decimal places fly by and, after n−1 of them, or 498 decimal places, you will then see that 499 is in the same repetitive category as the number 7. Naturally, if you choose to take the reciprocal of some common number such as 2, you will just see .50000000000···, and the zeroes will spill out all night, or until you call it quits.

While program listings 1 and 3 may be more fun and instantly applicable to something which you have had in mind but were just too busy to try, don't ignore the learning possibilities in those imperfect listings in Program listing 2. The name of the game in learning to program is practice. Predigested or cookbook programs are very necessary to avoid constantly reinventing the wheel, but the sooner and more often that you tread the backwaters of programming practice, the sooner you, and not the computer, will be the boss. ■

```
 5  DEFDBL Y
10  INPUT X,Y
20  IF X > Y THEN 50
30  X = X * 10
50  A = INT(X/Y)
60  R = ((X/Y) - A) * Y
70  PRINT A ;
80  X = R
90  GOTO 20
```

(If you want to check primes for their pattern of repetition, you may add the following lines.)

```
15  J = 1
75  J = J + 1
77  IF J = 2 * Y - 1 THEN STOP
```

Program listing 3. These inserted lines will stop the calculations after two complete repetitions have gone through the program. This will allow you to view the type of repetition pattern which the particular prime reciprocal under investigation follows.

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Baudot Message Formatter

—in BASIC

If you have ever programmed a PROM with a Baudot message for a RTTY station, you are well aware that the procedure for formatting the message is long and tedious. The manual approach, with repeated trial and error code table searches and trial "fittings," often leads to programming errors and short tempers.

Here is a BASIC program designed to make Baudot message formatting a quick and simple task.

The program is written in Microsoft™ extended BASIC, but can easily be adapted to any BASIC having string-variable capability.

An address offset capability is provided which allows joining message segments to form a message of unlimited length. The offset feature is also very useful when moving message segments about in the program field.

Special ASCII characters are provided on input to allow representation of non-printing Baudot characters.

The program output is tabular and consists of the PROM address (relocatable), character to be programmed, octal value of the character, and the 5-bit binary pattern to be programmed.

Lines 10-160 print the instructions. Lines 170-230 input the message to be programmed and set up the output table. The remainder of the program consists of an incremental data table search, an output data "filter," and a print command.

The program checks for valid Baudot characters and flags any ASCII non-equivalence.

For those of you who dislike typing programs with lengthy data tables, a paper tape of the program is available from the author. ■

```
10 FORI=1TO4:PRINT:NEXTI
20 PRINT"BAUDOT PROM FORMATTER"
30 PRINT"J.W. YOUNG ... W6RLL"
40 PRINT"MARCH 1979"
50 PRINT:PRINT
60 PRINT"ON INPUT MAKE THE FOLLOWING ASCII FOR BAUDOT SUBSTITUTIONS:"
70 PRINT:PRINT
80 PRINTTAB(20);"BAUDOT          ASCII"
90 PRINTTAB(20);"------          -----":PRINT
100 PRINTTAB(20);"CR              *"
110 PRINTTAB(20);"LF              +"
120 PRINTTAB(20);"LETTERS         <"
130 PRINTTAB(20);"FIGURES         >"
140 PRINTTAB(20);"BLANK           %"
150 PRINTTAB(20);"BELL            ="
160 E$=" ... NO BAUDOT EQUIVALENT FOR "
170 PRINT:PRINT:PRINT"INPUT MESSAGE":PRINT
180 LINEINPUTA$
190 PRINT:PRINT
200 INPUT"DESIRED ADDRESS OFFSET";O:PRINT:PRINT:O=INT(O)
210 PRINT:PRINT:PRINT"ADDRESS","CHARACTER","OCTAL","B4-B0"
220               PRINT"-------","---------","-----","-----"
230 PRINT:PRINT
240 FORI=1TOLEN(A$):T$=MID$(A$,I,1)
250 IFT$=CHR$(34)THENPRINT(I-1)+O,T$,"021","10001":GOTO380
260 RESTORE
270 FORJ=1TO200
280 READB$
290 IFB$="ERROR"THENPRINTB$+E$+T$:PRINT:PRINT:PRINT:END
300 IFB$<>T$THENNEXTJ
310 IFB$="*"THENB$="CR":GOTO370
320 IFB$="+"THENB$="LF":GOTO370
330 IFB$="%"THENB$="BLANK":GOTO370
340 IFB$="<"THENB$="LETTERS":GOTO370
350 IFB$="="THENB$="BELL":GOTO370
360 IFB$=">"THENB$="FIGURES"
370 PRINT(I-1)+O,:PRINTB$,:READB$:PRINTB$,:READB$:PRINTB$
380 NEXTI
390 PRINT:PRINT
400 DATAA,003,00011,B,031,11001,C,016,01110,D,011,01001,E,001,00001
410 DATAF,015,01101,G,032,11010,H,024,10100,I,006,00110,J,013,01011
420 DATAK,017,01111,L,022,10010,M,034,11100,N,014,01100,O,030,11000
430 DATAP,026,10110,Q,027,10111,R,012,01010,S,005,00101,T,020,10000
440 DATAU,007,00111,V,036,11110,W,023,10011,X,035,11101,Y,025,10101
450 DATAZ,021,10001," ",004,00100,*,010,01000,+,002,00010
460 DATA%,000,00000,>,033,11011,<,037,11111,=,005,00101,
470 DATA-,003,00011,?,031,11001,":",016,01110,$,011,01001,3,001,00001
480 DATA!,015,01101,&,032,11010,#,024,10100,8,006,00110,',013,01011
490 DATA(,017,01111,),022,10010,.,034,11100,",",014,01100,9,030,11000
500 DATA0,026,10110,1,027,10111,4,012,01010,5,020,10000
510 DATA7,007,00111,";",036,11110,2,023,10011,/,035,11101,6,025,10101
520 DATAERROR
```

Table 1. Program listing.

```
ON INPUT MAKE THE FOLLOWING ASCII FOR BAUDOT SUBSTITUTIONS:

                    BAUDOT          ASCII
                    ------          -----

                    CR              *
                    LF              +
                    LETTERS         <
                    FIGURES         >
                    BLANK           %
                    BELL            =


INPUT MESSAGE

*+<<THIS IS JOE W>6<RLL NNNN*+<<


DESIRED ADDRESS OFFSET

 0


ADDRESS       CHARACTER     OCTAL         B4-B0
-------       ---------     -----         -----


 0            CR            010           01000
 1            LF            002           00010
 2            LETTERS       037           11111
 3            LETTERS       037           11111
 4            T             020           10000
 5            H             024           10100
 6            I             006           00110
 7            S             005           00101
 8                          004           00100
 9            I             006           00110
 10           S             005           00101
 11                         004           00100
 12           J             013           01011
 13           O             030           11000
 14           E             001           00001
 15                         004           00100
 16           W             023           10011
 17           FIGURES       033           11011
 18           6             025           10101
 19           LETTERS       037           11111
 20           R             012           01010
 21           L             022           10010
 22           L             022           10010
 23                         004           00100
 24           N             014           01100
 25           N             014           01100
 26           N             014           01100
 27           N             014           01100
 28           CR            010           01000
 29           LF            002           00010
 30           LETTERS       037           11111
 31           LETTERS       037           11111
```

Table 2. Sample run.

Gary McClellan
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Fullerton CA 92634

Lab-Quality Hi I Supply

—part I

There is nothing as handy or as necessary as a good power supply on your test bench. Yet, because good power supplies cost so much, few of us can really afford to buy one. I think it is time to do something about that, and thus, here-described, is a laboratory-quality power supply capable of serving probably all of your needs.

The Hi I power supply has all of the features of the best laboratory supplies. You get an adjustable, fully-regulated output of 0- to 15-volts dc. The regulation is excellent—typically ensuring less than a 10-mV drop over the voltage range. The dc output is well filtered, too, with negligible ripple over the voltage/current ranges. And this supply will cause minimum interference to sensitive communications equipment, since simple noise-filtering has been included in the design.

There is adjustable current-limiting built in, and you can adjust for the maximum current delivered to the load—an important feature that can save equipment if a short is present. Included in this unit is provision for external sensing; this feature, found in the best high-current supplies, compensates for long power leads, insuring that the load gets full power at all times. This is a vital feature and will be discussed in more detail, but for now it's enough to say that it's necessary with heavy loads. You get a laboratory power supply with easy adjustment of voltage and current plus an optional digital display of each value and, to top it off, you can draw up to 20 Amperes. Needless to say, if you have been wanting to build a top-quality power supply, this might be your best bet!

Construction of this type of project is not especially hard, but it is best tackled by someone who is well-versed in soldering techniques and in the ability to follow a schematic. This just makes the project easier and increases your

Photos by Roger Wilcox

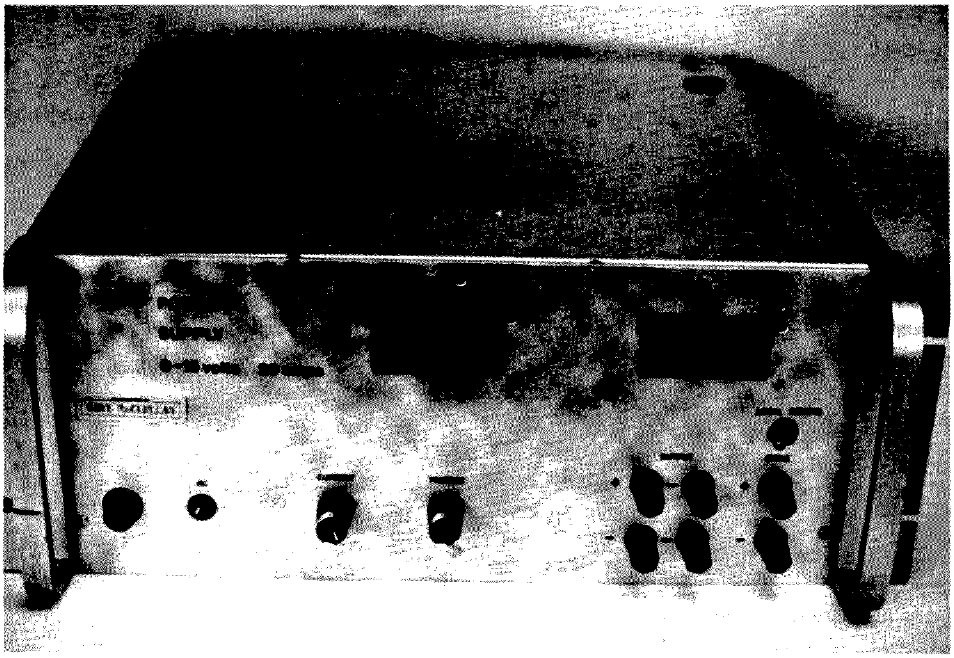

Photo A.

chances of success the first time the unit is powered. Like most heavy-duty power supplies, this one is big. The circuitry is arranged on a pair of heat sinks and on a plug-in PC card. Aside from a filter capacitor and power transformer mounted on the bottom of the case, the few other components mount on the front panel. Construction is fairly easy, and the most time will be spent wiring together the previously-mentioned components. The bulk of this project is on a single PC card which is easily built. In short, everything possible has been done to make this project easy to build.

Most of the components in this project are easy to get through surplus dealers listed in the back of this magazine. Feel free to raid your junk box for any parts not readily available. Most of the parts you will be hunting up will be power transistors and resistors. They are common in surplus. There are two potentially tough components to obtain: the power transformer and rectifiers. Since 30-Amp power transformers and 40-Amp rectifiers aren't especially common, even in surplus, special attention has been paid to locating these parts and in describing workable substitutes. The prototype cost around $65, using new and surplus parts, but this is a mere fraction of what commercial units cost (about $400).

One thing that may have entered your mind as you read this article is, "why a 20-Amp capacity?" The answer is simple. If you do any work on high-current logic such as TTL memories, or work on communications equipment, you need a high-current capacity. This is especially true in the communications field where transmitter power is rising and more is required of the power supply. Besides, using a messy storage battery to power communications equipment is definitely outdated. This supply has the power capacity for both simple low-power circuitry and those heavy-duty jobs, so you won't be stuck with using storage batteries as many people are.

Circuit Data

The Hi I power supply is based on a classic series-pass type of voltage-regulator circuit. It uses a total of three ICs and eight power transistors for up to 20 Amps of output. One of the ICs is a constant-voltage reference which provides a voltage to an error-op amp. The error-op amp compares the reference voltage to the output voltage of the power supply and adjusts the power transistors so that the two voltages are the same. This process is continuous, and keeps the output voltage constant regardless of load on the power supply.

A rather simplified idea of how the power supply works is shown in Fig. 1(a). (In these diagrams, unnecessary parts such as resistors have been left out to give you a clearer picture of what's going on.) The heart of this power supply is IC2, a 741-style dual op amp. It serves as an error amplifier, and the job of voltage regulation starts here. Its job is rather simple in that it strives to keep the dc levels on both inputs equal at all times. Let's look at another important part—IC1. This is a three-terminal voltage regulator, and it puts out 10 stable volts. This voltage is divided through pot R33, which serves as the front panel voltage-adjust control. The voltage off the pot drives one op amp input of the error amplifier. Next, the output voltage

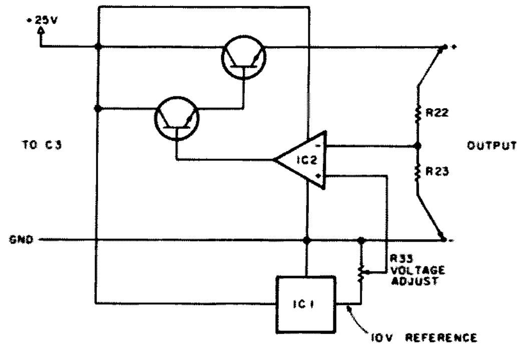

Fig. 1(a). Basic voltage regulation circuit.

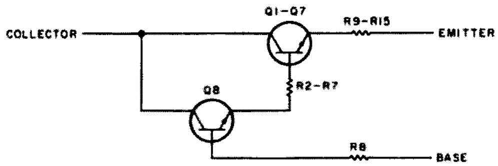

Fig. 1(b). Basic Darlington transistor.

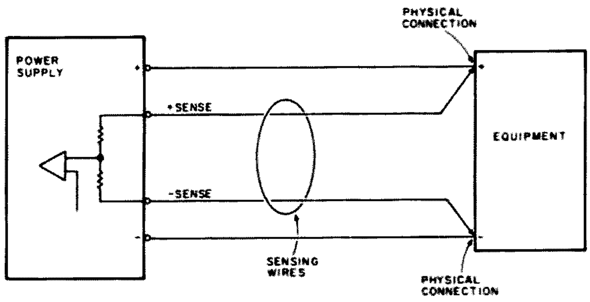

Fig. 2. Hookup for external sensing.

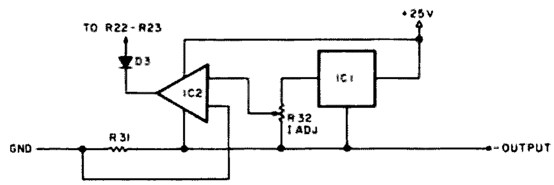

Fig. 3. Basic current-limiting circuit.

from the panel output jacks is scaled down by resistors R22 and R23. As a result, an output of 0 to 15 volts on the jacks appears as 0 to 10 volts at the resistor junction. This scaled voltage is connected to the other op amp input, and the error amp, IC2, compares the inputs. If, say, the scaled-voltage input is low compared to the reference input, the op amp will drive the power transistors harder, raising the supply voltage until the two error amp inputs are equal. If, suppose, the scaled input to the op amp is higher than the reference input, the reverse will happen—the transistors will receive less current and the output voltage will fall.

One important area that hasn't been discussed concerns the power transistors. There are eight silicon, 150-Watt NPN devices wired as a big Darlington transistor. This is done since 20-Amp Darlingtons are hard to get, and 8 discrete transistors tend to be cheap in surplus. A Dar-

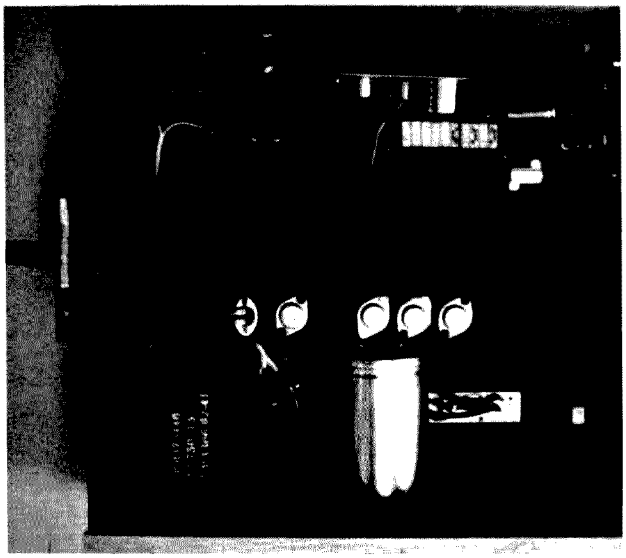

Photo B. This is a top view of the power supply, showing the location of the principal parts.

lington configuration is used to minimize the need for large amounts of current from the error amp, IC2. Otherwise, a current booster would be required. In this unit, the Q1 through Q7 transistors are wired in parallel, while Q8 provides the Darlington driver. All those resistors, R2 through R15, are necessary to prevent "current hogging," a condition whereby one transistor runs hot from excessive current while one near it runs cold from insufficient current. These resistors help to ensure longer life from the power transistors; they are shown more fully on the schematic.

While on the subject of voltage regulation, the connections for sensing and the reason for external sensing must be discussed. When you deal with high currents you invariably find that various voltage drops prevent you from getting the same voltage at your equipment as at the power supply. This voltage drop results from resistance in the connectors and cable, and increasing the current levels aggravates this problem. The solution is twofold. First, the wire size in the cable should be large enough to handle the load current—and it should be kept as short as possible. This part of the solution can help tremendously, but external sensing can ensure that the load receives the proper voltage. To provide this, the ends of resistors R22 and R23 are brought out to binding posts on the front panel. Each post is connected *directly* to the power terminals of the load or equipment. This is shown in Fig. 2. The important thing to remember is that these wires are connected *physically* to the equipment's power terminals. Thus, the power supply will automatically adjust for the correct voltage at the equipment and ignore voltage drops in the cable and connectors.

The current-limiting circuitry is formed by the second section of op amp IC2, voltage-reference IC1, and R31. In operation, IC1, a 10-volt regulator, supplies 10 volts to resistor R27 and pot R32. The voltage is

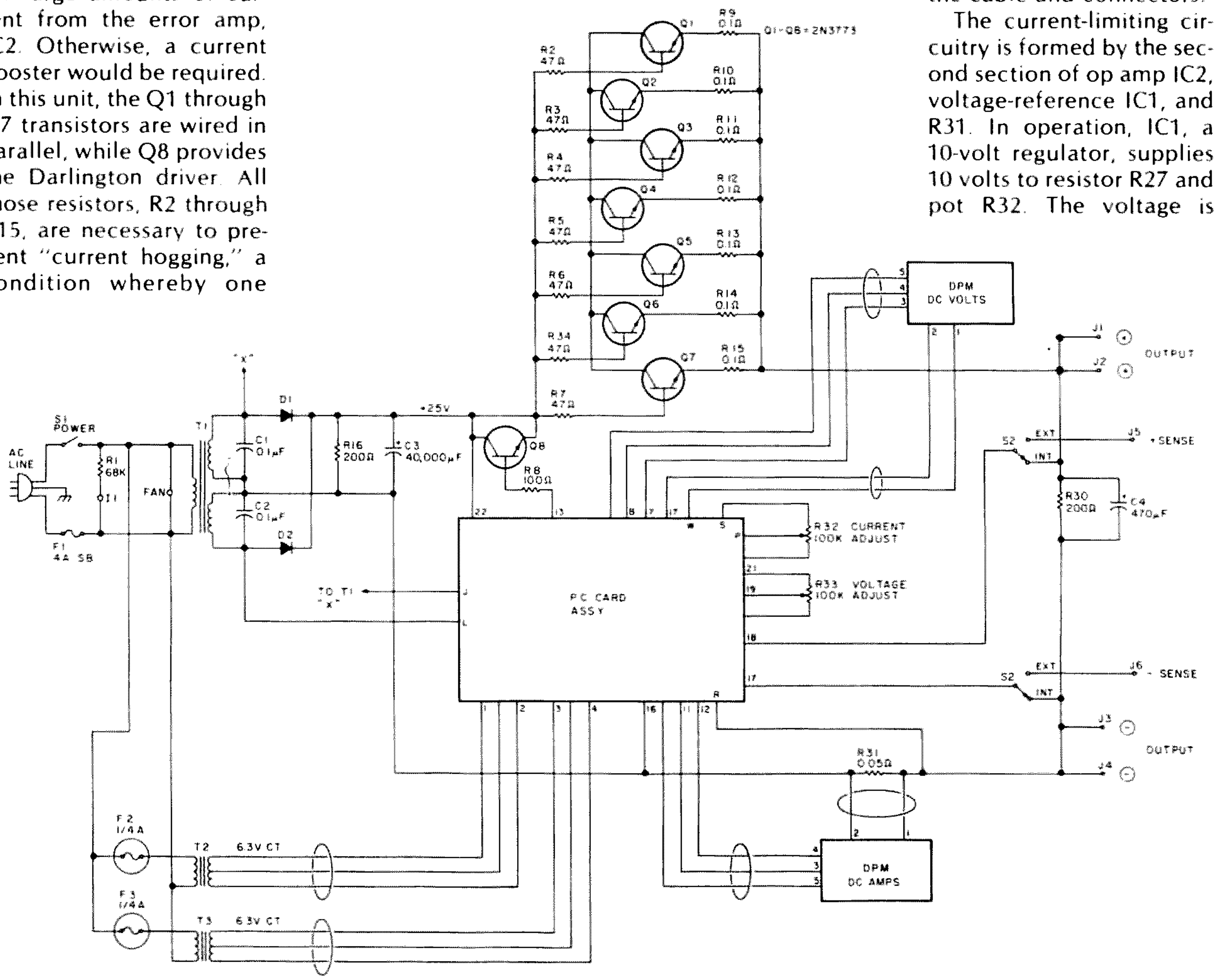

Fig. 4. Schematic—20-Amp power supply.

divided down to about 1.1 volts, which appears across the pot. This is shown generally in Fig. 3 and in the schematic. The pot is labeled Current Adjust and its output drives an op amp input. This voltage determines the trip point of the current-limiting circuitry and is vital to the operation of the circuitry. Next, a voltage drop occurs across R31, a big 0.05-Ohm resistor. This behemoth is made of 20 1-Ohm resistors, so "big" isn't an understatement! Current drawn from the power supply must pass through this resistor, and Ohm's Law tells us that 1.0 volt equals a 20-Amp current draw. Voltage is tapped from this resistor, and it drives the other input of IC2. In operation, the current-adjust pot, R32, is set for the desired current. With no load on the power supply, the op amp output is about 24 volts and diode D3 won't conduct. So, the power supply operates normally. As the current consumption of the load rises, it may produce enough voltage drop across R31 to equal the voltage from pot R32. The op amp, which is wired as a comparator, senses when the two input voltages are the same and the output swings from 24 volts to a low value which is determined by the setting of R32. When the output of the op amp goes low, it takes the voltage control line going to the other section of the dual-section IC with it, causing a reduction in the output voltage as if the voltage control pot had been turned.

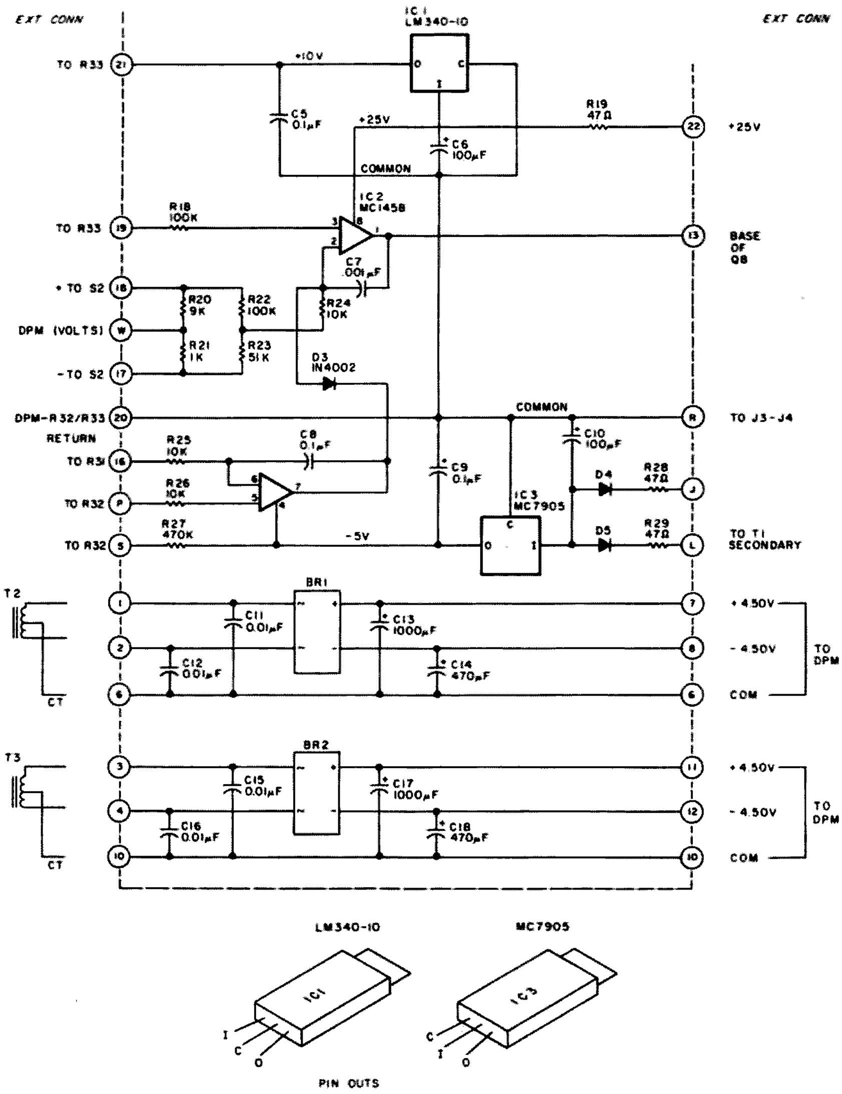

Fig. 5. PC card arrangement.

That just about does it for the power-supply circuit theory, but let's finish by looking at a few miscellaneous circuit details. On the schematic, the line voltage is changed to about 25 volts by transformer T1. This voltage is rectified by D1 and D2, two 40-Amp silicon rectifiers on a separate heat sink. Filtering is done by C3, a 40,000-uF unit. Also, ac voltage is tapped off T1, rectified by D4/D5, filtered by C10, and regulated to minus 5 volts by IC3. This voltage drives op amp IC2, assuring full regulation of the output voltage down to zero volts. It also is mandatory for enabling the current-limiting circuit to work. Noise is kept to a minimum by capacitors C1/C2, and stabilization of the power supply is done with capacitors C7 and C8. Full display of the output voltages and currents is done with two home-made digital panel meters (DPMs), and power-supply support circuitry is included. This is the job of T2/T3 on the chassis, and BR1/BR2 plus related parts on the PC card. The DPM construction will be discussed in part II of this article. If preferred, conventional analog meters may sub for the DPMs.

Locating the Parts

Although I made every possible attempt to use readily-available parts, some will cause problems. Luckily, there are ways to solve them. Most of the parts, and particularly all parts mounted on the PC card, are easy to get from such suppliers as Digi-Key and others. The eight power transistors are seen in surplus, too, and as this was written, California Digital plus others have them. As you shop or scrounge for parts, just remember one thing: Your power supply is as good as what you put in it, so watch what you buy.

You may have problems finding parts such as T1, C3, and the cabinet. Good sources for T1 include old IBM 12-volt, 20-Amp computer supplies that turn up in surplus. Try Fair Radio, Meshna, or B & F Enterprises. As this is written,

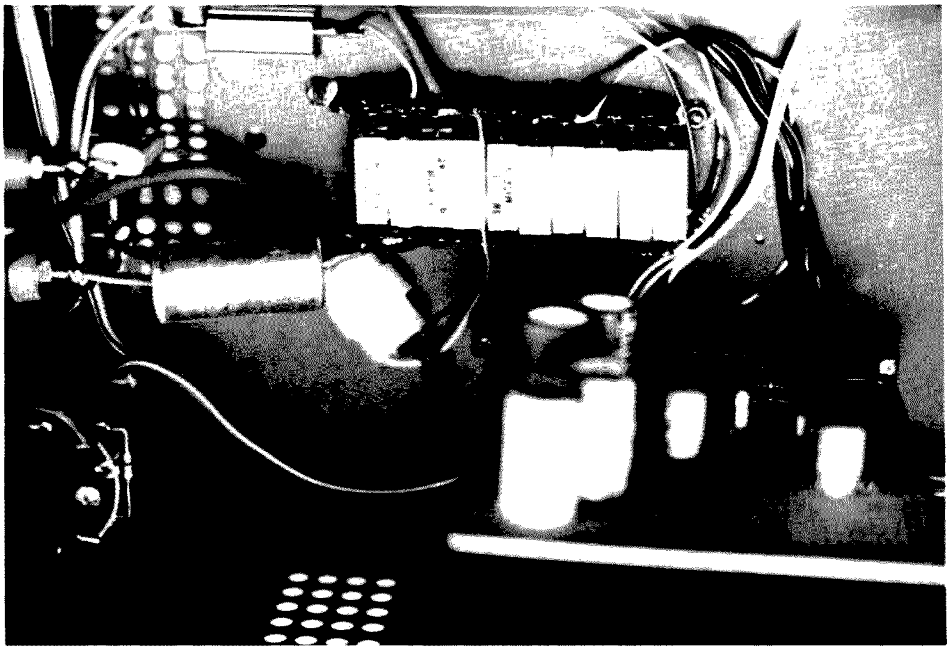

Photo C. Resistor R31 detail shows here: 20 1-Ohm resistors are on two terminal strips.

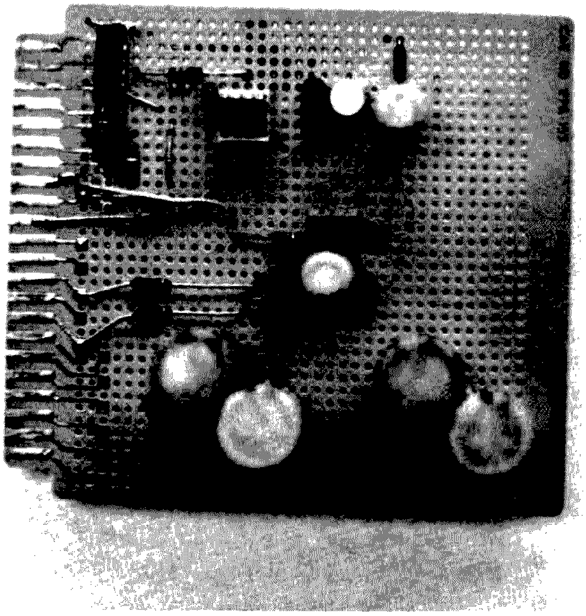

Photo D. Here is a top view of the PC card, showing the location of parts.

Poly Paks has been offering a 6-volt, 12-Amp transformer. You could use three of these, and then replace diodes D1/D2 with a 25-Amp bridge rectifier to get the proper voltages, albeit at reduced current. Or perhaps you could buy one new from Signal Transformer. Look around!

C3 is a big computer-grade unit that shows up often in surplus; try the stores mentioned earlier. You might have to parallel several units—say, four 10k-uF units, to get results.

For the cabinet, try surplus again, or else try Bud, LMB, or other such cabinet manufacturers.

Let me sum up this section by suggesting that you spend time looking through catalogs and talking to dealers. You'll probably get what you want and, if you're careful, you'll save money. In any case, you'll save a bundle over what a commercial unit costs!

Construction

Construction of this power supply is fairly easy if you know what you are doing and take your time. This project is built in three parts: PC card, heat sinks, and cabinet. It is suggested that you build one at a time, check for errors, and then proceed on to the next.

The first step is to assemble the PC card. Pick up the card from your local Radio Shack, plus the parts, and you are ready to start. First, use steel wool (such as in a soap pad) to clean the fingers on each side of the card. Shine them up. Then dab a little solder flux over the fingers and tin each neatly with solder. Clean off the excess flux with a good flux remover like Calectro® developer (Catalog no. 22-234), which works better for this job than some substances intended for this use, and it costs a fraction of what commercial flux remover costs. This one step of tinning the fingers will stop intermittents, which plague this type of PC board.

Next, slip the edge connector over the fingers, and refer to the numbers/letters stamped on it as you wire up the fingers. The rest of the construction can be guided well by the schematic and photo.

Wiring is not too critical, but keep the leads of C7 and C8 short, and mount C6 and C9 close to IC2's socket. You won't need any heat sinks on IC1 and IC3, so don't make provisions for any. If you prefer to use lower-cost analog meters on your version, omit C11 thru C18, BR1, and BR2. These components form power supplies for the DPMs we used. Resistors R20 and R21 form a 10:1 voltage divider, and may be 1% units. Other values may be used, such as 9.09k and 1.1k for the set, if desired. It would be a good idea to select these resistor values with a 5½-digit ohmmeter, but resistor error can be "tuned out" with the DPM calibration later on. If you use analog meters, omit R21 and select R20 to give your meter a 0-15 range. After you are done with the wiring, install IC2 and check for shorts and bad solder connections.

The second step is to build the heat sink assemblies. In the prototype, two heat sinks were used, one for D1/D2 and the other for the transistors. If desired, a single large sink may be used for these parts. Start by selecting a 6" square, finned heat sink for the

diodes. Drill holes for the diodes to fit, then mount them with diode mounting kits (mica washers, insulator, and hardware). Wire the two cathode lugs together and connect an 8" piece of no. 12 hookup wire to them. Then attach an 8" piece of no. 12 wire to each anode lead of the diodes. That finishes the diode heat-sink assembly.

Next, select a suitable heat sink for 8 power transistors. Mine is finned, black, and measures 6" high by 10" wide by 5" deep. A suitable heat sink found in surplus would be one of those used on computer supplies or high-powered amplifiers. Drill the 8 transistor mounting holes, and then mount transistors Q1 through Q8. Use transistor mounting kits with sockets and insulators. Put generous amounts of silicone grease under the insulator and case of each transistor, and then secure tightly with the hardware. Check for shorts to ground with your ohmmeter. Now comes the task of wiring up the transistors. The method used is rather important, so pay attention as to how you do the job.

Mount a 4-lug terminal strip at each end of the heat sink, on the terminal side. Cut a piece of no. 12 bus wire the length of the sink. Pass the wire through one terminal of each strip, and run it the length of the heat sink to the other terminal strip. Then run another no. 12 wire through the other set of terminals. Do not use the strip grounds! These bus wires form the collector and emitter leads of a super-Darlington transistor. Then take a length of no. 18 bus wire and tie a collector of any transistor to the big bus. Solder with a good, secure connection. Repeat this with the other transistors.

Next, install the seven emitter resistors, R9 through R15, from the emitter terminal of each transistor to the other big bus. Note that there is no such resistor (0.1 Ohm) on the emitter of Q1. Next, install resistors R2 through R6 to the base leads of Q1 through Q7. Tie the free ends of these resistors together, and connect all of them to the emitter of Q8. Solder the 100-Ohm, 1-Watt resistor, R8, to the base lead of this transistor. Connect the free end of the resistor to an unused lug on one of the terminal strips. Finish up by labeling the bus connections on the terminal strips, and by checking for poor solder joints. By assembling your transistors in this manner, you will minimize undesired voltage drop. The effort is worth it!

The last step is to drill the case and wire in the assemblies you built. When laying out the components, it is desirable to position the transformer, rectifier, and filter cap so they are as close as possible. This minimizes voltage drops. The heaviest current loop in the supply occurs between the transformer, rectifier, and filter, so keep those wires short. You were told to put 8" wires on the rectifiers because it was felt that this was the maximum length you should have. In practice, arrange things so you must shorten these wires. As far as the rest of the arrangement goes, use good construction practices. For best results, the wires around T1, C3, both heat sink assemblies, and the output jacks should be kept short.

After the holes are drilled, you might want to assemble the front panel first. All the pots and switches are mounted and interconnected with the PC module with multi-conduc-

Parts List

C1, C2, C5, C9—0.1-uF, 50-volt disc capacitors
C3—40,000-uF, 30-volt computer-grade electrolytic capacitor
C4—470-uF, 25-volt electrolytic capacitor
C6, C10—100-uF, 25-volt, PC-mount electrolytic capacitors
C7—0.001-uF mylar capacitor, 25 volt or up
C8—0.1-uF, 50-volt mylar capacitor
C11, C12, C15, C16—0.01-uF, 25-volt disc capacitors
C13, C17—1000-uF, 6.3-volt, PC-mount electrolytic capacitors
C14, C18—470-uF, 6.3-volt, PC-mount electrolytic capacitors
D1, D2—40-Amp, 50-piv diodes (Motorola 1N1183A or International Rectifier 40HFR5, or similar)
D3, D4, D5—1-Amp, 50-piv diodes, 1N4002 or similar
BR1, BR2—1-Amp, 50-piv bridge rectifiers
FAN—Surplus box fan, 115 volts, 60 Hz
F1—4-Amp, 3AG slow-blow fuse and chassis holder
F2, F3—¼-Amp, 3AG standard fuse and chassis holders
I1—Type NE-51H neon lamp in holder
J1, J2—Heavy-duty red binding posts—5 way
J3, J4—Heavy-duty black binding posts—5 way
J5—Red 5-way binding post
J6—Black 5-way binding post
IC1—National LM-340-10 regulator, 10 volts
IC2—Motorola MC-1458 dual-op amp IC
IC3—Motorola MC-7905 regulator, minus 5 volts
Q1, Q8—2N3773 power transistors on heat sink

(All resistors 5% film unless noted)

R1—68k, ¼-Watt resistor
R2-R7, R34—47-Ohm, ½-Watt resistors
R8—100-Ohm, ½-Watt resistor
R9-R15—0.1-Ohm, 7-Watt wire-wound power resistors
R16, R30—200-Ohm, 5-Watt resistors
R17—Not used.
R18, R22—100k, ¼-Watt resistors
R19, R28, R29—47-Ohm, ¼-Watt resistors
R20—9k Ohm, 0.1% resistor (May be selected 5% film resistors—see text.)
R21—1k Ohm, 0.1% resistor, as above
R23—51k Ohm, ¼-Watt resistor
R24, R25, R26—10k Ohm, ¼-Watt resistors
R27—470k Ohm, ¼-Watt resistors
R31—0.05-Ohm resistor, 100 Watts. (Use 20 1-Ohm, 5-Watt resistors in parallel.)
R32, R33—100k Ohm, 10-turn pots from surplus (Beckman model 7276-R100K)
S1—10-Amp, SPST toggle switch
S2—DPDT toggle switch (Current rating not critical.)
T1—35-volt center-tapped, 30-Amp power transformer
T2, T3—6.3-volt c-t, 600-mA filament transformers
Misc: Large cabinet for finished unit, Radio Shack model 276-154 PC card, 22-pin dual-edge connector, no. 12 wire, hookup wire, hardware, etc.

Suppliers Listing

Although we have found many other suppliers of parts for the power supplies, we have found these dealers to be a good sample of typical parts sources.

B & F Enterprises 119 Foster St. Peabody MA 01906	Transformers, big resistors, big capacitors, pots and miscellaneous
Fair Radio Sales P.O. Box 1105 1016 E. Eureka St. Lima OH 45802	Transformers, big capacitors, and resistors, cabinet, etc.
John Meshna Surplus P.O. Box 62 E. Lynn MA 01904	Transformers, capacitors, resistors, miscellaneous
Digi-Key Corp. P.O. Box 677 Hiway 32 South Thief River Falls MN 56701	ICs, small resistors, capacitors, hardware
Signal Transformer 500 Bayview Ave. Inwood NY 11696	Transformer T1 (Their model 24-25 looks promising.)
California Digital P.O. Box 3097K Torrance CA 90503	Filter capacitors, power transistors, miscellaneous

tor ribbon cable. This makes a nice, neat layout. The power switch wiring around S1 is wired separately with no. 18 stranded wire. You don't want a 60-Hz signal in the cable! Also use more no. 18 wire around the rest of the ac line wiring. You may not want to mount the DPMs until you see part II of this article; space limitations here prevent construction details on these playing card-sized units. But, in all likelihood, you will be busy with what I have presented so far, and by the time you reach this point, part II will be out. Of course, you may prefer to cut costs and use analog panel meters, and that is fine.

One thing before we leave the front panel: Be sure the leads from S2 go *directly* to the output jacks. These are the sensing leads.

Next, you can turn to the rear panel and install the fan and power cord. Then turn to the bottom of the box and install T1, C3, the heat sinks, and the PC card connector. Leave the connector loose since you will be connecting wires to it. A terminal strip mounted next to the power cord is a handy addition you can make, since you will be connecting many wires to it. Wire up the ac line wiring first, then turn to wiring up D1/D2. Connect C3, being sure to use terminal lugs, and remember to keep the leads short. Then connect a short wire from C3 to the collector of the heat sink Darlington transistors. Do this at the *fan end* of the heat sink. Install the minus lead from C3 to output terminals J3/J4. Then finish up the heavy wiring by running a short no. 12 wire from the emitter terminal on the power transistor heat sink to the positive terminals, J1/J2. It might be better if you connect the wire to the emitter terminal on the side opposite the terminal you made the collector connection, but this is a matter of convenience. Finish up the balance of the wiring, which will be mostly to the edge connector. Check it over when you are done, for shorts and errors. With that you are all set to proceed to "Checkout."

Checkout

Now, except for a few checks, you are all set to fire up your power supply and see if it works. Remove the PC card and connect a voltmeter to the output terminals. Apply power to the supply and read the meter. It should read zero, or close to it. If not, check the transistor heat sink for a shorted or reversed transistor. Then, when this is taken care of, measure the voltage across C3. It should be around 20-27 volts dc. If not, check out the parts before it and repair. Switch off the supply, and wait a few minutes for C3 to discharge. Insert the PC card and set the sense switch, S2, to internal. Apply power to the supply, and you should find you can adjust the output voltage smoothly from zero to about 15 volts with the voltage-adjust pot. Connect a load such as a 1-Ohm, 100-Watt resistor, and you should find there is no change of the output voltage at the output terminals over the output range. The current-adjust pot will cause the output voltage to fall or "fold back" to a lower level; advancing this pot will cause the output voltage to rise to the correct value. So, if you find you suddenly lose regulation, this is why. The adjustment pot's range is typically from 180 mA to a little over 20 Amps. This concludes the checkout of your power supply. If you have any problems, check the wiring on the PC card and the solder joints you made with the high-current wiring.

Operation

Operation of this power supply is a snap. Turn it on, set the voltage, and connect the load. Or, if you prefer, advance the voltage while the load is connected. The current-adjust pot is adjusted until the output voltage starts to drop, then increased slightly. This way, a short in the load will trip the current-limiting circuitry and shut down the power supply.

We have found the power supply to be great for running VHF communications gear since the regulated source of power tends to increase the transmitter's power output. This supply also has come in handy for other heavy-duty tasks such as emergency battery charging (saved a tow charge!) and powering entertainment radios that were sick. Yet it also powers CMOS circuitry. For me, this power supply rapidly became indispensable.

For heavy loads above 10 Amps, it often will help to connect leads to the external sensing jacks and run them directly to the power terminals on the equipment. This ensures that the voltage will be regulated directly at the equipment terminals, and often transmitter power output will be greater. But when you use external sensing, be extra-careful to connect the sensing wiring well. If one of the wires comes off, this supply will put out a full, unregulated dc voltage, and that may be harmful to your rig! This situation is true with all such supplies, so be careful.■

A Do-It-Yourself Speech Compandor

—let's experiment!

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One of the most popular words in ham radio jargon these days is *compandoring*. It is rare to pick up an amateur radio publication and not find some mention of this "new" technique. Since you will be hearing a lot more about speech compandoring in the future, you should know what it is, how it works, and if it is applicable in your station. I should add that the bulk of my compandor experience has been with SSB equipment. However, the application to be described should be equally effective with AM or FM gear.

What is compandoring? The word is a contraction of compressor and expandor. The compressor is associated with the transmitter and the expandor is used in the receiver. Actually, there are two forms of speech compandoring, frequency and amplitude. These are separate and distinct techniques which can be used together or separately. This article confines itself to amplitude compandor techniques which you can incorporate in your gear.

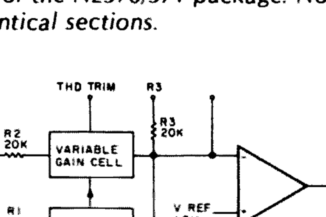

Fig. 1. Pinout for the NE570/571 package. Note symmetry of the two identical sections.

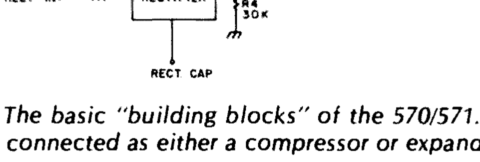

Fig. 2. The basic "building blocks" of the 570/571. They can be connected as either a compressor or expandor.

Frequency Compandoring

At the moment, this technique is rather complex and, therefore, relatively expensive. It involves compressing the frequency spectrum at the transmitter, then reassembling it to its original form at the receiver. The main advantage is the reduction in occupied bandwidth. With reasonably good band conditions, the improvement in signal-to-noise ratio is only modest. However, in the presence of heavy QRM, the ability to "get through" is significantly enhanced by narrowing the required bandwidth.

Amplitude Compandoring

Thanks to Signetics Corp., amplitude compandoring is relatively inexpensive and is applicable to any ham rig, either existing or on the drawing board. It involves amplitude compression of the transmitted signal and expansion to its original form at the receiving end of the circuit. The material which follows covers this technique and should be of interest to all experiment-minded amateurs.

The VBC System

The voice bandwidth compression (VBC) system, invented by Dr. Richard Harris and Tom Lott, involves both frequency and amplitude compandoring. The frequency technique involves interleaving the vowel and consonant sounds (which never occur in human speech at the same time). Since the sounds are at different ends of the voice spectrum, combining them by means of filters permits reducing the occupied bandwidth of the transmitted signal by approximately half. The VBC system (NBVM) has been described extensively in *QST*, the *Handbook*, and *73* (January, 1980). Refer to these if you are interested in this technique.

Enter The Chip

A significant part of the benefit obtained in the VBC system is due to amplitude compandoring of the speech. Naturally, this does not reduce the spectrum required, but it certainly does improve the "talk power" of a compandored radio. Actually, amplitude compandoring has been used for many years by the telephone company to improve signal-to-noise ratios on

their voice circuits. Until the advent of integrated circuits, it required many vacuum-tube stages to efficiently compress and/or expand telephone conversations without distortion. Each active communications circuit required a separate compandor.

Earlier, I mentioned Signetics. Some time ago, they introduced a semiconductor device (the NE571) which packed all those tubes into an inexpensive IC. The chip features processing circuits that can be configured either as a compressor or an expandor. The pinout of the NE571 is shown in Fig. 1.

It is an easy device to work with since the connections to the innards are duplicated for the two sections (the chip contains two identical channels) on each side of the package. There are three principal sections in each channel, an operational amplifier, a variable gain cell, and a full-wave rectifier (see Fig. 2).

If the three blocks are connected together as shown in Fig. 3, the channel will act as a compressor. It works in the following manner. The audio output is applied to the rectifier and variable gain cell. As the output level increases, the voltage from the rectifier also increases. This, in turn, increases the signal through the variable gain cell. Thus, more degenerative feedback is applied to the op-amp input and its gain drops. In practice, a two-unit increase in input results in only a one-unit increase in the output. The incoming signal is thereby effectively compressed. When the peaks are significantly compressed and the lower energy (and amplitude) peaks are less compressed, the peak-to-average ratio of the voice is decreased. The net effect is for the transmitter to sound louder at the other end of the voice circuit.

What makes the NE571 such a spectacular device is that compression occurs logarithmically over the entire dynamic range. Since there is no clipping or limiting point, the waveform is essentially unmodified and, therefore, undistorted. Signetics claims less than 2% distortion (1% for the NE570) which is virtually inaudible in a communications circuit. Even this small amount of distortion can be trimmed out in hi-fi applications by using the "THD TRIM" connection (pins 8 and 9). Because of its low distortion, the compressor can be left in the circuit at all times, unless you wish to switch it in and out to demonstrate its effectiveness.

While the compression application for the NE571 is impressive, it is the expandor configuration that is exciting. Although the NE571 has been available for some time, everyone has overlooked its usefulness in ham radio applications. The incorrect assumption has been made that, to be useful, the compandored radio must be communicating with another compandored radio to derive any benefit from the NE571. This is definitely not the case.

Obviously, the compressor action will provide more talk power no matter what radio is receiving a signal from any transmitter. When the expandor is installed in a radio, it will produce up to a 16-dB improvement in the signal-to-noise ratio of the received signal whether the transmitter is an Atlas, Swan, Yaesu, Kenwood, or any other rig, for that matter.

The same three building blocks that were used in the compressor can be re-configured as an expandor. The block diagram is shown in Fig. 4. In this case, the variable gain cell is in series with the incoming audio and the op-amp input. The incoming audio is also applied to the full-wave rectifier. When the input audio increases, the gain of the variable cell also increases. This, in turn, passes more signal to the op amp. Thus, every unit of increase in the input results in a two-unit increase in the output. As before, in the compressor configuration, the action is logarithmic over a 110-dB dynamic range.

How does expanding the audio increase the signal-to-noise ratio, you ask? It's a little harder to explain than compression, a technique amateurs have been familiar with for years. However, bear with me and see what happens in an actual situation.

Let's say you have an expandor (which can be switched in and out of the circuit) connected to your receiver. Let's tune in a station and adjust the volume for a comfortable listening level with the expandor switched out of the circuit. All set? Now switch in the expandor. What happens? The volume gets a lot louder since we stretched (or expanded) the audio out to a higher amplitude. What do you do now? You reach over and turn the volume down to once again establish a comfortable listening level. But, what

The Stoner PRO-10 operates between 28.0 and 29.5 MHz. It is the first ham transceiver to feature amplitude-compandored speech.

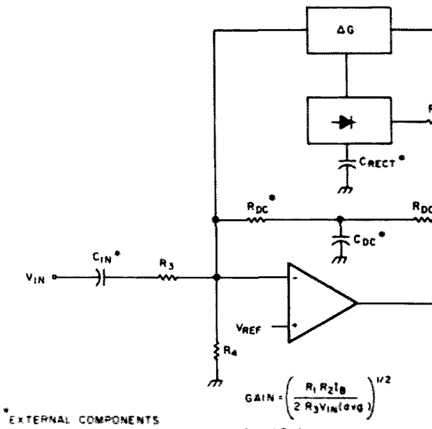

Fig. 3. The basic configuration to assemble the "blocks" as a compressor.

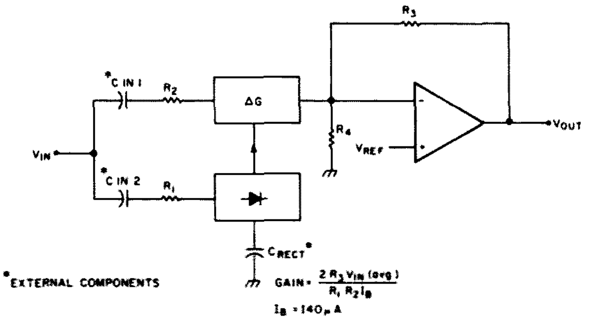

Fig. 4. The basic configuration to assemble the "blocks" as an expandor.

happens between words or when the station quits talking? The background noise is reduced by the amount that you turned the volume down! Since the volume of the incoming station is the same, and the background noise is reduced, the signal-to-noise ratio is improved. The expansion occurs logarithmically, and no audible distortion is added to the incoming signal.

A Home-Brew Compandor

The first commercial application of the NE571 in an amateur radio transceiver is the PRO-10 shown in the photograph. The PRO-10 incorporates a unique PLL synthesizer and vfo combination with 100-Watts output over the range of 28.0 to 29.5 MHz.

The circuit of the NE571 compandor (as used in the PRO-10) is shown in Figs. 5 and 6. It should be relatively easy to add this circuit to an existing solid-state SSB transceiver.

The compressor portion is shown in Fig. 5. Note that if you use only this half of the chip, it will be necessary to connect pin 13 (B+) and the components associated with pin 1. The audio input connects to pin 6. Since the NE571 has a high input impedance, a small disc capacitor is used to block dc. A dynamic microphone will not provide sufficient drive. A stage of preamplification with approximately 20 dB of gain will be required ahead of the NE571. The capacitor between pins 2-3 and 7 couples audio into the full-wave rectifier and variable gain cell. The 1-megohm resistor from B+ to pin 1 (see Fig. 6) provides tracking bias for the diode rectifier. The 1-uF tantalum capacitor establishes the decay time of the compandor action.

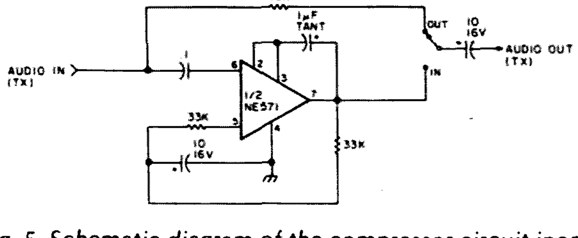

Fig. 5. Schematic diagram of the compressor circuit incorporated in the PRO-10.

To incorporate the circuit in an existing circuit, break the connection between the microphone preamplifier and the stage the preamplifier drives. Insert the circuitry shown in Fig. 5. Before putting it on the air, check the waveform at pin 7. There should be no sign of clipping with loud speech into the microphone. If clipping is observed, it means there is too much gain ahead of the compressor. With the proper drive level, there should be 1-2 volts of signal at pin 7. Since the output amplitude of the NE571 is quite high, it will be necessary to reduce the drive to the following circuitry. The 10k potentiometer should be adjusted so that with a loud voice the maximum drive level is approximately the same whether the compressor is switched in or out of the circuit.

PRO-10 Expandor

The expandor portion of the NE571 is going to be a bit more tricky to interface with your equipment and have the level correct. The circuitry of the expandor-half of the NE571 is shown in Fig. 6. Note that if this circuit is used by itself, pin 4 in Fig. 5 will have to be grounded.

The audio from the detector will probably require one stage of amplification before applying it to the inputs of the NE571. Pin 14 is the variable gain cell and pin 15 is the rectifier input. The detected audio is applied to both of these inputs. The 33k resistor determines the operating point of the expandor. For example, with the 33k value shown, the circuit will have −4-dB gain with 0-dBM input. Values between 22k and 56k will produce 0-dB gain with values between 0- and −10-dBM input, respectively.

The 10k resistor, connected to the OUT connection on the switch, bypasses audio around the compressor when the NE571 is switched out of the circuit. Since the impedance the expandor "sees" is not known, the value must be empirically adjusted by the constructor. The value is correct when a strong incoming station appears to have the same speaker volume when the expandor is switched in or out of the circuit.

Using the expandor is not a panacea. For example, if a signal is in the noise, the expandor cannot help. If the audio peaks are no higher than the noise, then, obviously, the noise and audio will be expanded equally. Conceivably, if the signal were lower than the noise, it could make reception worse when the expandor was switched in. I've never heard this happen, however. Most of the time the expandor will make an improvement which varies from the noticeable to the spectacular.

For example, a 1-microvolt signal produces a 15-dB signal-to-noise ratio in the PRO-10. When the expandor is switched on, the S/N ratio increases to

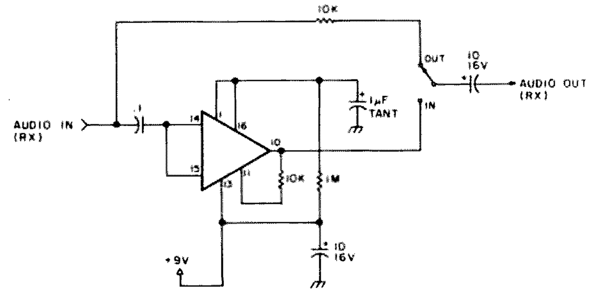

Fig. 6. Schematic diagram of the expandor circuit incorporated in the PRO-10.

about 25 dB. A signal strong enough to actuate the avc produces a S/N ratio well in excess of 30 dB with the expandor in the circuit.

While this article has emphasized an HF SSB application for the NE571, it should be equally useful in FM and other applications. For example, it could be used in low-speed data circuits, such as transferring programs off cassette tape recorders. With a properly designed circuit, it will stretch the pulses to increase their amplitude with respect to the noise. That's called increasing the signal-to-noise ratio.

I would like to thank Tom Lott of VBC, Inc., for "planting the seed" on the usefulness of the NE571, and also to thank Fred Cleveland of the same company for his technical assistance. Special thanks and gratitude are due Signetics, who provided invaluable help with the NE571.■

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Morse Converter for Frequency Displays

—another breakthrough for blind hams

The following article describes a digital converter which was designed and built by WA6AXE/3 for the visually-handicapped person. The device converts the binary-coded decimal (BCD) output which drives the 7-segment LED frequency display of the DRAKE TR-7 into Morse code audio output.

Photo A. The Digital Frequency Display-to-Morse Code Converter (DFD-MCC). The name DIGICON (Digital Converter) was given to my project by W6LZV.

After completing my last project ("Morse Converter for DMMs"*), it was time to begin work on a new converter which would be of benefit to more hams. The DMM-to-Morse code converter's usage by the visually-handicapped person is limited to those blind hams who want the challenge of using a piece of test equipment normally used only by the sighted person. However, this new digital converter can be used by any blind ham whose rig has a digital frequency display!

My blind friend, W6LZV, had just purchased the Drake TR-7; therefore, it was selected for use in the design of the new digital converter.

One area of concern to many blind amateurs has been their inability to discern the exact frequency on which they were operating. This surely does not have to be a problem any longer. Since digital frequency

73 Magazine, September, 1979.

display can provide an extremely accurate frequency readout, this new converter, in conjunction with a digital frequency display, can be a most valuable asset to any blind amateur radio operator.

Since the converter was designed to be an integral part of a blind ham's station, it is right at home with W6LZV. It is functioning perfectly!

Though the Drake TR-7 was used in the design of the project, the concept of the project itself can relate to any rig having a digital frequency readout.

For simplicity in this article, I will hereafter refer to the Digital Frequency Display-to-Morse Code Converter as the DFD-MCC.

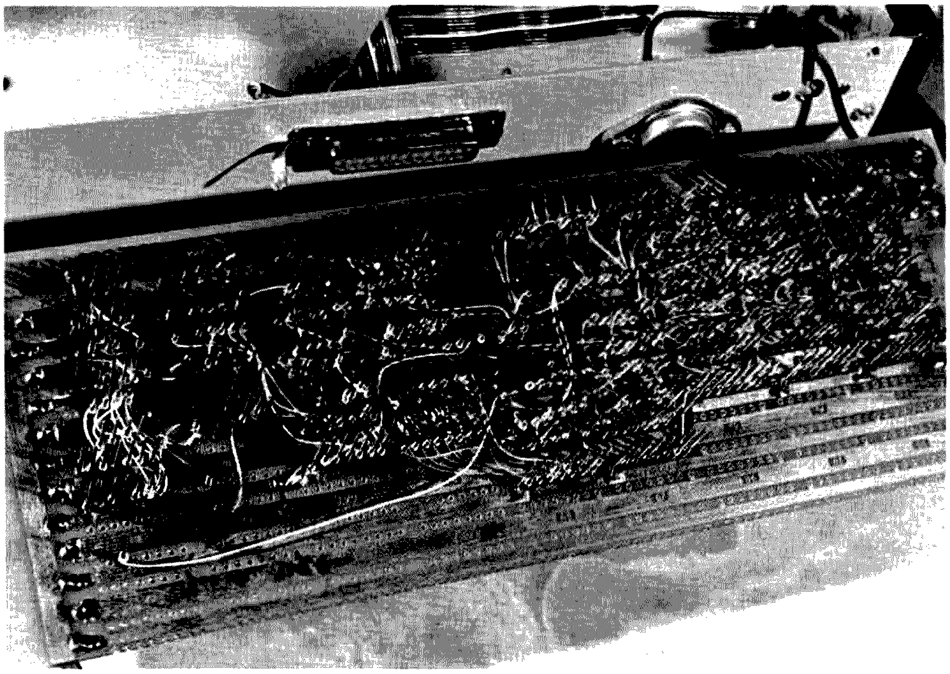

Photo B. This photograph details the appearance of the wire-wrapping technique. The wire-wrapping was done with #30 KYNAR wire and the WSU-30M wire-wrapping tool.

Beginning the Project

Starting the project was quite frustrating. I began research on it back in September, 1978. At that time, no schematic of a Drake DR-7 board was available. I had thought about looking at the DR-7 board in a friend's TR-7, and trying to draw the schematic from scratch, but this would have been entirely too time consuming. Then I had a brainstorm; I called Ron Wysong K8AY, the Director of Engineering at Drake. After telling him about the design concept, I asked if there was a way I could obtain a copy of at least the DR-7 schematic. Thanks to Ron, I had the schematic four days later, and thereafter things really started rolling.

Design Objectives

The main objective was to provide the blind user with the Morse code (audio output) equivalent of each of the six digits making up the TR-7's frequency display. This was done because of the TR-7's general coverage possibilities. If a "ham bands only" type of transceiver were to be used, the first two digits (10s of MHz and 1s of MHz) could be deleted.

Another prime objective was to keep the amount of external controls (switches and pushbuttons) down to a minimum, and to keep the overall external layout as simple as possible.

By providing the DR-7 board (optional digital frequency readout board inside of the TR-7) with an external input, it can be used as a frequency counter. Therefore, one extra benefit realized from using the Drake TR-7 in this project is a frequency counter-to-Morse code converter!

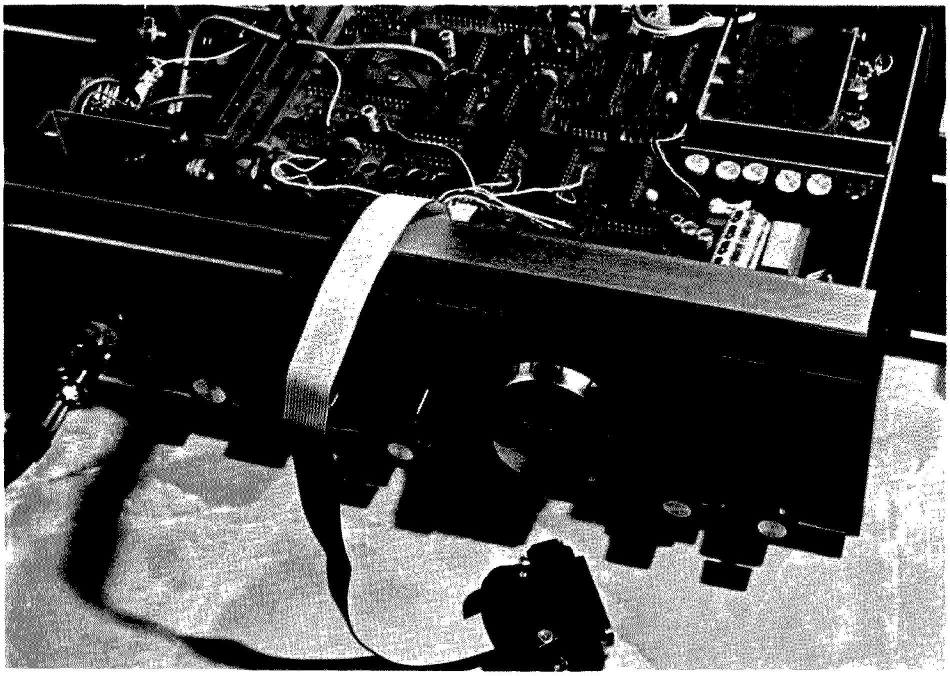

Photo C. This shows the 14-conductor ribbon-wire cable as it enters the Drake TR-7. The black plug connector is used to connect the DR-7 board's output with the DFD-MCC's input.

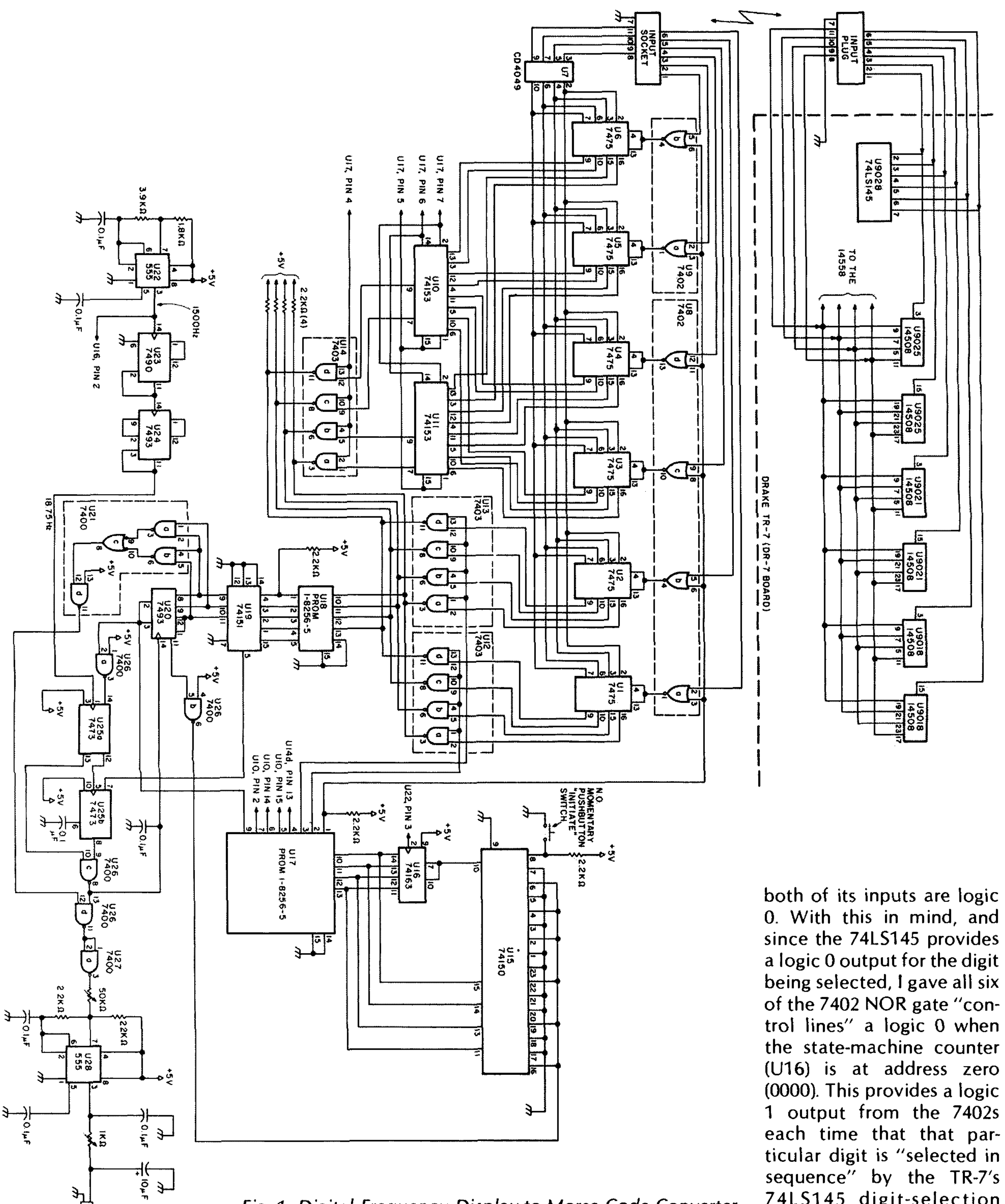

Fig. 1. Digital Frequency Display-to-Morse Code Converter.

TR-7 Digital Display (MUX)

See Fig. 1. The TR-7 multiplexed display components which drive the DFD-MCC are: U9018, U9021, and U9025—14508 dual 4-bit latches used for the binary-coded decimal (BCD), and U9028—a 74LS145 BCD-to-decimal decoder/driver used for the digit selection.

DFD-MCC (DEMUX)

To accomplish the demultiplexing of the TR-7's multiplexed frequency display, I used six 7475 quad latches (U1-U6), and two 7402 quad 2-input NOR gate chips (U8 and U9).

Demux Logic

A NOR gate provides a logic 1 output only when both of its inputs are logic 0. With this in mind, and since the 74LS145 provides a logic 0 output for the digit being selected, I gave all six of the 7402 NOR gate "control lines" a logic 0 when the state-machine counter (U16) is at address zero (0000). This provides a logic 1 output from the 7402s each time that that particular digit is "selected in sequence" by the TR-7's 74LS145 digit-selection chip. The logic 1 output is then driven to the 7475 quad latch enable inputs (pins 4 and 13). This ENABLES the 7475s to "follow" any changes that occur in the digital frequency display while the converter is waiting for the "next instruction"—the initiate

command. Once the initiate command is set (grounding pin 8 of U15, 74150), a logic 1 is sent to the NOR gate control lines. This action drives the NOR gate outputs to logic 0, thereby DISABLING the 7475 latches and "locking-in" each one of the six digits.

Digit Sequencing

Now that the six digits are demultiplexed and stored in the 7475 quad latches, we need to send each one of them, in proper sequence, to the BCD-to-Morse converter ROM (U18). The contents of U1 through U6 are: 10s of MHz, 1s of MHz, 100s of kHz, 10s of kHz, 1s of kHz, and 100s of Hz, respectively. Proper sequencing through the six digits is accomplished by the network of IC chips U10-U14.

The state-machine controller ROM (U17) provides all logic necessary for enabling, disabling, and addressing the five IC chips which make up the digit-sequencing network.

U10 and U11, 74153 dual 1-of-4 data selectors, are used to select/sequence digits three through six. U12, U13, and U14, 7403 quad 2-input NAND gates with "open collectors," comprise a WIRED-NOR bus system used for sending all six digits, one at a time, to the BCD-to-Morse converter ROM on one set of four lines.

The following paragraphs will detail the events taking place during each "state" of the state-machine controller ROM (with regard to the digit-sequencing process).

During states 0001 and 0010, the 1st digit (10s of MHz) is being addressed and sent. The 1st digit (stored in U1) enters the bus system via U12. To permit only the 1st digit onto the bus system, we provide a logic 1 (pin 2 of U17) to the "enable output lines" of only U12. The other two 7403 chips (U13 and U14) are provided with a logic 0, thereby disabling their output. At this point, the BCD information at the inputs of U13 and U14 have no effect on the bus system.

During states 0011 and 0100, the 2nd digit (1s of MHz) is being addressed and sent. Chips U12 and U14 get a logic 0 on their enable output lines. U13 is the only 7403 receiving the logic 1 (from pin 3 to U17) for enabling its output to enter onto the bus system.

During states 0101 and 0110, the 3rd digit (100s of kHz) is being addressed and sent. Beginning with this digit, the 74153s, U10 and U11, come into play. Both of the 74153's chip outputs are enabled, as are the enable output control lines of U14 (from pin 4 of U17). Chips U12 and U13 are now disabled, and will remain disabled through state 1111. The binary address, 00, necessary to push out the 3rd digit from the 74153s, is provided to pins 2 and 14 (from the state-

State	Read Enable	U10/11, 74153 (B)	U10/11, 74153 (A)	U10/11, Chip Enable	U14 Output Enable	U13 Output Enable	U12 Output Enable	Digit "lock-up"	Remarks
0000	1	0	0	1	0	0	0	0	Wait for next instruction
0001	1	0	0	1	0	0	1	1	Address 1st digit (10s of MHz)
0010	0	0	0	1	0	0	1	1	Send 1st digit (10s of MHz)
0011	1	0	0	1	0	1	0	1	Address 2nd digit (1s of MHz)
0100	0	0	0	1	0	1	0	1	Send 2nd digit (1s of MHz)
0101	1	0	0	0	1	0	0	1	Address 3rd digit (100s of kHz)
0110	0	0	0	0	1	0	0	1	Send 3rd digit (100s of kHz)
0111	1	0	1	1	0	0	0	1	Clear BCD-to-Morse converter
1000	1	0	1	0	1	0	0	1	Address 4th digit (10s of kHz)
1001	0	0	1	0	1	0	0	1	Send 4th digit (10s of kHz)
1010	1	1	0	1	0	0	0	1	Clear BCD-to-Morse converter
1011	1	1	0	0	1	0	0	1	Address 5th digit (1s of kHz)
1100	0	1	0	0	1	0	0	1	Send 5th digit (1s of kHz)
1101	1	1	1	1	0	0	0	1	Clear BCD-to-Morse converter
1110	1	1	1	0	1	0	0	1	Address 6th digit (100s of Hz)
1111	0	1	1	0	1	0	0	1	Send 6th digit (100s of Hz)

Fig. 2. Control ROM contents and program.

Digit	ROM Address	ROM Contents
0	0000	11111
1	0001	11110
2	0010	11100
3	0011	11000
4	0100	10000
5	0101	00000
6	0110	00001
7	0111	00011
8	1000	00111
9	1001	01111
blank	1111	11111

Fig. 3. Code conversion ROM contents.

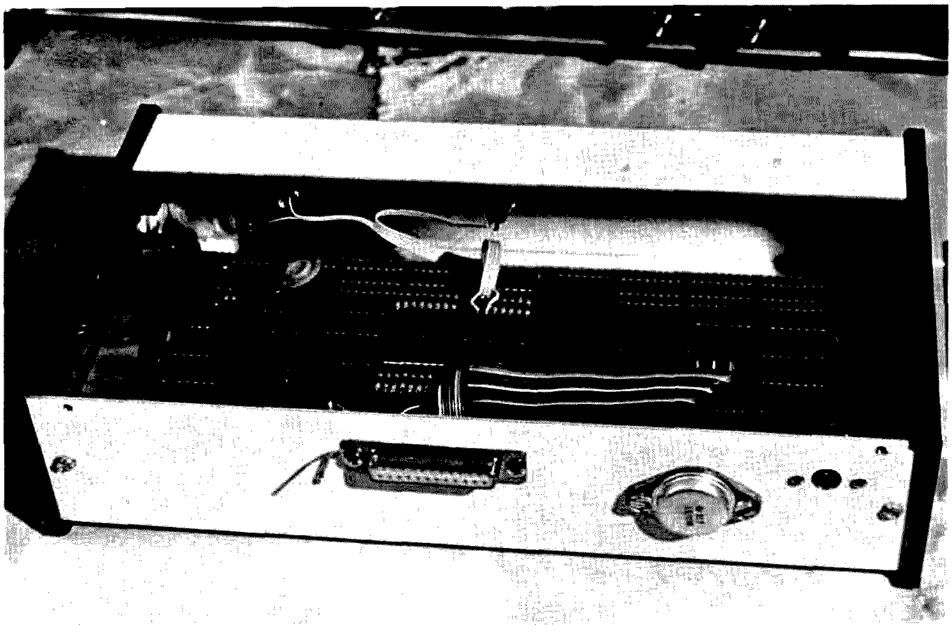

Photo D. Here is a "back" view of the DFD-MCC. The LM309K 5-V regulator is located on the right-hand side. The input socket is located in the center of the back apron. The unregulated dc input connector *is located on the right side of the LM309K.*

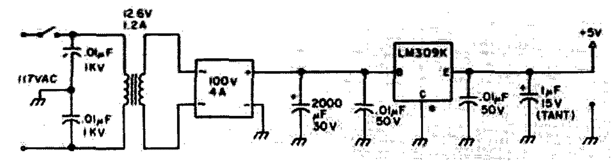

Fig. 4. 117-V ac input power supply for the DFD-MCC. (The main cabinet's back apron is used as the heatsink for the LM309K.)

machine controller ROM, U17).

During state 0111, "clearing the BCD-to-Morse converter," all chips which receive logic from U18 are disabled.

During states 1000 and 1001, the 4th digit (10s of kHz) is being addressed and sent. As with the 3rd digit, the necessary binary address, now 01, is provided to the 74153s. Again, the output 7403 (U14) and both of the 74153s are enabled.

During state 1010, "clearing the BCD-to-Morse converter," all chips which receive logic from U18 are again disabled.

During states 1011 and 1100, the 5th digit (1s of kHz) is being addressed and sent. The binary address, 10, is sent to the 74153s. U14 and both of the 74153s are enabled. U12 and U13 remain disabled.

During state 1101, all chips receiving logic from U18 are again disabled. During state 1110 and 1111, the 6th digit (100s of Hz) is being addressed and sent. The binary address, 11, is delivered to both 74153s. U14 and both of the 74153s are enabled. Chips U12 and U13 remain disabled.

Once the 6th digit is sent, the state-counter reverts to address 0000 where the logic outputs from the state-machine controller ROM tell all chips to "wait for the next instruction".

The control ROM (U17) program, which has just been narratively described, along with the exact contents of this ROM, is shown in Fig. 2.

TR-7-to-DFD-MCC Interface

At this point, it is time to mention what has happened to the binary-coded decimal (BCD) which was generated by the TR-7's 14508 chips. The BCD leaving the 14508s is in the form of "positive" logic. Since I had already planned on using positive logic BCD as the input to the BCD-to-Morse coverter ROM (U18), the use of a CD4049, and a 7403 bus system provided the necessary inversions to permit BCD to enter U18. The actual flow is as follows: BCD from the TR-7 enters the "interface" CD4049, CMOS-to-TTL buffer (inverting) chip. As it leaves the CD4049, it is in an inverted form ($\overline{BCD}$), and enters the 7475 quad latches. Leaving the 7475 latches, and entering the 7403 NAND gates, which comprise the WIRED-NOR bus system, the information remains in the $\overline{BCD}$ *form*. But, as it leaves the 7403 NAND gates and enters onto the bus system, it is once again inverted back to BCD. Therefore, we now have positive logic BCD entering U18 from the bus system.

BCD-to-Morse Converter ROM

The output of the WIRED-NOR bus system is connected to the ADDRESS lines of the BCD-to-Morse converter ROM (U18), a Harris PROM 1-8256-5 code-conversion ROM. This "field-programmable" ROM converts BCD to an intermediate code in which 0 represents a dit and 1, a dah. The contents of the code-coversion ROM are shown in Fig. 3. Note that the ROM will convert a "blanked" first digit into a Morse code zero. With this in mind, the blind user of the DFD-MCC can account for all six digits, whether or not the first is blanked (actually a zero, but it is suppressed to the sighted person) or is a valid digit (1 through 9).

I chose the Harris PROM 1-8256-5 due to its local availability. This chip can be replaced by any of the 32 × 8 type of PROMS: 8223, 82S23, 74188, 74S188, etc. Programming of the 8223 and 82S23 has been discussed in previous editions of *73 Magazine*, and will not be discussed in this article.

The State-Machine Controller Network

This network is composed of chips U15, a 74150 16-to-1 data selector, U16, a 74163 4-bit synchronous counter, and U17, a PROM 1-8256-5 32 × 8 ROM. U15 is the input multiplexer, acting like a single pole, 16-throw logic switch. U16 is the "state" counter whose binary outputs determine the current state. U17 is the "state-machine" ROM. Its address lines are connected to the state counter's output line.

Once again, there are various types of 32 × 8 (256-bit) PROMS available for use as the state-machine ROM (U17).

Other Information

The power supply. The power supply used for the DFD-MCC is shown in Fig. 4.

Changing CW speeds. The speed of the CW output is determined by the frequency of the square wave entering pin 1 of the 7473 (U25). The output speed in wpm is equal to 1.2 times this frequency. My

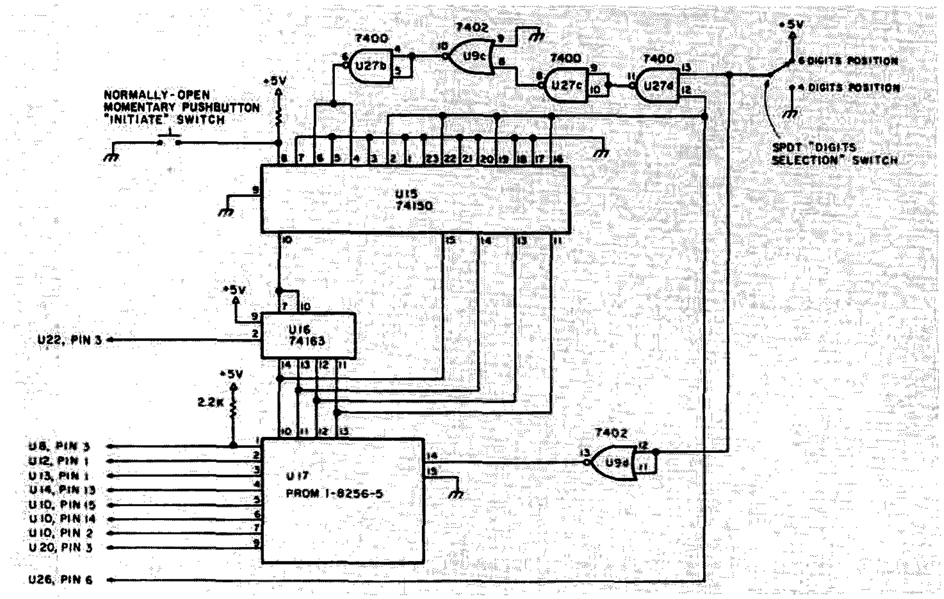

Fig. 5. Optional 4- or 6-digit selection.

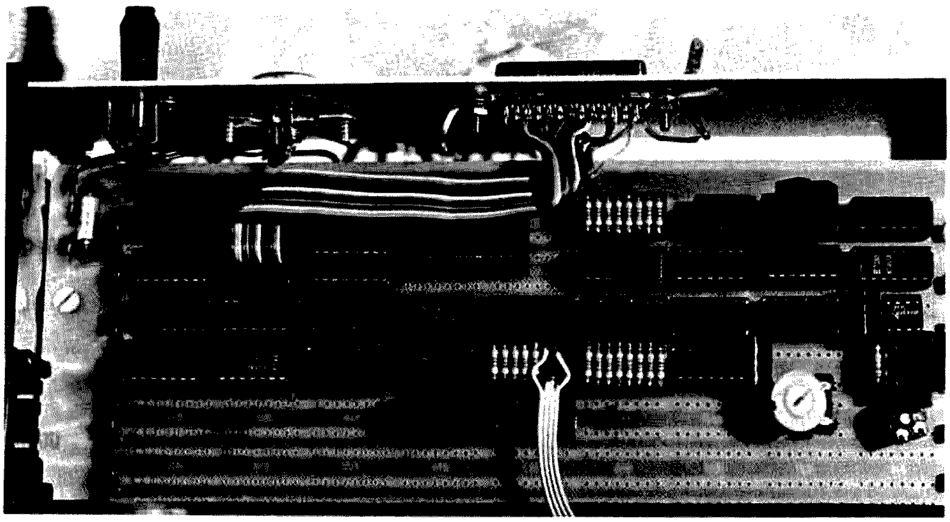

Photo E. This photo details the usage of DIP plugs for holding the discrete components. Note the "modular fashion" which simplifies the overall layout.

converter is currently set at about 22 wpm. The best way to alter the CW speed is to change the division ratio of U24.

The master clock. The master clock is a NE555P timer IC wired as an astable multivibrator with a free-running frequency of about 1500 Hz. This frequency is further divided by 7490 and 7493 counters (U23 and U24) to about 18.5 Hz, for use in the BCD-to-Morse converter.

Construction notes. I used the Ten-Tec cabinets due to their beauty and simplicity of design (Photo A). Since the current design is a "prototype," I used the wire-wrapping technique (Photo B). This gave me the complete versatility in construction that I wanted. I used a 14-conductor ribbon-wire cable to interconnect the TR-7 and the DFD-MCC (Photo C). The LM309K, 5-V regulator, was mounted on the back apron of the cabinet so that maximum heat dissipation would be obtained (Photo D). Most of the discrete components were placed on DIP plugs (component holders/carriers) because they make it easier to change parts (modular fashion) and also enhance the beauty and simplicity of the layout. (See Photo E).

Wanting to keep the amount of switches and other controlling devices down to a minimum, the only controls which are placed on the front panels are the on-off switch on the power supply, and the normally-open momentary pushbutton switch on the main cabinet. This simplicity in design minimizes the number of external controls which have to be dealt with by the blind user.

Connections to the DR-7 board were made by "hardwiring" the 11-conductor ribbon-wire cable (14-conductor cable with 3 wires not used) directly to the appropriate junctions (See Photo F).

Since we are dealing with 28 IC chips, twelve 0.01-uF, 50-V disc "despiking" capacitors were used. Also, a 10-uF, 20-V tantalum capacitor was used at the point where the +5-V line enters onto the PC board.

The 50-Ohm potentiometer, located inside the main cabinet, is used as a pitch control. The 1-Ohm potentiometer, also located inside the main cabinet, is used as the output volume control.

Though Fig. 1 shows only one 2.2k-Ohm "pull-up" resistor (pin 1 of U17 and U18), pull-up resistors (2.2-k-Ohm) should be used on all outputs of both U17 and U18.

The approximate "new" component cost for this digital converter is $90.00 (including the cabinets and wire-wrap type PC board).

"After Installation" Notes

During the installation phase of this project, several interfacing matters became apparent. The interconnecting cables between the DFD-MCC and the transceiver's digital-display PC board should be kept as

State	Read Enable	U10/11, 74153 (B)	U10/11, 74153 (A)	U10/11, Chip Enable	U14 Output Enable	U13 Output Enable	U12 Output Enable	Digit "lock-up"	Remarks
00000	1	0	0	1	0	0	0	0	Wait for next instruction
00001	1	0	0	1	0	0	1	1	Address 1st digit (10s of MHz)
00010	0	0	0	1	0	0	1	1	Send 1st digit (10s of MHz)
00011	1	0	0	1	0	1	0	1	Address 2nd digit (1s of MHz)
00100	0	0	0	1	0	1	0	1	Send 2nd digit (1s of MHz)
00101	1	0	0	0	1	0	0	1	Address 3rd digit (100s of kHz)
00110	0	0	0	0	1	0	0	1	Send 3rd digit (100s of kHz)
00111	1	0	1	1	0	0	0	1	Clear BCD-to-Morse converter
01000	1	0	1	0	1	0	0	1	Address 4th digit (10s of kHz)
01001	0	0	1	0	1	0	0	1	Send 4th digit (10s of kHz)
01010	1	1	0	1	0	0	0	1	Clear BCD-to-Morse converter
01011	1	1	0	0	1	0	0	1	Address 5th digit (1s of kHz)
01100	0	1	0	0	1	0	0	1	Send 5th digit (1s of kHz)
01101	1	1	1	1	0	0	0	1	Clear BCD-to-Morse converter
01110	1	1	1	0	1	0	0	1	Address 6th digit (100s of Hz)
01111	0	1	1	0	1	0	0	1	Send 6th digit (100s of Hz)
10000	1	0	0	1	0	0	0	0	Wait for next instruction
10001	1	0	0	1	0	0	0	1	Continue to next instruction
10010	1	0	0	1	0	0	0	1	Continue to next instruction
10011	1	0	0	1	0	0	0	1	Continue to next instruction
10100	1	0	0	1	0	0	0	1	Continue to next instruction
10101	1	0	0	0	1	0	0	1	Address 3rd digit (100s of kHz)
10110	0	0	0	0	1	0	0	1	Send 3rd digit (100s of kHz)
10111	1	0	1	1	0	0	0	1	Clear BCD-to-Morse converter
11000	1	0	1	0	1	0	0	1	Address 4th digit (10s of kHz)
11001	0	0	1	0	1	0	0	1	Send 4th digit (10s of kHz)
11010	1	1	0	1	0	0	0	1	Clear BCD-to-Morse converter
11011	1	1	0	0	1	0	0	1	Address 5th digit (1s of kHz)
11100	0	1	0	0	1	0	0	1	Send 5th digit (1s of kHz)
11101	1	1	1	1	0	0	0	1	Clear BCD-to-Morse converter
11110	1	1	1	0	1	0	0	1	Address 6th digit (100s of Hz)
11111	0	1	1	0	1	0	0	1	Send 6th digit (100s of Hz)

Fig. 6. Control ROM (U17) contents and program for the optional 4- to 6-digit selection.

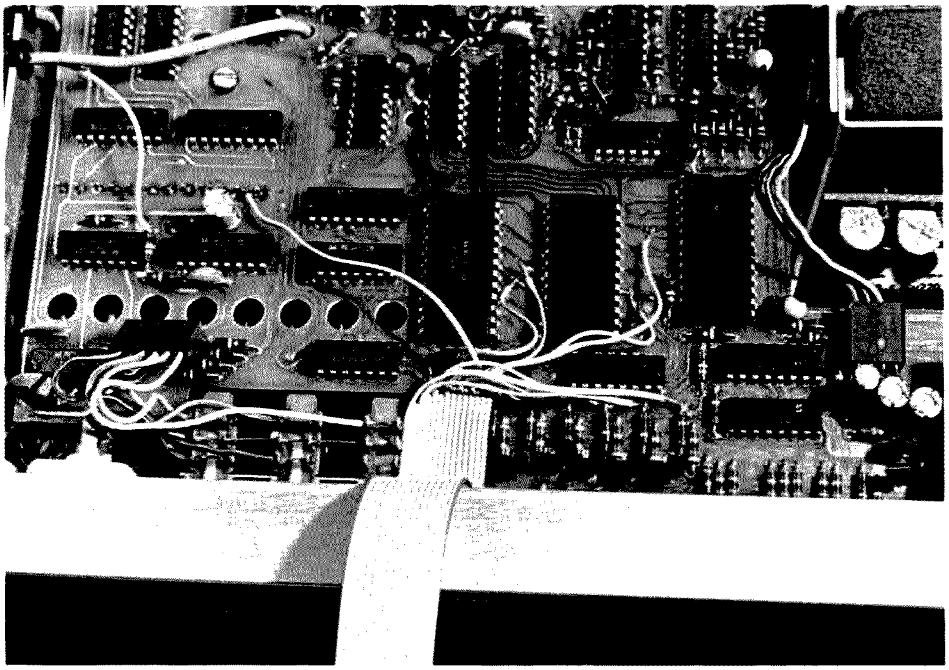

Photo F. Details of the hard-wiring technique used on the DR-7 board can be seen here.

short as possible and should be shielded.

When soldering around CMOS-type IC chips, always use a 3-wire grounded soldering iron/gun.

If the builder uses a connector between the DFD-MCC inputs and the transceiver outputs (display board), the DFD-MCC power supply must be turned off prior to disconnecting or connecting or the 7402 and CD4049 IC chips can be damaged.

One final glitch which we had to overcome was the sporadic transmission of an erroneous 3rd digit. It was noted that the erroneously-sent digit was always a duplicate of the 1st digit. After looking at the 74LS145 output lines, we saw that there was a very slight feedthrough spike on the 3rd digit's firing line. Instead of dealing with the spike on the transceiver's display PC board, I dropped 0.001-uF bypass disc capacitors onto the 7475 (3rd-digit) output lines. This solved the problem and maintained all discrete components inside the main DFD-MCC cabinet.

Option—4- or 6-Digit Selection

Though my converter was designed to provide the user with the contents of all six digits making up the digital frequency display, Fig. 5 shows the additional use of U9C, U9D, U27B, U27C, and U27D. With these NAND and NOR gates, we now have the option of giving the blind user only 4 digits or the full 6 digits. This option was made by using existing unused gates from U9 and U27. If the builder decides to include this option, the schematic in Fig. 1 should be altered as shown in Fig. 5. Also, U17 (PROM 1-8256-5) should be "blown" as shown in Fig 6. U17 in this optional version uses all 32 states of the PROM.

The 4-digit option provides the user with the contents of the 100s of kHz, 10s of kHz, 1s of kHz, and 100s of Hz.

Acknowledgements

My sincere thanks to WB3EVS for his technical assistance, to WB5FIX for the use of his TR-7 in the initial stages of the project, to K8AY for his assistance in obtaining the DR-7 schematic, and to WA6DLI for the superb photographs.

Future Projects

Plans are currently underway for a "universal" type of digital converter for the visually handicapped. This universal converter would hook up to any rig, with or without a digital frequency display.

On the extravagant, yet still very practical side, I have plans for making a "talking" frequency display.

I will be glad to correspond about the DFD-MCC or any other digital converter. An SASE would be appreciated. ■

References

1. Robert J. Souza WA1MXV, "The Morse Clock—timely repeater ID," *73 Magazine*, July, 1977, p. 54.
2. Don Lancaster, *TTL Cookbook*, 1974, Howard W. Sams & Co., Inc.

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Communications Division
Missouri State Highway Patrol
Troop G
Willow Springs MO 65793

On the Trail of the Hamburglar

—retrieving ripped-off radios

The recent newspaper article read, "The county auditor collected $3,641.65 from the sale of 563 items the Sheriff's Department had recovered as unidentified stolen property. The money will go into the county's general revenue fund. Guns, bicycles, and radio equipment were the most popular items during the six-hour-long auction."

Once your ham rig has been stolen, what are your chances of getting it back? Probably better than you think, and certainly better than the newspaper article suggests, provided you have helped your cause by doing a little preventive work of your own.

Much has been said on the subject of marking your possessions with identifying numbers to aid in their recovery should they be stolen. Here we will have a brief look into the systems used by law enforcement agencies across the country to detect and identify stolen property by using these identifying numbers. Police evidence rooms everywhere are crowded with recovered stolen property. Much of it will never be returned to the rightful owners simply because it cannot be identified.

Photo A. The author making an NCIC inquiry through the IBM video terminal at his dispatching console.

In early 1967, the FBI placed in service a system designed to help counteract the growing crime rate. Known as the National Crime Information Center, but more commonly by its initials, NCIC, it is an advanced computerized information storage system with instant retrieval capability. Through the use of very sophisticated equipment located in Washington, D.C., NCIC stores vast amounts of data pertaining to crimes and wanted criminals. Most of this is beyond the scope of this article. We are interested in the part of this system known as the "Stolen Property File."

To be effective, such a system must be universally and immediately accessible. Each and every police department in the country, no matter how small, must have the means of making computer entries and inquiries. The means by which this is accomplished is a nationwide computer

Photo B. The author checks a response to an inquiry.

system using high-speed data transmission to all parts of the country by way of high-quality telephone lines.

Each state operates its own in-state computer system with interfaces to NCIC and the National Law Enforcement Telecommunications System, NLETS, by which the routine message traffic of the police trade is handled and by which direct computer-to-computer inquiries are made. Headquartered in Phoenix, Arizona, where the control and switching computer is located, NLETS handles computerized communications among the fifty states.

While details of local computer systems vary widely from state to state, most have numerous terminals, each of which may rapidly transmit and receive from any other terminal in any state. Nearly every police department of substantial size operates at least one terminal, and larger departments handle computer traffic for smaller agencies which cannot justify the cost of maintaining a terminal because of their low volume of traffic. Usually terminals are located at dispatch consoles, making it possible for officers in the field to obtain data very quickly from almost anywhere in the nation. Using his computer terminal, a dispatcher can obtain fully-automated information on drivers' licenses and automobile registrations both from his own state's motor vehicle bureau and from that of any other state. He also has full access to the FBI's NCIC files. Response times to these inquiries normally are very short. Where video display terminals are used, the reply to an officer's inquiry can normally be read right back to him with only a short pause. Within the state of Missouri, there are presently about two hundred terminals active on this system, known there as MULES, the Missouri Uniform Law Enforcement System. (See Fig. 1.) Any reference to Missouri's widely-known reputation for raising prime quality, real live mules is surely coincidental.

When the NCIC program was first begun, such in-state computer facilities did not exist. They were developed to replace the radiotelegraph and wire teletype nets formerly used for police communications and also are used extensively for various statistical functions and record-keeping within the individual states.

How can we use this vast computer network to aid in the recovery of stolen property? Four things are necessary for the system to function properly:

1. The article stolen must have been marked with at least one clearly identifiable, unique number in such a way that it cannot easily be removed.

2. The theft must be reported to the police agency with jurisdiction along with all descriptive data, including identifying numbers.

3. The police agency must initiate an entry into the NCIC Stolen Property File.

4. The stolen article must then, at some later time, become the object of a computer inquiry into the Stolen Property File. That is to say, it must become the object of some police officer's attention so that he will request that such a check be made.

Further examination of these criteria is necessary. Most equipment is marked at the factory with a serial number. The problem lies in the way the serial number is attached to the equipment. Usually the number is stamped on a small tag

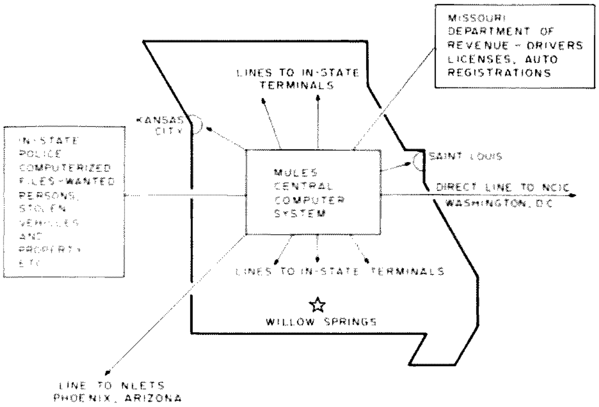

Fig. 1. MULES—The Missouri Uniform Law Enforcement System. Details vary from state to state, but police agencies nationwide have the same capability to utilize the NLETS message system and the NCIC files.

made of foil or light aluminum, and sometimes even paper, which is attached to the equipment in a variety of mediocre ways. The glue, screws, or pop rivets used require little imagination from a thief bent on removing the serial number. Once removed, there is almost no way to match the gear with the missing serial number. We are left with the necessity of adding to the equipment valid identifying numbers which are difficult to remove and which are easily traced back to the owner.

Remember, the same nationwide computer system that allows access to NCIC files also allows an immediate check of drivers' licenses by number from any state through NLETS. When a driver's license number is applied to the equipment, along with the two-letter state identifier (MO for Missouri), complete name and address information of the owner is immediately available to the inquiring policeman. It must be emphasized that the state identifier is absolutely required since it is nearly impossible to check all fifty states to see which one issued a driver's license bearing that number. These two-letter codes are the same as those used by the US Postal Service and are standard nationwide.

The best procedure is to engrave the unit's serial number, your driver's license number with state ID code, and your social security number on each piece of gear. Some uniform system should be used; for example:

SER. 698571
SOC. 487-46-5177
MO DL C016575694711288

There is another advantage to having your driver's license and social security numbers on each piece of gear. Any time an inquiry is made on either of those numbers, the response will include all items bearing that number which are reported stolen, while the serial number would draw a response showing only the one piece of gear bearing that number. If the theft included several items of equipment from your ham station and the culprit was caught with only a single item, the NCIC computer would immediately notify the officer that not only was the piece of gear in question stolen, but also that there were other pieces of gear taken. This can be of considerable importance since a thief wouldn't be likely to confess voluntarily that he has the remainder of your ham station stashed away at his home.

Numbers other than the unit's original serial number are known to NCIC as "Owner Applied Numbers" and are entered into the computer in such a way that they can be queried independently of the serial number. An inquiry on either number will produce an identical response.

Obviously, the theft must be reported to the police and an investigation must be made before the numbers you have engraved can be listed with NCIC. Only a bona fide police agency, with prior authorization from the FBI, can generate these computer transactions. If you don't have the information available, of course NCIC cannot be of service. This fact points to another benefit of using your driver's license and social security numbers. Even if you don't remember the serial number, or lose it, the item still can be listed with NCIC since your driver's license and social security numbers will nearly always be available.

The numbers should be applied to the gear using the most durable method available and should be placed in a conspicuous place on the gear. It is good to place the numbers both inside and outside the equipment cabinet. The sight of an area on the gear where a number obviously has been removed will always arouse suspicion and lead an officer to check further. If the number appears again inside the cabinet, it almost certainly will be found and checked.

The means are available to reduce losses due to theft considerably. It should be equally clear that this system cannot function effectively without the cooperation and assistance of each of us. This system is used extensively for all types of articles, and all the information contained in this article pertains to all of your personal property as well as your radio gear. Enormous amounts of money and effort have been expended to devise and perfect this system. Only those in the computer field can fully appreciate the effort and many years of time which were required to standardize the many states on a common computer data base.

For those who wonder just how active the NCIC system is, the FBI offers the following information. As of May 1, 1978, there were over six and one-half million active records on file in the following categories: 139,821 persons wanted for felony crimes, 901,235 stolen and felony-related vehicles, 1,238,807 stolen guns, 14,572 stolen boats, 331,379 lost or stolen license plates, and 906,266 other articles of stolen property, including ham radio gear. No individual wants to see his equipment become one of these statistics, but should it happen to you, be ready to assist by having made the right preparations. ■

Contests

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TENNESSEE QSO PARTY
Operating Periods:
2100 GMT Saturday, March 22 to 0500 GMT Sunday, March 23 and 1400 to 2200 GMT Sunday, March 23

Sponsored by the Tennessee Council of ARCs. Repeater contacts are not allowed. Mobiles compete against mobiles, portables against portables. Single transmitter entries only. No county line operation for multiple contacts. Portable stations must set up per field day rules. No list operation permitted.

EXCHANGE:

Tennessee stations give RS(T) and county. Others give RS(T) and state, province, district, or country. The same station may be worked on different bands, modes, or counties.

SCORING:

Phone contacts count one point per contact; CW contacts count 2 points on 80 or 1½ on all other bands. Out-of-state stations take QSO points times the number of different counties worked for the final score. Tennessee stations take QSO points times sum of following: different states plus different Tennessee counties plus different VE/VO districts. Bonus points of 200 for each county outside of home county with minimum of 10 QSOs in each. Power bonus of 1.5 multiplier for all stations operating at 200 Watts dc or less.

FREQUENCIES:

Phone—3980, 7280, 14280, 21380, 28580.

CW—50 kHz from bottom; Novices within their bands.

AWARDS:

Plaque to Tennessee top scorer, Tennessee mobile and portable, and out-of-state high score. Certificates with results to every station sending in logs with at least 15 contacts.

ENTRIES:

Logs must show date/time in GMT, station worked, band, mode, exchange, and score. Use separate log sheets for each band with over 50 contacts. Must submit cross check sheet similar to ARRL check sheet CD77 if worked over 200 QSOs. Logs must be legible to avoid disqualification. Mailing deadline is May 1st. Include a business-size addressed envelope with your log and send to: Dave Goggio, 1419 Favell, Memphis TN 38116.

1980 INTERNATIONAL SSTV CONTEST

Saturday, March 8, 1500 to 2300 GMT
Sunday, March 9, 1500 to 2300 GMT

SPONSOR *73 Magazine*, Peterborough NH 03458 USA

OBJECT To exchange SSTV pictures with as many stations in as many parts of the world as possible during the contest periods.

FREQUENCIES All amateur frequencies between 3.5 and 29.7 MHz where SSTV is permitted.

EXCHANGE Exchange of pictures must include callsign, RST report, and consecutive contact number starting with 001. FCC rules require a verbal exchange of callsigns for US stations. Do not include the contact number in the verbal exchange.

CREDITS One (1) point for each station worked. A station may be worked once on each band for credit. One (1) point for each US state or Canadian province worked. Five (5) points for each country worked. Five (5) points for each continent worked. Each state, province, country, and continent may be counted only once for credit. Total score is the sum of all credits.

ENTRIES Activity sheets should show station worked, state or province, country, continent, and band (80, 40, 20, 15, 10). Summary sheets should show number of stations worked, number of states and provinces worked, number of countries worked, number of continents worked, and total score. Entries become the property of the contest committee. Excessive discrepancies in a contest entry may cause disqualification. Contest entries must be postmarked no later than April 30, 1980. The decisions of the contest committee are final.

AWARDS The top scorer will receive a certificate and a one year subscription to *73 Magazine*. Certificates will also be awarded to the station working the most countries and to the station working the most continents.

Send all entries to:
R. Brooks Kendall W1JKF
10 Stocker St
Saugus MA 01906

or David Ingram K4TWJ
Eastwood Village, #1201 South
Rte. 11, Box 499
Birmingham AL 35210

BARTG SPRING RTTY CONTEST
Starts: 0200 GMT Saturday, March 22
Ends: 0200 GMT Monday, March 24

The total contest period is 48 hours, but not more than 30 hours of operation is permitted. Time spent listening counts as operating time. The 18 hour non-operating period can be taken at any time during the contest, but off periods may not be less than 3 hours at a time. Times on the air must be summarized on the summary sheet. There will be separate categories for single operators, multi-operator stations, and SWLs. Use all amateur bands from 80 to 10 meters on RTTY only. Stations may not be contacted more than once on any one band, but additional contacts may be made with the same station if a different band is used. The ARRL Countries List will be used and, in addition, each W/K, VE/VO, and VK call area will be counted as a separate country. Note, however, that W/K, VE/VO, and VK count only once for OCA purposes.

EXCHANGE:

Messages exchanged will consist of: time (in GMT), consisting of a full four-figure group (the use of the expression "same" or "same as yours" will not be acceptable), RST, and message number. The number must consist of a three-figure group starting with 001 for the first contact made.

SCORING:

All 2-way RTTY contacts with stations within own country count 2 points, outside own country count 10 points. All stations will receive a bonus of 200 points for each country worked including their own. Note that any one country may be counted again if worked on a different band, but continents are counted once only. Note: Proof of contact will be required in cases where the station worked does not appear in any other contest log received or the station worked does not send in a check log. The final score is the sum of: QSO points times the total of countries worked plus the total country points times 200 times the number of continents worked. For example: 302 exchange points x 10 countries = 3020, 10 countries x 200 x 3 continents = 6000; final score = 9020.

ENTRIES AND AWARDS:

Use a separate sheet for each band and indicate all times on the air in the logs. Logs must contain: date/time in GMT, callsign of station worked, RST and message number sent/received, time received, and points

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Looking West

from page 8

have their spirits lifted. I know that when I go through some of the cards here, my spirits are lifted and I sometimes have a tear in my eye reading the cards. It's so heartwarming to see the expression of support from the people for the hostages, and hopefully we can resolve this crisis very, very soon. Thank you once again, ham radio operators."

THE BIG NEW YEAR'S DAY INTERLINK DEPT.

We opened this month's column with a story about the WB6BJM/R repeater and its public service work. Our closing story also involves some open operation of this normally private repeater, and what also appears to be becoming an annual event of this group. I speak of the New Year's Day interlink between WB6BJM/R and any other system that has interest in the project. This year, it was a four-way with the K4VYN repeater in Tysons Corner VA and two Ohio machines: WR8ADP in Dayton and WR8ACB in Cincinnati.

I could not hang around for the entire event, but what I did hear and see was well worth my time. Again, Joe had opened his private repeater to any and all who happened by the channel during the five hours of on and off festivities. Within a short time, hundreds of operators in all cities involved in the hookup had a chance to converse with one another. To say the operation ran as smooth as silk would be an understatement. It was simply beautiful and definitely a tribute to all involved.

Joe has told me that he is interested in expanding the linking concept. If you happen to have an autopatch-equipped repeater handy and would like to get involved in this project in the future, you might drop a letter to Joe Olivera WB6BJM, Pipo Communications, PO Box 3435, Hollywood CA 90028. Whether you take an active part in it or just listen, it's one heck of a way to start a new year . . . or celebrate any holiday for that matter.

Contests

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claimed. Note: Logs from SWLs must contain both the full report sent and received by the station logged. Incomplete loggings are not eligible for scoring. The summary sheet should show the full scoring, the times on the air, and, in the case of multi-operator stations, the names and callsigns of all operators involved with the operation of the station. Summary sheets and logs are available from the Contest Manager; please include 2 IRCs to cover postage (or large SASE in United Kingdom). All logs must be received by May 31st in order to qualify. Send your contest or check logs to: Ted Double G8CDW, 89 Linden Gardens, Enfield, Middlesex, England EN1 4DX. The judges' decision will be final and no correspondence can be entered into in respect to incorrect or late entries; all logs will remain the property of the BARTG. Certificates will be awarded to the leading stations in each of the three classes, the top station in each continent, and each W/K, VE/VO, and VK call area.

If a contestant manages to contact 25 or more different countries on 2-way RTTY during the contest, a claim may be made for the Quarter Century Award (QCA) issued by BARTG and for which a charge of $3.00 US or 15 IRCs is made. Make your claim at the same time as you send in your log. Holders of existing QCA awards will automatically have any new countries added to their records. However, in view of the high volume of work which the Contest Manager will have to deal with, it will not be possible to prepare and send out new awards or update existing awards until the final results of the contest have been evaluated and dispatched.

Similarly, if any contestant manages to contact stations on 2-way RTTY within each of the 6 continents and the BARTG Contest Manager has received a contest or check log from each of the 6 operators concerned, a claim may be made for the WAC award issued by the *RTTY Journal*. The necessary information will be sent on to the *Journal*, who will issue the WAC award free of charge.

WISCONSIN QSO PARTY
Starts: 2100 GMT March 29
Ends: 0300 GMT March 31

The maximum operating time is 24 hours; any station may be worked only once (on any band). General call is "CO WIS." Repeater QSOs are not allowed.

EXCHANGE:

RS(T) and Wisconsin county or state.

FREQUENCIES:

Phone—3990, 7290, 14290, 21390, 28590.

CW—60 kHz up from band edge; 20 kHz up from bottom of Novice bands.

SCORING:

Phone contacts count one point each; CW contacts count two points each. Multiply QSO points times total Wisconsin counties (maximum 72) or by state and county total for Wisconsin stations.

AWARDS & ENTRIES:

Awards to the highest score per state and the highest club score. Logs must show date, band, mode, time (GMT), call, report, and score. Logs must be legible or will be classified as check logs. Logs containing more than 100 contacts must also be submitted with ARRL or similar "dupe" sheet. All entries must be postmarked before May 1st. Send results to: Wisconsin QSO Party, c/o West Allis RAC, PO Box 1072, Milwaukee WI 53201.

YL INTERNATIONAL SSBERS QSO PARTY
CW
Starts: 0001 GMT March 29
Ends: 2359 GMT March 30
Phone
Starts: 0001 GMT April 19
Ends: 2359 GMT April 20

Two 6-hour rest periods are required during each contest period (CW/phone). All bands will be used and the same station may be contacted on different bands for contact points, but not for country multipliers. The country multiplier is used only one time. Two meters may be used, but no repeater contacts are allowed.

Any member desiring to enter the DX/WK team category should immediately send a request to: Lyle F. Shaw, 52340 Tallyho Drive, South Bend IN 46635. For record purposes, requests should be made in writing. In the week preceding the QSO Party, members wishing a partner may request one through system controls on the SSBers daily systems. No team assignments will be made after the party begins. A DX/WK team consists of a DX and WK member of ISSB. The team score is the sum of both partners. Score to be determined when both logs are received. When only one log is received, credit will be given as single operator.

YL/OM teams are self-evident in their operation and need not file as with DX/WK teams. Each YL/OM team consists of one YL member and one OM member who are related: husband/wife, father/daughter, mother/son, or brother/sister. Operation must be from same QTH, using same rig with his/her own call. Nonmembers must operate in single-operator category.

EXCHANGE:

Name, RS(T), SSBers number, country, state, partner's call (if available); if non-member, send "no number," QTH.

FREQUENCIES:

CW—3665, 7070, 14070, 21070, 28070.

Phone—3925, 7290, 14333, 21373, 28673.

Please note: Listen for DX on 3765 and 7090. Listen for VK on 3690 on 75-meter phone, as their top frequency is 3700. It is requested that stations spread out to relieve the congestion on 14333. Please use frequencies from 14280 to 14345, remembering the nets on 14313 and 14336. Also, DX stations use frequencies 14160 to 14190 for contacts between DX.

SCORING:

On CW: Score 6 points for each member contacted on any continent. All CW contacts must be made outside the American phone band. Non-member contacts count one for each contact.

On phone: Score 3 points for each member contacted on any

Continued on page 136

RTTY Loop

from page 18

Let's bop out of converter building long enough to consider a question sent in by Bob Bunn WAØLKE. Bob writes that he is setting up his RTTY station, but that a German amateur told him that this equipment operates on 170-Hz shift, using tones of 1275 Hz and 1445 Hz. He wants to know how to buy, build, or modify a terminal unit to work the DA on these frequencies.

Well, Bob, it all boils down to what you will be receiving. As we have stated here before, put AFSK into an SSB rig and FSK comes out. That is, it does not matter what frequency tones the DX station feeds into his transmitter; all you will see is plain old 170-Hz shift FSK RTTY. What frequency audio tones you recover depends only on your receiver. Any converter that works on anyone else would work on him. Okay?

Those of you in the mid-Atlantic area, be sure to come to Baltimore on March 30, 1980, for the Greater Baltimore Hamboree and Computerfest. Sponsored by the Baltimore Amateur Radio Club and Calvert Hall, it promises to be a whale of an event, with good ol' NSD, himself, speaking. I will be there, too, so hope to see you there. Check the "Social Events" section of *73* for details.

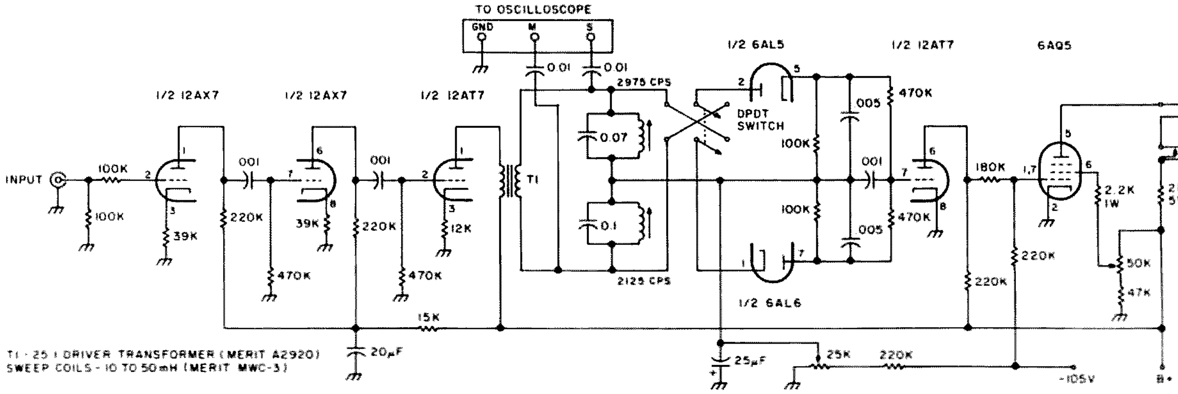

Fig. 3.

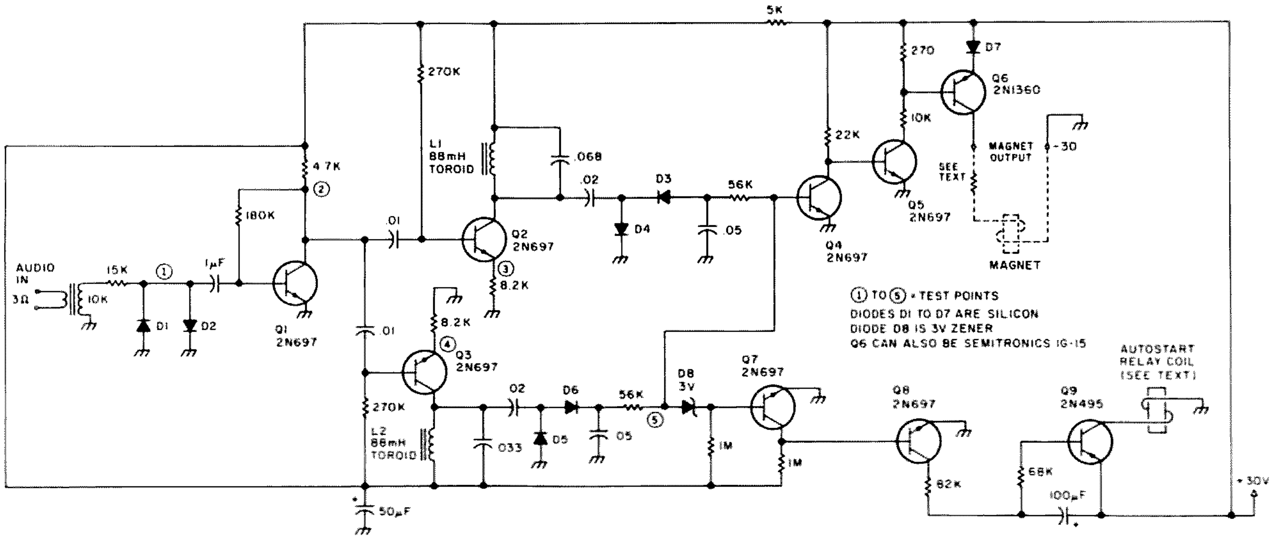

Fig. 4.

Contests

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continent. Non-member contacts count 1 point each.

For both contests: Only member stations' contacts count as multipliers. Count one multiplier for each state, country, YL/OM team, DX/WK team, partners (when DX/WK partners contact each other).

AWARDS:

Extraordinary certificates will be issued to the highest individual score, DX/WK teams, YL/OM teams, and score for highest score for single-operator category. Regular certificates for highest state and country winners.

ENTRIES:

Logs must show date/time in GMT, RS(T), SSBer number, partner's call, mode of operation, band, and period of rest time. Summary sheets must be compiled and enclosed. All logs must be postmarked by May 15th. Send all compiled logs, along with your comments, to Lyle F. Shaw, 52340 Tallyho Drive, South Bend IN 46635.

1980 INTERNATIONAL SSTV CONTEST

See page 126

DX

from page 10

on 40 meters.

ZA3KL worked many stations on CW in December but is not legitimate. The beam heading from the east coast of the US was sometimes more in the direction of the South Pacific than toward Europe.

January 2 produced a severe earthquake in the Azores Islands, measuring 7.8 on the Richter scale. CT2AP appeared on 10 meters, operating from Angra at the Headquarters of the Security Police. The FCC was contacted regarding possible third party traffic with CT2, normally verboten, and the FCC Treaty Branch cabled the Portuguese government; nothing was forthcoming.

The ARRL's DX Advisory Committee voted on three items late in 1979. Voted down were "name changes" for the (formerly) VR1 islands, country status for Tierra del Fuego off the coast of Argentina, and implementation of a Board of Directors proposal for a new award based on IARU (International Amateur Radio Union) member societies/countries.

From March to September, 1979, OK3TAB/D2A made 18,000 contacts while VK0PK worked 3,300 during his stay on Macquarie, which ended in December. KG6SW changed his call to KH0AC on New Year's Day; Len has confirmed 30,000 contacts from the Marianas, through manager W7OM, since 1971. New manager for KH0AC is Jon Zabel K7ZA, 20711-231st Avenue SE, Maple Valley WA 98038.

Listen to the W6TI DX bulletin on 14002 at 0200 UTC Mondays. And, speaking of on-the-air bulletins . . .

"ARRL bulletin NR 2 from ARRL Headquarters, Newington CT January 3, 1980 to all radio amateurs. Because of lack of sponsorship for providing DX information, the weekly ARRL DX bulletin service has been temporarily discontinued. Clubs or individuals that (sic) may wish to provide information on a regular basis should leave a message with ARRL DX Editor . . ."

By the time you read this, the League's DX bulletin may be back in service, but as this is written, it is kaput. They are apparently very particular from where and from whom they get their DX hot news, since there is certainly no lack of active DXers in Connecticut.

If you still need that "country" at the United Nations Headquarters on Manhattan Island, look for 4U1UN Thursday night/Friday morning 2200-0600 on 160, 80, 40, and 20. Primary operator seems to be N2KW.

K7JVR, AA7A, and N7CW made 7100 contacts between November 28 and December 3 from Antigua (VP2A). Their highlight was working PA0HIP on 160 for his 100th country on Top Band.

SV0AA's operation as /9 from Crete went off as planned in late November, but he didn't get on from Rhodes (Dodecanese). The IC-701 blew up and a borrowed Century 21 was pressed into service. It was not available for the Dodecanese.

A word to the wise: The FCC is cracking down on out-of-band operations by all license classes, particularly Generals in the Advanced portions of the HF bands. Many non-US amateurs do not know how the phone bands are divided among US license classes, and, consequently, they fail to listen above 14275 or 21350 when working split.

FR7ZL, who lives on Reunion, may be operating from either Glorioso or Tromelin by the time you read this. There has been trouble getting QSLs to Guy and trouble getting replies out. Try registered mail and have patience.

I0DUD spent *much time* at the Vatican during the winter signing HV3SJ on 15 SSB. W0BW was there in November and tried, without success, to stir up some CW activity among other potential operators.

C5ACG operates from the American Embassy using a TR7. He will be in The Gambia for several years.

All the information for this column was from *The DX Bulletin* out of Vernon CT. Please send input for this column c/o *73*. We especially would like photographs, and your guest editorials will be considered for this column, also. Good DXing!

DX MYTHS DISPELLED

Author Anonymous

1. DX stations are chased off the air by interference on their frequency.

It may bother you, but the DX station working split isn't listening to his frequency. Almost always he has skipped to somewhere where the interference isn't being heard.

2. I can't compete with these guys with eight elements at 150 feet.

No one antenna system is the best for all conditions. A local with four elements at 75 feet on a hill used to get beaten out consistently to the Caribbean by lesser stations. Two local guys who are on top of the DX heap run three elements at 45-60 feet. After a kW and a properly tuned antenna, knowledge, skill, and dedication are most important.

3. The bottom of the sunspot cycle is no time for DXing.

Humbug! I got my DXCC at the bottom. Sure, signals were weaker and you had to watch openings more closely, but the receiver wasn't S9 from one end to the other of every band either. 40 and 80 bore lots of excitement.

4. Lists ought to be outlawed.

Not all DX stations are equipped with powerful transmitters or selective enough receivers to do the job. The operator may not be a contest-type who can or wishes to tackle a pileup. He's in the driver's seat and we do it his way. As for "Masters of Ceremonies," they are usually the fellows who have made friends with the DX operator and they are responsible for him being on the air at ail. I can tell you from experience that any power or glory an MC might feel lasts no longer than one session. The headaches start early.

5. The best way to QSL is direct, with no mention of radio on the envelope.

If mail is being stolen, they'll probably steal first class mail first. They may be after stamps. Use common stamps, send the way the DX station suggests, and follow with a card through the Bureau.

6. The exchange of signal reports constitutes a valid contact.

Not necessarily so. If you put the DX callsign in your log and vice-versa, there must have been a contact. However, if there is an "MC" running the show, he probably has already passed your call to the DX station and the only way he can quickly confirm a valid contact is to hear you repeat your report. That's usually the only new info that's been passed directly between you and the DX station.

7. Valid DXCC phone or CW contacts must be two-way phone or two-way CW.

Not so. The award says *your* mode was CW or phone when you had contact with 100, etc., DXCC countries. It may excite many people with time delay changing to CW or the DX station may be so rusty on CW he can't recognize his own call, but those are different problems. The mode type DXCCs really credit the operator's expertise in a field, not so much in pure DXing.

8. The poor W9s (or 1s, 2s, 3s, 4s, 5s, 6s, 7s, 8s, 0s, VEs).

Stop complaining about this curtain, that disadvantage, or whatever. In the end, it's all equal.

9. Those who work for a living have a disadvantage.

Those who want to work something badly enough find a way. The best way is to have a ham for a boss.

10. DXers are obnoxious loudmouths and/or stuffed shirts.

No more so than anyone else, but they do tend to put a little extra in their stations, be on the air more, subscribe to bulletins, and in general be more informed. In our area, DXers are often club officers, involved in emergency work, mobile, VHF, and RTTY.

11. DXers are nuts.

Maybe, but they do respond, like almost everyone, to competition, whether against someone else or themselves. Seems like fishing is the best parallel hobby. Every time you throw in a line, you don't know what trophy you will come up with.

Awards

from page 12

Class 1—DX stations must work 2,000 European stations, of which 100 must be made on the 40- and/or 80-meter band. The requirement is the same for Europeans.

No QSL cards are required. General certification rules apply. Should all your contacts be on CW, DIG will provide a special "CW AWARD" sticker for this accomplishment. Fee for the WDXS Award is US $5.00 or 10 IRCs.

EUROPEAN PREFIXES AWARD

The EU-PX-A is issued by DIG for contacts of 100 different European prefixes on or after January 1, 1969. There are no band or mode restrictions. Endorsement stickers are awarded for 150, 200, 250, and 300 prefixes claimed.

Should all your contacts be on CW, the sponsor has made a special "CW AWARD" sticker available to recognize this accomplishment.

GCR apply and award fee is US $5.00 or 10 IRCs.

THE ONE MILLION AWARD

The 1,000,000 Award is Issued by DIG to those amateurs who can accumulate one million points by adding together the postal codes of each German station contacted. The same postal code may be claimed only once.

In making application for this award, your list of contacts would look something like that shown in Fig. 2.

As you will note, the list of contacts are made in order of the postal code number on the right hand column. Some postal codes may appear on your QSL or in the *Callbook* as a one-, two-, or three-digit number. In these instances, add zeros to make it a four-digit code (e.g., a postal code may appear as 41; add zeros to make it 4100).

Call	Date	Band	QTH	Postal Code
DL7IG	18/8/69	80	Berlin	1000
DL6TZ	12/11/68	20	Hamburg	2000
DL9KP	11/10/69	40	Duisburg	4100
DJ8OT	27/11/69	80	Velbert	5620
DL2JB	13/1/68	40	Laudenbach	6941
DL9XN	15/6/67	15	Boblingen	7030
				total at least 1,000,000

Fig. 2. Sample list of contacts for figuring score for the 1,000,000 Award.

GCR apply and the award fee is the same as with other DIG awards—$5.00 or 10 IRCs.

WORKED DIG MEMBERS AWARD

The W-DIG-M Award is issued to those amateurs who submit proof of working DIG members on any band or mode with no restrictions as to date.

Three classes of this award are issued:

Class 3—DX stations work 15 DIG members; European stations work 50 DIG members.

Class 2—DX stations work 30 DIG members; European stations work 75 DIG members.

Class 1—DX stations work 50 DIG members; European stations work 100 DIG members.

A "CW ONLY" sticker is available for making all contacts on CW. GCR apply and the award fee is $5.00 US or 10 IRCs.

INTERNATIONAL AIRPORT AWARD

The IAPA will be issued for contacts with amateur radio stations in 50 different cities with an international airport. All 6 continents must be worked and the applicant may claim only one contact from his or her own country; the remaining 49 contacts must be made outside your country. All contacts must be made after January 1, 1973, and there are no band or mode restrictions.

Fee for this diploma is US $5.00 or 10 IRCs.

TWO MODES AWARD

This award requires the applicant to work 50 different countries on CW, including Germany and all six continents, and again the *same* 50 countries on phone. All contacts must be made on or after January 1, 1962, to qualify.

GCR apply and award fee is US $5.00 or 10 IRCs.

WORKED GERMAN LARGE CITIES

The WGLC Award is available in three classes. There are no restrictions as to modes. There are no band endorsements. All contacts must be made by using more than one band. Each city may be claimed only once regardless of band. All contacts must be made on or after January 1, 1962.

Class 3—DX stations work 10; Europeans must work 20 cities.

Class 2—DX stations work 20; Europeans must work 40 cities.

Class 1—DX stations work 30; Europeans must work 60 cities.

Should all your contacts be made on CW, DIG has prepared a special "CW ONLY" sticker made available upon your initial application.

German Large Cities are: Aachen, Augsburg, Berlin, Bielefeld, Bochum, Bonn, Bottrop, Braunschweig, Bremen, Bremerhaven, Darmstadt, Dortmund, Dusseldorf, Duisburg, Essen, Frankfurt/Main, Freiburg, Gelsenkirchen, Gottingen, Hagen, Hamburg, Hanover, Heidelberg, Heilbronn, Herne, Karlsruhe, Kassel, Kiel, Koblenz, Koln, Krefeld, Leverkusen, Ludwigshafen, Lubeck, Mainz, Mannheim, Monchengladbach, Mulheim/Ruhr, Munchen, Munster, Neuss, Nurnberg, Oberhausen, Offenbach/Main, Oldenburg, Osnabruck, Recklinghausen, Regensburg, Remscheid, Rhedyt, Saarbrucken, Salzgitter, Solingen, Stuttgart, Trier, Ulm, Wanne-Eickel, Wiesbaden, Wilhelmshaven, Witten, Wurzburg, Wuppertal.

And, at press time, I learned the following cities have been added to the list of Large German Cities: Erlangen, Furth, Kaiserslautern, and Wolfsburg.

GCR apply and award fee is the usual US $5.00 or 10 IRCs.

As you can see, both DARC and DIG have very extensive award programs made available for you and me. Should you wish to inquire or for that matter submit application for one or more of the awards shown in this column thus far, may I suggest you write our good friend DJ8OT

directly: Eberhard Warnecke DJ8OT, Postfach 101244, 5620 Velbert 1, Federal Republic of Germany.

There remain two additional awards being sponsored by DIG; however, I wish to caution you not to apply for them through DJ8OT. The following awards have separate award custodians.

ACTION 40 AWARD

This diploma can only be applied for by licensed amateurs having proven contacts with at least 100 different amateur stations within one calendar month after November 1, 1977, on the 40-meter amateur band only.

All modes are accepted. Contest QSOs and crossband QSOs do not count. Split-frequency QSOs do count, however.

Your application must show the callsign worked, the name and QTH of the operator, mode, and date and time GMT. GCR apply and award fee is US $5.00 or 10 IRCs. Mail your application and fee to: Klaus Kleine DJ1XP, Fasanenweg 22, D-4714 Selm-Bork, Federal Republic of Germany.

DIG DIPLOMA 77

This diploma requires applicant to work at least 77 DIG members from at least 7 different countries, but only 7 X 7 (49) DIG members out of one's own country after January 1, 1977. The award is made for phone only and mixed modes or bands are accepted. Fee is US $5.00 or 10 IRCs. For further explanation of this award or for submitting application, write to: Henry Bielinskl DC6JG, Werfstr, 245, D-2300 Kiel 14, Federal Republic of Germany.

ULSTER COUNTY AWARD

Today I received a very complimentary letter about our Awards column from Harold Twiss WA2RXF, who represents the Overlook Mountain ARC in Lake Katrine, New York. In his letter, Harold enclosed details of a very nice award being offered through his club.

This award requires applicants to contact other amateurs residing in the New York county of Ulster.

To qualify, DX stations must contact two amateurs in Ulster County, while amateurs in the continental US must make three contacts. There are no band or mode limitations, and there are no date restrictions either.

To apply, submit a list of contacts giving usual logbook data and enclosing the award fee of 50 cents or 4 IRCs to: Harold Twiss WA2RXF, Country Lane, Lake Katrine NY 12449.

WORKED A SHEBOYGAN AWARD

With activity on 10 meters at an all time high, now is your opportunity to earn the very attractive W.A.S. (Worked A Sheboygan) Award.

All that is required is that a contact be made with any station in Sheboygan County, Wisconsin, on the 10-meter band.

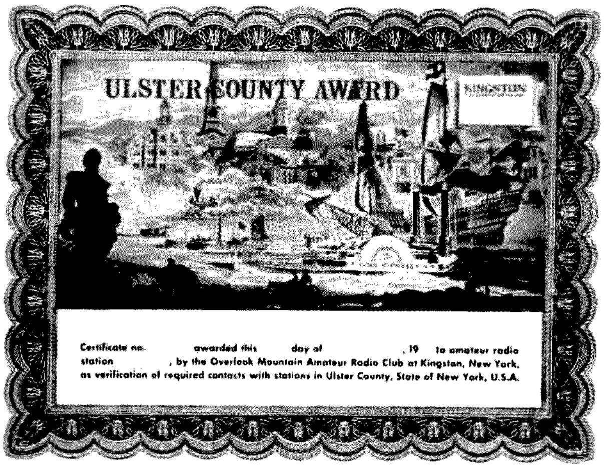
To apply, merely send your logbook information to the Awards Manager, Sheboygan County ARC, Inc., Farnsworth Jr. High School, Sheboygan, Wisconsin 53081. As a gesture, should you find that earning the award is impossible to do, why not drop the Jr. High School a letter and arrange for a schedule with one of their amateurs. Their club station is K9ERO.

NEW AWARD FROM PARS

The Poway Amateur Radio Society (PARS) has announced that a handsome new certificate is now available known as the "Distinguished PARS Communicator." The certificate has been issued to promote amateur radio contacts between PARS members and the amateur community at large. To qualify for the PARS certificate, operators must contact 5 PARS members (25 for San Diego county residents) and then submit their list of contacts in log form with an SASE to: Operations—PARS, PO Box 996, Poway CA 92064.

WHITE TAIL DEER AWARD

The Mid-Michigan Amateur Radio Club has announced the first of a series of awards featuring the wildlife of Michigan. The certificate is available to all licensed amateurs and shortwave listeners. The White Tail Deer Award requires contacts with two Mid-Michigan Amateur Radio Club stations, or contacts with one MMARC station and three White Tail Deer Award certificate holders. For Novice applicants, the requirements are one contact with an MMARC station or one contact with a White Tail Deer Award certificate holder. For shortwave listeners, the requirements are one MMARC station heard or one White Tail Deer Award certificate holder. A detailed list showing name, call, and QTH of the station or stations worked or heard should be accompanied by one dollar US to cover postage and printing costs. Payment may be made by cash, check, money order, IRCs, or USA postage cards, although photocopies of QSLs will be accepted. Contacts may be made over any period of time, so dig back through your logs. Also, note any special endorsements that you want on your award. Repeater contacts cannot be used, but satellite contacts can. Send applications and information to: Gary Lorenz WD8JFF, Awards Manager, MMARC, 3210 N. County Line Rd., Farwell MI 48622.



OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
24208	1	0043:26	79.7
24221	2	0137:42	93.3
24233	3	0037:01	78.1
24246	4	0131:17	91.7
24258	5	0030:36	76.5
24271	6	0124:52	90.1
24283	7	0024:12	75.0
24296	8	0118:28	88.6
24308	9	0017:47	73.4
24321	10	0112:03	87.0
24333	11	0011:23	71.9
24346	12	0105:38	85.5
24358	13	0004:58	70.3
24371	14	0059:14	83.9
24384	15	0153:30	97.5
24396	16	0052:49	82.3
24409	17	0147:05	95.9
24421	18	0046:24	80.8
24434	19	0140:40	94.4
24446	20	0040:00	79.2
24459	21	0134:16	92.8
24471	22	0033:35	77.7
24484	23	0127:51	91.2
24496	24	0027:10	76.1
24509	25	0121:26	89.7
24521	26	0020:46	74.5
24534	27	0115:02	88.1
24546	28	0014:21	73.0
24559	29	0108:37	86.6
24571	30	0007:56	71.4
24584	31	0102:12	85.0

OSCAR 8 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
10132	1	0025:31	56.2
10146	2	0030:29	57.5
10160	3	0035:28	58.7
10174	4	0040:26	60.0
10188	5	0045:24	61.3
10202	6	0050:22	62.5
10216	7	0055:21	63.8
10230	8	0100:19	65.0
10244	9	0105:17	66.3
10258	10	0110:15	67.6
10272	11	0115:13	68.8
10286	12	0120:11	70.1
10300	13	0125:09	71.4
10314	14	0130:07	72.6
10328	15	0135:05	73.9
10342	16	0140:03	75.2
10355	17	0001:48	50.6
10369	18	0006:46	51.9
10383	19	0011:44	53.1
10397	20	0016:42	54.4
10411	21	0021:39	55.7
10425	22	0026:37	56.9
10439	23	0031:35	58.2
10453	24	0036:32	59.4
10467	25	0041:30	60.7
10481	26	0046:28	62.0
10495	27	0051:25	63.2
10509	28	0056:23	64.5
10523	29	0101:20	65.8
10537	30	0106:18	67.0
10551	31	0111:15	68.3

OSCAR 7 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
24596	1	0001:32	69.8
24609	2	0055:47	83.4
24622	3	0150:03	97.0
24634	4	0049:23	81.9
24647	5	0143:39	95.5
24659	6	0042:58	80.3
24672	7	0137:14	93.9
24684	8	0036:33	78.8
24697	9	0130:49	92.3
24709	10	0030:08	77.2
24722	11	0124:24	90.8
24734	12	0023:44	75.6
24747	13	0118:00	89.2
24759	14	0017:19	74.1
24772	15	0111:35	87.7
24784	16	0010:54	72.5
24797	17	0105:10	86.1
24809	18	0004:29	71.0
24822	19	0058:45	84.5
24835	20	0153:01	98.1
24847	21	0052:21	83.0
24860	22	0146:36	96.6
24872	23	0045:56	81.4
24885	24	0140:12	95.0
24897	25	0039:31	79.9
24910	26	0133:47	93.5
24922	27	0033:06	78.3
24935	28	0127:22	91.9
24947	29	0026:41	76.7
24960	30	0120:57	90.3

OSCAR 8 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
10565	1	0116:13	69.5
10579	2	0121:10	70.8
10593	3	0126:07	72.1
10607	4	0131:05	73.3
10621	5	0136:02	74.6
10635	6	0140:59	75.8
10648	7	0002:44	51.3
10662	8	0007:41	52.6
10676	9	0012:38	53.8
10690	10	0017:35	55.1
10704	11	0022:33	56.3
10718	12	0027:30	57.6
10732	13	0032:27	58.9
10746	14	0037:24	60.1
10760	15	0042:21	61.4
10774	16	0047:18	62.6
10788	17	0052:15	63.9
10802	18	0057:12	65.2
10816	19	0102:08	66.4
10830	20	0107:05	67.7
10844	21	0112:02	68.9
10858	22	0116:59	70.2
10872	23	0121:56	71.4
10886	24	0126:52	72.7
10900	25	0131:49	74.0
10914	26	0136:46	75.2
10928	27	0141:42	76.5
10941	28	0003:26	51.9
10955	29	0008:23	53.2
10969	30	0013:19	54.5

FCC

Reprinted from the Federal Register.

47 CFR Part 97

[FCC 79-794]

Deletion of Permit Requirement for Canadian Amateurs Operating in the United States

AGENCY: Federal Communications Commission.

ACTION: Order.

SUMMARY: The Commission authorized Canadian amateurs to operate their amateur stations in the United States without requiring an operating permit issued by the United States. The 1952 treaty which established the U.S.-Canadian amateur reciprocal arrangement gives each country the option to require or not require such a permit. The Commission took this action in order to simplify licensing requirements in the Amateur Radio Service.

EFFECTIVE DATE: January 21, 1980.

ADDRESSES: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: Maurice J. DePont, Private Radio Bureau, (202) 254-6884.

SUPPLEMENTARY INFORMATION:

Adopted: December 4, 1979.

Released: December 12, 1979.

1. Since 1952, the United States and Canada have by treaty allowed amateurs of each country to operate their amateur radio stations in the other country under a special reciprocal permit procedure. (See TIAS No. 2508). The Commission has received a letter from Canadian officials seeking to modify the reciprocal arrangement to allow amateurs to operate their stations in the other country without requiring an operating permit. The treaty which governs the U.S.-Canadian reciprocal agreement, TIAS 2508, states in part, "Each visiting amateur *may* (emphasis ours) be required to register and receive a permit before operating any amateur station licensed by his government." It is therefore in the discretion of each country to forego the requirement of a permit.

2. We agree with the Canadian government that deletion of the permit requirement would be in the best interests of both countries. Often, amateur operators planning vacations abroad do not allow enough time for processing their permit application. Permits represent an unnecessary formality. The ostensible purpose for having a permit system is to maintain a data base on visting amateur operators to facilitate investigation of rule violations. However, the data on Canadian licensees will be available to us by consulting Canada's licensee lists. Enforcement efforts will not be affected by the deletion of the permit requirement since the number of rule violations committed by Canadian amateur licensees, operating in the United States, has been extremely small. Further, deletion of the permit requirement would be in keeping with the Commission's policy of deregulation and simplification of licensing procedures in the Amateur Radio Service. By this Order, we are deleting the requirement that Canadian amateur licensees obtain a permit before operating in the United States. A letter, by Direction of the Commission, will be sent to the administration in Canada and will constitute a working arrangement with Canada to recognize a similar privilege for American amateur licensees to operate in Canada.

3. In view of the foregoing, the

Commission finds that amendment of Part 97 to allow Canadian Amateur licensees to operate without a permit is in the public interest, convenience and necessity. The specific rule amendments are set forth below. Authority for these amendments is contained in Sections 4(i) and 303 of the Communications Act of 1934, as amended, and Article III of TIAS 2508, Convention Between the United States of America and Canada Relating to the Operation by Citizens of Either Country of Certain Radio Equipment or Stations in the Other Country. Since the rule changes herein ordered serve the public interest by relieving an existing restriction, and further, since public comments, we believe, would be unlikely, we are dispensing with the prior notice and public procedure provisions of the Administrative Procedure Act as unnecessary, 5 U.S.C. 553(b). The effective date of the rule changes herein ordered is January 21, 1980, so that elimination of Amateur Reciprocal Permits will occur simultaneously in both the United States and Canada.

4. Accordingly, it is ordered, that Part 97 of the Commission's Rules is amended, effective January 21, 1980, as set forth below.

5. For further information on these rule changes contact Maurice J. DePont, (202) 254-6884.

(Secs. 4, 303, 48 Stat., as amended, 1066, 1082; 47 U.S.C. 154, 303.)

Federal Communications Commission.

William J. Tricarico,

Secretary.

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended, as follows:

1. In § 97.40, paragraph (a) is amended as follows:

§ 97.40 Station license required.

(a) No transmitting station shall be operated in the amateur radio service without being licensed by the Federal Communications Commission, except that an amateur radio station licensed by the Government of Canada may, in accordance with § 97.41, be operated in the United States without the prior approval of the Commission.

* * * * *

2. Section 97.41 is redesignated § 97.42, and a new § 97.41 is added, as follows:

§ 97.41 Operation of Canadian Amateur Stations in the United States.

(a) An amateur radio station licensed by the Government of Canada may be operated in the United States without the prior approval of the Federal Communications Commission.

(b) Operation of a Canadian amateur station in the United States must comply with all of the following:

(1) The terms of the Convention Between the United States and Canada (TIAS No. 2508) Relating to the Operation by Citizens of Either Country of Certain Radio Equipment or Stations in the Other Country. (See Appendix 4 to Part 97.)

(2) The operating terms and conditions of the amateur station license issued by the Government of Canada.

(3) The provisions of Subparts A through E of Part 97.

(4) Any further conditions the Commission may impose upon the privilege of operating in the United States.

(c) At any time the Commission may, in its discretion, modify, suspend, or cancel the privilege of any Canadian licensee operating an amateur radio station in the United States.

3. Sections 97.42 and 97.43 are redesignated §§ 97.43 and 97.44, respectively, and redesignated § 97.43 is revised to read as follows:

§ 97.43 Mailing address furnished by licensee.

Each application shall set forth and each licensee shall furnish the Commission with an address in the United States to be used by the Commission in serving documents or directing correspondence to that licensee. Unless any licensee advises the Commission to the contrary, the address contained in the licensee's most recent application will be used by the Commission for this purpose.

[FR Doc. 79-38561 Filed 12-14-79; 8:45 am]

BILLING CODE 6712-01-M

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47 CFR Part 97

[RM-2490; RM-2666; FCC 79-792]

Amateur Radio Service; Amending Rules Concerning Availability of Operator License

AGENCY: Federal Communications Commission.

ACTION: Memorandum Opinion and Order.

SUMMARY: The Commission grants a petition to allow an amateur radio operator to use a photocopy of an amateur license, while operating an amateur station. This action amends § 97.82 of the Amateur Radio Service, of the Commission's Rules and Reguations.

EFFECTIVE DATE: December 21, 1979.

ADDRESSES: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: Private Radio Bureau, Personal Radio Branch, Attorney Roy C. Howell, (202) 254-6884.

Adopted: December 4, 1979.

Released: December 12, 1979.

1. The Commission has under consideration two petitions requesting amendment of § 97.82 and § 97.83. The first petition, RM-2490, was filed on November 25, 1974 by Mr. Ronald K. Long. Subsequently, on March 1, 1976, Mr. Robert L. Bingham petitioned in RM-2666 for an identical amendment to the Amateur Radio Rules.

2. Petitioners' request that the rules be amended to remove the requirement of having only the original amateur radio operators' license (pursuant to § 97.82), and station license (pursuant to § 97.83) in the possession of the control operator of an amateur radio station. Petitioners' argument for amendment of § 97.83 to allow station operators to have a photocopy of their station license in their possession, while operating an amateur radio station, is moot; and, the reason is because § 97.83 presently allows this practice, i.e.

> The original license of each amateur station or a photocopy thereof shall be posted in a conspicuous place in the room occupied by the licensed operator while the station is being operated at a fixed location or shall be kept in his personal possession.

3. Petitioner, Mr. Robert L. Bingham, asserts that § 97.82 in its present form lacks any contemporary administrative justification, insofar as technological advancements have made this rule obsolete. According to petitioner (Mr. Bingham) § 97.82 was enacted during an era when portable or mobile radio operation was very minimum; and, therefore, amateur radio stations were generally at a fixed location. However, today with the advent of hand held portable units, transistorized mobile equipment, and the small QRP transceivers have made amateur radio operation away from a fixed location very easy.

Thus, as stated by petitioner (Mr. Bingham).

> The idea of hanging the license up on the wall above the station equipment is no longer the proper way to do it if you are one of those who practice one of these three types of operations away from home.

4. Petitioner, Mr. Ronald K. Long, argues that § 97.82 is unduly restrictive; and, with the widely increasing mobile operation of amateur radio stations, § 97.82 effectively requires that the original license be carried in the personal wallet or purse where it may easily become damaged or lost. Hence § 97.82 causes great inconvenience to the amateur radio operator while operating a portable amateur radio station. The only filed comment (filed by Mr. Philip A. Litchfield) likewise asserts that § 97.82 is unreasonably restrictive. The comment states,

> Continual carrying of the original soon makes the original illegible, subject to mutilation and possible loss, and thus requiring replacement of same.

5. The Commission finds merit in petitioners' proposals to amend § 97.82. The administrative intent of § 97.82 is to provide the Enforcement Division of the Field Operations Bureau ready availability of the amateur operators' license to aid enforcement purposes. The ready availability interest of § 97.82 is satisifed if amateur radio operators produce a photocopy of their original license to an enforcement official. The Commission fully understands and agrees with petitioners, that with the incidence of portable and mobile radio station operations, the requirement of an amateur radio operator to carry the original license may result in unnecessary damage or loss to the document during the five year life of the license.

6. Since no party would be adversely affected by the rule changes, and adverse public comments would be unlikely, we are dispensing with prior notice and public procedure provisions of the administrative Procedure Act as unnecessary, 5 U.S.C. 553(b). In view of the foregoing, it is ordered, effective December 21, 1979, that Part 97 of the Commission's Rules and Regulations is amended as shown below. Authority for this action is pursuant to Section 4(i) and 303 of the Communications Act of 1934, as amended. Further information about this action by the Commission may be obtained by contacting Roy C. Howell, Personal Radio Branch, Private Radio Bureau, FCC, 2025 M Street, NW., Washington, D.C. 20554. (202) 254-6884.

(Secs. 4, 303, 48 stat., as amended, 1066, 1082; 47 U.S.C. 154, 303)

Federal Communications Commission.

William Tricarico,

Secretary.

Part 97 of Chapter I of Title 47 of the Code of the Federal Regulations is amended as follows:

1. Section 97.82 is amended to read as follows:

§ 97.82 Availability of operator license.

Each amateur radio operator must have the original or a photocopy of his or her operator license in his or her personal possession when serving as the control operator of an amateur radio station. The original license shall be available for inspection by any authorized Government official upon request made by an authorized representative of the Commission, except when such license has been filed with application for modification or renewal thereof, or has been mutilated, lost or destroyed, and request has been made for a duplicate license in accordance with § 97.57.

[FR Doc. 79-38562 Filed 12-14-79; 8:45 am]

BILLING CODE 6712-01-M

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47 CFR Part 97

[Docket No. 20679; FCC 79-859]

Requiring Volunteer Examiners in the Amateur Radio Service To Submit Photocopies of Their Operator License With Their Requests for Examination Papers

AGENCY: Federal Communications Commission.

ACTION: Report and Order.

SUMMARY: This Report and Order terminates a Notice of Proposed Rulemaking which proposed to amend the Amateur Radio Service Rules. The proposed amendment would have required volunteer examiners to submit a photocopy of their own license to the Commission when requesting permission to examine others. This proceeding has been terminated because amendments already adopted by the Commission have made the proposed amendment unnecessary.

EFFECTIVE DATE: Non-Applicable.

ADDRESSES: Federal Communications Commission, 1919 M Street NW., Washington, DC 20554.

FOR FURTHER INFORMATION CONTACT: Judith St. Ledger-Roty, Rules Division, Private Radio Bureau, (202) 634-2443.

Report and Order (Proceeding Terminated)

Adopted: December 19, 1979.

Released: January 7, 1980.

By the Commission:

In the matter of amendment of Part 97 of the Commission's Rules to require volunteer examiners in the Amateur Radio Service to submit photocopies of their operator license with their requests for examination papers.

1. On December 19, 1975, the Commission adopted a *Notice of Proposed Rulemaking* proposing amendment of § 97.29 (which is presently § 97.28) of the Amateur Radio Service Rules. 57 F.C.C. 2d 797 (1976), 40 FR 59602 (1975). At issue was the manner in which the Commission permitted license examinations by mail.

2. At the time the *Notice* was released, the examinations for the Novice, Technician, and Conditional class licenses were conducted by mail. Prospective licensees would select a qualified volunteer examiner who would then conduct the telegraphy portion of the exam for the applicant. If the applicant passed this portion, the volunteer examiner would submit a written request to the Commission for permission to administer the written portion of the examination. In order to qualify as an examiner, the Commission required each volunteer to state that he was 21 years old, and held an amateur license of a class higher than that sought by the applicant. The Commission would then forward the written examination to the volunteer examiner who in turn would administer the exam.

3. By December 1975, the Commission had discovered substantial abuses of this licensing procedure. Volunteer examiners had claimed qualifications they did not possess, and some names submitted as volunteers proved to be fictitous. However, the Commission did not have sufficient resources to verify every volunteer examiners' qualifications.

4. In order to limit abuse, and preserve the integrity and fairness of the mail examination program, the Commission proposed to amend Section 97.29 to require volunteer examiners to submit a photocopy of their amateur license when requesting examination papers. The Commission received five comments, four of which opposed the proposed amendment and suggested that the Commission improve its own internal procedures for verification rather than impose any additional burden on volunteer examiners. One participant pointed out that the added expense to the examiner might well dissuade would-be volunteers from participating in the licensing program. One volunteer examiner who filed comments felt that the need to maintain the integrity of the program outweighed any disadvantage to the examiners.

5. The problem of fraudulently obtained licenses was also, in part, the subject of the *Notice of Proposed Rulemaking in Docket 20282,* 49 F.C.C. 2d 1175 (1974). One of the broad objectives of this docket was to minimize any adverse impact on presently licensed amateurs while at the same time ensuring the vitality of the mail examination processes. *In its First Report and Order,* 59 F.C.C. 2d 877 (1976), the Commission, guided by the views of an estimated 4,000 participants, modified its proposals to assure that no amateur who already held a license would be harmed by new licensing procedures. The procedures adopted in the *First Report and Order* were designed to limit the availability of volunteer-administered examinations to

two categories of applicants:

(a) Applicants for the Novice license;[1] and

(b) Applicants who show by a physician's certification that they are unable to appear at a Commission examination point because of a protracted disability preventing travel. 59 F.C.C. 2d at 879.

6. The amendments to the Amateur Rules adopted in the *First Report and Order in Docket 20282* provided a workable alternative to the proposals put forth in this docket. On the basis of these amendments, and the negative public reaction from the amateur community, the Commission believes that the public interest, convenience and necessity is best served by the termination of this proceeding.

Accordingly, by authority contained in Sections 4(i) and 303(r) of the Communications Act of 1934, as amended, IT IS ORDERED that this proceeding is TERMINATED.

Federal Communications Commission.
William J. Tricarico,
Secretary.

[1] The Commission placed no restrictions on the Novice Class applicant because there is little incentive for that class to cheat. The examination for the Novice Class license is simpler than the examination for other amateur operator licenses.

New Products

from page 27

all of which are programmable from the keyboard. Thus, CQs, test messages, station descriptions, etc., can be "canned" for smooth and easy operating.

There are also a number of nice-to-have technical and "housekeeping" features built into the Macrotronics unit. These include automatic carriage return and line feed (auto CR/LF), automatic unshift-on-space, "auto diddle" (in which the "LTRS" character is sent whenever the transmit buffer is empty), automatic scrolling (where lines of text move up the screen as it fills up), and automatic 10-minute ID in which the CW ID message is automatically inserted every 10 minutes from the start of the send mode to keep one legal during long-winded contacts.

Another handy feature is KOX, or keyboard operated transmit, analogous to the push-to-talk (PTT) of SSB operation, which keys the transmitter automatically on send and unkeys on receive. This highly desirable feature permits full station T/R control from the PET's keyboard. And, not to overlook any of the PET's capabilities, the M650's designers have allowed the unit to "piggyback" onto the digital clock that the computer contains. As long as the PET is left running continuously, you can even send the present time in UTC at the touch of a key!

The M650 contains a built-in phase locked loop (PLL) demodulator and an LED indicator for "visual cue" tuning. There is also provision for connecting an external TU (terminal unit) and an optional loop keyer module. No external power supply is required.

CW, Too

In addition to its RTTY capability, the M650 is also ready to go with Morse encode and decode with the PET. The Morse program allows continuous speed adjustment from 1 to 100 wpm in any of three modes—receive, send, and code practice.

In the receive mode, a CW signal will be automatically decoded and be presented on the video monitor screen. Changes in the sending station's speed are automatically corrected for by means of an exponential smoothing technique. In the send mode, the M650 acts as a keyboard-actuated keyer—whatever is typed in is encoded and directly keys the transmitter, although the keyboard is buffered as in RTTY. This allows for "typing ahead" and overall smooth code transmission. In the code practice mode, the computer speed may be changed at any time by simply typing in the desired speed in wpm. A special feature is one that allows any key (or bug or electronic keyer) to be used with the unit. The decoded text is displayed on the video monitor. This provides a good means of monitoring and improving one's sending "fist." A sidetone oscillator allows for connection of a speaker for code practice or "processed audio" reception of received CW signals.

Interface and Software

The M650 includes an RS232 input (for use with an external TU), solid-state multiple keying circuits that will key positive or negative voltages, and necessary interconnecting cables and connectors for hookup to the PET.

The software consists of two computer programs, one for Morse code and one for RTTY, supplied on two cassette tapes. Both programs are written in BASIC for the PET, with machine-language subprograms. Each program requires 8K of RAM. This is easily accommodated on the PET, although only one program—Morse or RTTY—can be stored at a given time. The RTTY software was designed by Wayne Reindollar and the Morse software by Ron Lodewyck N6EE. Lodewyck is the co-author of Radio Shack's Level I, Level II, and Disk BASIC instruction courses and Commodore's Basic BASIC tutorial.

Does It Work?

To borrow an old phrase—"as advertised." And more. The thick (28-page) user's manual was very well written and comprehensively covered installation and operating procedures. No major difficulty was encountered in setting up the unit, despite my never having operated on RTTY before.

Putting the unit on the air recalled days some 25 years ago when I put forth my first Novice CW "CQ". Feeling again like an unsure beginner, it was necessary to refer to the operating manual for the first few days to get the "hang" of making contacts and to keep from being "overrun and overwhelmed" by the many built-in automatic features. Learning just how to automatically send RTTY CQs, respond smartly to incoming calls, make use of the "instant" replay function, bring up the preprogrammed messages, and do other neat little "tricks" with the unit was an experience. I'm still exploring the M650's powerful capabilities and expect to be for some time to come.

Getting the Macrotronics/PET system on the air was strictly a matter of learning how to harness the system's potential. All the functions were run through and checked; there were no glitches or "bugs" detectable in either the RTTY or CW programs. Despite the newness of the product, Macrotronics has been running the programs for some time in pre-production and seems to have gotten the programs and hardware right before going public.

To be objective about my evaluation of the M650, it's only fair to pass along some comments regarding "hands-on" performance, operating characteristics, and features. In no way are these intended to downgrade what is an excellent product, one that has forced a real breakthrough in ham RTTY and CW technology. Here's what I found:

1. The M650 *does* tie up the PET, which must be loaded and kept running if it's to be a full-time system. And, as mentioned, the program must be swapped out between the RTTY and CW modes. It takes about 4 minutes to load each program and another 30 seconds to initialize the variables and load the machine-language subprograms in the CW mode.

2. The 12-pin Molex® connectors at the two rear-panel user ports were fine, but RCA-type phono jacks would have been more convenient to hook into the transceiver's audio input/output jacks, keying circuit, AFSK input, etc. As it was, I installed single-hole mount RCA-type jacks (Radio Shack #274-346) on the rear apron rather than use the Molex connectors. Also, a longer cable could have been provided to reach the PET's ports.

3. With the PLL circuit of the M650, CW must be received in the transceiver's USB or LSB mode, using an SSB rather than a CW filter. The PLL has a lower limit of 800 Hz and thus can't work with the typical narrow bandpass CW filter, unless the rig happens to have an "i-f shift" circuit which can be used to increase the center frequency of the CW filter passband (the Kenwood TS-820 and TS-180 are rigs that have this feature). Obviously, this requirement presents an annoyance in trying to work two-way CW.

4. Some RFI is generated by the PET, and it's aggravated by the interconnections with the transceiver. This was only serious on weak signals in my shack. If you experience problems from RFI, use shielded interconnecting cables, be sure the equipment is well grounded, and feed the antenna with coaxial cable to prevent RFI from the computer from being picked up by the transmission line. If the

interference is especially severe, ferrite beads on the interconnecting cables should help.

5. The M650's CW function worked especially well. However, the operator-selected speed has a recognition range of approximately −30% to +40% of the set speed. If the incoming signal is outside this range, you have to reset the speed. Also, character-spacing "specs" are fixed, so that if the station you are in QSO with isn't sending letter-perfect, "swingless" Morse, reception will be garbled. The system is at its best when communicating between stations using machine- or electronic-keying systems. Taped code practice and CW bulletins from W1AW, for example, make excellent copy.

6. The PLL circuit was very difficult to "optimize" for solid RTTY copy, and the single LED didn't help too much in fine-tuning signals. I found that whereas a weak S4-S5 signal was enough to result in good copy on CW, an S7-S9 plus signal was required on RTTY for reasonably garble-free reception. The manufacturer makes no bones about the fact that for best results, a separate demodulator (TU), such as their accessory FSD-1, should be used. My experience confirmed their recommendation, and a demodulator will be high on my "nice-to-have" accessory list. Space is available inside the "oversize" M650 cabinet in which to mount the FSD-1 or a home-brew demodulator board. The front panel contains two DPDT switches for use with the FSD-1 or other accessories, and there is a meter cutout with a Macrotronics logo cleverly installed in its future position.

7. The instruction manual is well written, but what is needed are small plasticized cards—one each for RTTY and CW—to use as "cheat sheets" to remind the operator of all the functions at his command. I found it almost too much to try to remember how to "bring up" a certain function or to dig it out of the manual during a hot-and-heavy QSO.

About the only other "complaint" worth mentioning is that several months elapsed after the estimated delivery date before the PET interface adapter was available for shipment.

No PET? More hams own TRS-80s than PETs, so if you do, you're also in luck. Macrotronics has introduced systems for other popular computers, including the TRS-80, Apple, and Exidy Sorcerer. The M80 and M800 are for the TRS-80, the latter being a super-deluxe system requiring a Level II 16K TRS-80. The A650 is designed to mate with the Apple, and the S80 harnesses the capabilities of the Sorcerer. In addition, a less-expensive PET interface, known as the M65, is also available. It's similar to the M650 but has fewer features and doesn't include the cabinet. At present, all of the interface units are sold in wired-and-tested form only (the M80 and M65 were once available as kits).

Other RTTY accessories and equipment offered by Macrotronics include a Baudot/ASCII interface for a printer and a plug-in loop keyer module. An AFSK tone module for use with SSB transmitters is also planned.

The M650 is sold by *Macrotronics, Inc., PO Box 518, Keyes CA 95328*. Price is $210 delivered. Reader Service number 44.

Karl T. Thurber, Jr. W8FX
Ft. Walton Beach FL

MFJ PHONE PATCHES

MFJ, famous for its quality line of amateur radio accessories, has just released two telephone patches for amateur radio applications. Since both patches (models 620 and 624) are identical except for the signal level meter, our review is applicable to both models.

The MFJ Telepatch is fundamentally a hybrid phone patch designed to transformer-interconnect a telephone line, receiver audio output, and transmitter microphone input.

To prevent the receiver audio from tripping the voice-actuated transmitter circuitry during VOX operation, an adjustable null circuit is provided, settable by a front panel control. This highlights one advantage which the 624 has over the meterless 620—touchups and trimming may be made while watching the meter response. Otherwise, initial setup of the 620 will require patience, trial and error, or the use of auxiliary test equipment.

As shown in the photo, the Telepatch has four controls. "Receiver Gain" accommodates continuous level adjustment between the speaker output and the telephone line. Similarly, "Transmitter Gain" prevents overdriving the mike input of the transmitter from the telephone line.

MFJ's Telepatch.

For manual operation, the null control is unused, but with VOX, that provision is a real advantage. Obviously, receiver audio could be coupled back into the transmitter, keying it up each time a signal is received. By feeding the received audio into a balanced bridge, however, the audio signal does not appear at the microphone jack, only on the telephone line. A separate "Null Adjust" pot permits careful setting of this function. In some installations, the null circuit components will not provide a proper match for the audio load, and a change in circuit capacitance may be required. The technique is described in the literature included and extra solder pads are provided on the circuit board for additional capacitors.

When properly pruned, the null circuit will provide some 30 dB of attenuation, assuring good VOX operation.

The rear apron of the attractive Ten-Tec cabinet displays an array of jacks and terminals for custom requirements. Separate microphone and speaker jacks as well as transmitter input and receiver output jacks are accessible. They are standard RCA phono jacks. A two-screw terminal strip is used to interconnect the phone patch with the telephone line. Since some local public service regulations may require the use of a coupler between this accessory and the telephone line, it would be a good idea to contact your service representative to find out whether there are special requirements for your telephone. Electrically, the Telepatch works fine without the additional Ma Bell hardware.

Low-pass RFI pi-section filters are provided on both sides of the phone line input to prevent stray rf coupling while transmitting. Two separate audio transformers are used in the Telepatch to ensure adequate input/output isolation.

Typical of previous products from MFJ which we have examined, construction of the Telepatch is clean and uncluttered. Component values are adequate for the job, and tolerances are well within range for the application.

The Telepatch is accompanied by several mimeographed instruction sheets, a complete schematic diagram, and block diagrams for typical installations. The diagrams provide virtually all the hookup information needed even without the text!

For the well-equipped ham shack—especially for the traffic operator—we would recommend a phone patch of the caliber of the MFJ Telepatch 620 or 624 ($49.95 and $59.95 plus $3 shipping). *MFJ, PO Box 494, Mississippi State MS 39762*, or MFJ dealers nationwide. Reader Service number 47.

Robert B. Grove
Brasstown NC

AEA INTRODUCES NEW LOW-COST COMPUTERIZED MORSE KEYER

A new microprocessor-based Morse keyer—the MK-1—has been introduced by Advanced Electronic Applications (AEA) of Lynnwood, Washington.

The MK-1 incorporates more than 20 special features. It can

easily be programmed to send code at any rate between 2 and 99 wpm with precise full weighting control. The operator can adjust the dot to element space ratio from 0.5:1 to 1.5:1 and the dash to element space ratio from 2.0:1 to 4.0:1.

Other features incorporated in the MK-1 include: selectable semi-automatic "bug" mode, automatic stepped sidetone frequency selection, iambic keying, operation on 9 to 16 volts dc at 200 mA, and transmitter output for grid-block or transistor circuits.

All control of the keyer is performed with a keypad mounted on the top surface of the case. Mating connectors are supplied.

For more information on the MK-1, contact *AEA, PO Box 2160, Lynnwood WA 98036; (206)-775-7373.* Reader Service number 2.

KANTRONICS' FIELD DAY

Kantronics' Field Day is a Morse code and radioteletype reader with automatic CW-speed display. The unit is self-contained with built-in alphanumeric displays, power supply, and RTTY/CW demodulator. The heart of the Field Day is an Intel 8035 microcomputer with a special CW decoding program.

The Field Day is easy to install. Simply connect the power cord to 117 V ac and an audio cable between your receiver earphone jack and the Field Day audio input terminal. The Field Day is compact, measuring 3.44" high by 8.5" wide by 9.25" deep. It fits snugly beside or on top of your main station units. A tilt handle on the case is easy to adjust and allows for optimum viewing.

Special features on the Field Day include a speed display, code display, Morse copy, RTTY copy, a "smart" code editor, automatic CW-speed tracking, a tuning eye (LED), input filtering, and an internal speaker. A switch on the back of the unit sets the Field Day for CW or RTTY. When receiving code, the characters travel across the screen from right to left. The characters are big (½ inch) and are easy to read.

The Field Day computes incoming code speed automatically. Once you've tuned in a station, the unit can adjust to the code being sent, and then it begins to display it properly. The speed display is optional; that is, you can turn it on or off. Speed is displayed on the two left-most readouts.

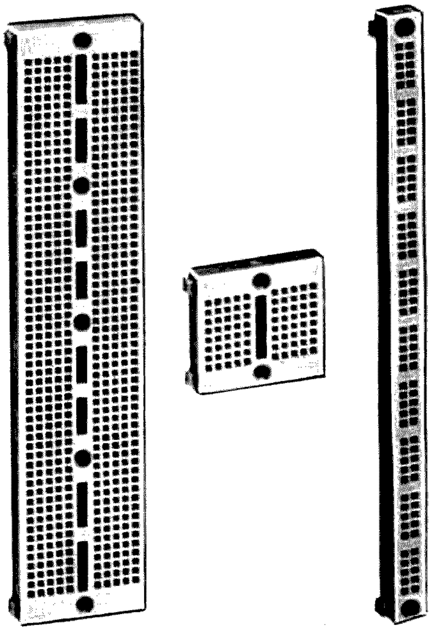
The input filter is about 200 Hz wide and it separates interfering signals well. It is usually possible to tune in one of three or four signals heard and get accurate copy. Two signals right on top of each other, in frequency and volume, could not be separated. Tuning of CW signals is made easier by the tuning eye. You must rotate the tuning dial on your receiver until the LED pulses with the incoming code. Once the eye is blinking, the Field Day automatically computes code speed and starts displaying the code on ten alphanumeric displays.

The smart code editor is engaged by pushing an EDIT button on the front panel. The editing program makes the Field Day an unusual code reader. The editor allows "sloppy" code (incorrect inter-character spacing or dot-dash weighting) to be copied. Really poor code can, however, fool the Field Day.

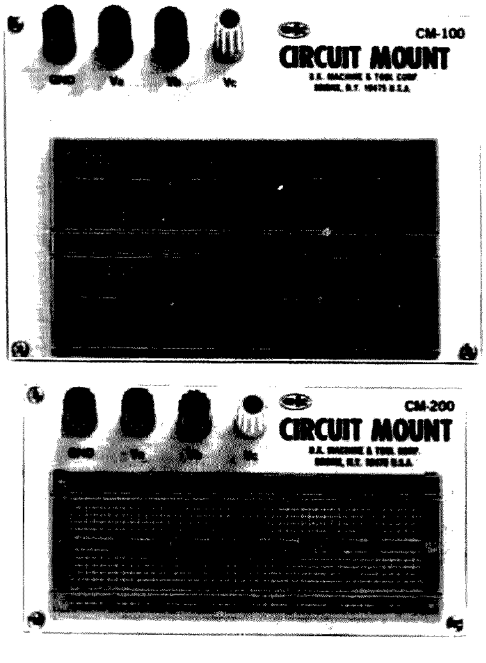
Field Day is a product of *Kantronics, 1202 E. 23rd St., Lawrence KS 66044; (913)-842-7745.*

PROTOTYPE BOARDS FROM OK TOOL

OK Machine and Tool Corporation has introduced a new series of "Circuit Mount" boards for electronics projects and prototypes. All boards feature solderless insertion-type sockets on .100 inch centers. Each row has 5 common points. Larger boards also feature 40-point bus lines, while a separate bus strip module is also available. All boards can accept standard component leads including DIPs, while interconnections are easily made using standard 22 AWG solid wire. "Circuit Mount" prototype boards are available in a range of sizes from small modules designed to hold a single IC up to 1020-point panel-mounted boards complete with binding posts. All separate modules are interlocking and also feature screw holes for permanent mounting. Delivery is from stock at local electronics retailers or directly from *OK*



The Field Day from Kantronics.



"Circuit Mounts" from OK Tool.

Machine and Tool Corp., 3455 Conner Street, Bronx NY 10475. Reader Service number 54.

USER'S REPORT—THE SKYTEC CW SPEAKER

During these days of rapidly skyrocketing inflation, it's becoming increasingly difficult for one to truly get his money's worth when buying almost any item of an inexpensive nature. That single situation prompted me to write this report on a very outstanding and beneficial unit—the Skytec acoustically tuned CW speaker. Originally, this little gem captured my attention by its attractive and novel appearance. Once connected to my transceiver, however, I found this "single-frequency" speaker more practical than my FT-901DM's CW filter or audio peak filter . . . and that's a statement which will require substantiation.

Narrowband i-f filters, while providing very sharp selectivity to reduce adjacent channel interference, create a certain amount of "ringing" in the output. This is caused by propagation delays introduced by circuit components of the filter. Thus, the more narrow a bandpass, the more pronounced its ringing. An audio filter usually provides extreme selectivity and amplification at the reproduced audio frequency, resulting in a form of "tunnel vision" centered around one's operating frequency (some audio filters eliminate this problem by providing varying degrees of selectivity; some do not).

The Skytec CW speaker is an ideal solution to both of these dilemmas. A desired signal can be sharply peaked by approximately 20 dB, yet adjacent channel signals can still be heard reduced in volume. This means the Skytec filter doesn't need to be removed for CW band scanning.

The Skytec unit filters directly at the room level, eliminating any ringing—a very pleasant change from i-f filters. One might wonder how effective audio-range filtering compares with i-f filtering, since it can't compensate for agc attacks by strong signals. Unless the interference is dead on frequency, only a slightly varying audio level is noticed with the Skytec. In fact, if one doesn't watch his S-meter, he probably will not be aware of that adjacent channel interference.

If the station transceiver employs a medium bandwidth i-f filter, its use in conjunction with the Skytec filter provides an unbeatable combination capable of filtering at both the i-f and audio levels . . . and it still reduces the tunnel-vision-type operation. I'm particularly pleased with my Skytec's ability to reduce band and power line noises. Since these raspy sounds fall outside the CW speaker's frequency range, I'm often unaware of their presence until disconnecting the Skytec unit. A tuning sleeve on the speaker's front allows the operator to set the desired frequency peak between 600 and 750 Hz, and the unit's attractiveness makes it a functional conversation piece for any CW operator's setup.

The Skytec acoustically tuned CW speaker.

This report is being written following an enjoyable contact with VU2GO on 20-meter CW. VU2GO's signal was quite weak and there was QRM. The 901DM's bandpass was set at 1 kHz to prevent ringing from turning the signal into a mass of echos. The audio peak filter added too much ringing and prevented following small changes in VU2GO's signal. The Skytec speaker boosted the VU signal while permitting slight frequency changes to pass without attenuation. I hardly heard a UA0 and a JA2 off to the sides of our QSO, and they didn't prove distracting. I would have given one of these fellows a call after the VU QSO, but there wasn't time . . . for that or for tuning the 901DM's audio peak filter if it had been in use. (It was also 7:00 am and time to leave for work.)

All aspects considered, the Skytec CW1 speaker is a true gem. It isn't heavily advertised in flashing lights, but it has all the merit of a DXer's secret weapon. The manufacturer is *Skytec, Box 535, Talmage CA 95481*. Reader Service number 477.

Dave Ingram K4TWJ
Birmingham AL

Corrections

In "What Do You Do When Your Rotator Dies?" (November, 1979, p. 149), the connection of the diodes shown across the electrolytic capacitors is in error. The diodes should be connected with their cathodes to the positive sides of the electrolytics.

Our thanks to K6WX and N4AHI for pointing this out.

Gene Smarte WB6TOV
News Editor

I'm sorry to report that the $30 digital voltmeter (*73*, January, 1980, p. 83) is not available as a kit from Beckman Instruments. Although it was planned as a kit when accepted for publication, time didn't allow me to provide one! I want to thank all those people who wrote for information on the kit, though.

I would also like to make some corrections to the article, "Build this $50 Mini-Counter" (December, 1979, *73*). In Fig. 3 (p. 60), the resistors going to the "b" and "g" pads on the IC are reversed. And the nearby "insulated jumper" connects in only two places. There's no connection in the center of the wire.

Gary McClellan
Fullerton CA

Ham Help

I have all issues of *73* from about 1964 to December, 1979, and I am just out of room for any more.

I will send all these issues to the individual or club that first gets a letter to me! Free!

David D. Blackmer WA6UNK
Route 3, Evergreen
Nipomo CA 93444

I need diagrams and operation manuals for the following equipment (all made by Link): Model 1623 test meter, 2552 test meter, 2210 transceiver, 1305-ED-2A receiver, and 2240-ED-2A transmitter.

John C. White WB6BLV
560 N. Indiana St.
Porterville CA 93257

I have an old communications receiver made by RCA, a CR-88. It is not an AR-88. Nobody seems to know anything about this receiver; it was made about 1945. I'm looking for a schematic and an instruction book. Can anyone help me?

Guillermo Moreno Rivas
Sindicalismo #87-219
Escandon Z18. Mexico D.F.

LETTERS

from page 20

parties the ARRL throws. I've seen these all my life at the ARRL conventions where the macho thing was to get stupid drunk. They also have hosted these booze parties at electronics shows, with the membership paying the tab. It's your money, fellows! How on Earth does boozing up a bunch of people "promote ham radio"?

6. Having visited Geneva recently, I understand that it is expensive, but $1,000 per day? Total insanity and an expense account vacation gone berserk! Sherry and I had no problem staying in Geneva for well under $100 per day, complete . . . for the two of us. I'd also be interested in taking a look and seeing how many of the "representatives" were accredited and how many were over there on a nice expense account vacation courtesy of the League membership. I'll be surprised if more than three or four were accredited.

7. I've been hearing about me trying to destroy amateur radio for a long time, but the destruction never seems to come off. I think we will be hearing a lot more about the details on what actually happened at WARC and the place the ARRL played. If credit is due, I'll be glad to give credit.

10. Apparently the Chinese have made a complete change, and, instead of having the decisions made in Peking, as before, their delegation was given the power . . . and lost the battle with the ARRL when they got drunker than the League people. I have a feeling that there may be two sides to that story.

11. Hey! They said something nice about me! The future? Wait until you get the details on the two brand new modes of communications I'll be pushing . . . plus a little satellite scheme I have up my sleeve.

12. This one is really difficult to swallow.

13. Baloney. Why all this badmouthing of the FCC by the League?

14. See #1.

15. I sure hope that hams don't get swept up in nationalistic politics. This stuff makes as much sense as a lot of the drivel from Iran and is aimed at getting the Archie Bunker set excited. Of course, if it comes to secession, how about New Hampshire breaking off? We have lots of wood to run our cars and an atomic power plant for electricity. Now, if they'd just let us have nuclear weapons so we could defend ourselves . . .

16. More nationalistic nonsense. Cooler heads, if there are any, will remind directors about the fact that there are more amateurs in Japan than in the U.S., so it is unlikely that Japan is going to oppose amateur radio.

17. What possible effect would it have for us to stop buying FM gear? With about a half million two-meter users in Japan, the 100,000 hams using it here are a drop in the bucket. What is wrong with you fellows out there? When you hear baloney, why don't you say something?

If the League is in favor of home-brewing, why do they have so few articles on it in QST *. . . particularly as compared to* 73? QST *devotes extensive coverage to DX, contests, traffic handling, and CW . . . and relatively little to home-brewing.*

The League did save money for years to invest in a new building; however, this was after *WWII. Their real savings were in the '60s when Mort Kahn became a director. Mort, a shrewd New York businessman, was elected over Dannals (with my assistance) and he did a couple of good things. First, he engineered the forced retirement of Budlong. Second, he pointed out to the other directors that there was no reason to spend the money already put aside for the new building when the members could be talked into donating to a building fund. He set this up and he was right . . . they got the money donated for the new building. The old building fund was kept in stocks and bonds. Then they turned around and sold their old building in East Hartford for about what the new building cost. This, too, was put into stocks . . . which is where the nearly $2 million they have stashed away "for a rainy day" came from . . . not WWII. Note that I am not calling names or smearing anyone . . . just pointing out facts. If the League has any argument with what I have said, fine . . . let's see some of the details on expenses down through the years. These have been carefully kept a secret from the members. The "cannibal, chink, and gook" approach to clubs is aimed at getting the red-neck vote. Having recently visited the Asian area, I can assure you that we will do much better to appreciate their strengths and not indulge in an orgy of name-calling.—Wayne.*

SHUT UP?

Since I was licensed as a Novice in January, 1978, with virtually no knowledge in electronics or amateur operating practices, I have been on a "learning spree" and enjoying every minute of it. I have tried to remain objective to the political throes of this hobby, but now feel compelled to speak out. Let me explain.

I have relied heavily on information in most of the amateur radio periodicals—*73, QST, Ham Radio Horizons, CQ,* an occasional *Ham Radio*—and have taken note of your repeated criticism of the ARRL and the supposed debacle they have gotten the amateur radio fraternity into, from FCC doctrines to WARC, but have at no time seen any truly constructive criticism or suggestions that may help the ARRL better represent the amateur community. Quoting your December, 1979, editorial: "About the only good thing you can say about our government is that, crummy as it is, *we* don't know of a better one anywhere." Likewise, we don't have a better official representative of the amateur population here in the good ol' USA.

73 Magazine offers a lot to the amateur. Its magnitude and scope are clearly a function of its editors' deep belief and love of this hobby, but, likewise, *QST*, as official representative of amateur radio in this country, provides an *enormous* amount of information to its readers, specifically in areas which other magazines, 73 included, don't even consider.

The problem with the ARRL is that, crummy as it is, we don't know of a better one anywhere. You can quote me on that, too! As American citizens, we all have the opportunity to shape and make good our criticism of the American government. Its constitution provides for such criticism. Seems to me the ARRL has the same sort of process built in also. When was the last time you voted for any office of the ARRL, from SCM to Division Representative or even Director? My point is this: If right, stand behind and support it; if wrong, put it right, much the same as you would try to do with the American government. My guess is that you have been fighting for so long you have lost sight of your goal (notwithstanding your own accomplishments) of a truly representative body of people to make the plight of the radio amateur not only heard, but answered, *fairly*, in the *best* interests of *all*. If the fervor you have in your column could be used as a catalyst to unite the amateur community in support for needed changes in the ARRL, as opposed to merely a sounding board, just think how much better amateur radio would be for all. Your magazine has much clout and I would say is probably as well read as *QST* (I myself subscribe to both). If the ARRL is to be made better, *we* have to change it! So how about it, Wayne? Are you gonna *put up* or *shut up?*

Joe Silvasi KC2J
Wrightstown NJ

SUN BIRDS

Please forgive me for taking up your valuable time, but I think I have an idea worth looking into. In the cities and larger towns, the schools are full of electronic gear and anyone can join a class and learn radio or electronics. But in the smaller towns and villages, there is no way they can get this schooling except by reading books. And the places that have the least are the places that need the ham communications the most.

Each year there are thousands of "Sun Birds" who drive

south for the winter and back north for the summer. Of the thousands, I am sure that there are some hams who would be glad to stop and spend a few days helping a would-be ham, if we could just get the giver and receiver together. There should be a column in a magazine where they could write and publish their names and addresses. They would need a place to park a trailer, camper, or motor home. I know this works because I spent 5 days out on the road in Alaska with a Novice. At the end of the week, he went into Anchorage and upgraded to General.

William E. Johnston W6NYK
Tecopa CA

P.S. I am spending my spare time, while out here in the desert, teaching a Novice class at the Death Valley High School at Shoshone CA.

HAM HELP

I wanted to let you know that *73 Magazine* is about the best in its field, if not the tops. I particularly enjoy the construction projects, even though I am handicapped.

A terrible thing happened. One gentleman answered one of my "Ham Help" pleas and a nurse (or myself) lost all of the info except that I believe it was a WD call from (I believe) the southeast. I hope that that OM, as well as others, will read this and call or write to me.

Special thanks to the *73* staff for researching an article on a simple IC keyer circa 1973. I really appreciate the effort . . . it is above the call of duty and *73* is the only magazine that has done that for me.

John C. White WB6BLV
560 N. Indiana St.
Porterville CA 93257

VP1 QSLS

The Kansas City DX Club will have operated from VP1-land before, during, and after the 1980 ARRL DX Phone Contest. Our club call was VP1A. QSL to WB0TNY, Box 4798, Overland Park KS 66204. Following are other calls used and where to QSL them: VP1AB/W0AR; VP1RLB/WB0TNY; VP1SWC/KA0BCW; VP1DD/W0AWA; VP1NLB/W0FNO; VP1CS/K0CS; VP1SAR/WB0ISW; VP1WG/W0DEL.

Rick Barnett WB0TNY
Overland Park KS

JUNK BOX HAM

I have tried a couple of your antenna projects with good results. The "Balun for a Buck" was really a saver. Being an old "junk-box" ham, I guess I enjoy making something work out of things discarded.

Please keep the issues coming. Thank you.

Harold L. Allison W5CZP
Paragould AR

Microcomputer Interfacing

from page 22

devices and the CPU. These signals are $IO/\overline{M}$, $\overline{RD}$, and $\overline{WR}$. The $IO/\overline{M}$ signal is used to indicate what type of device the 8085 is attempting to communicate with; logic 1 = I/O devices and logic 0 = memories. The $\overline{RD}$ and $\overline{WR}$ signals coordinate the reading or writing of data, respectively. These three signals are used directly by the 8085-compatible memory and I/O devices such as the 8155 and 8355. In other systems, you may have to use these signals to generate the $\overline{MR}$, $\overline{MW}$, $\overline{IN}$, and $\overline{OUT}$ signals that we have discussed and used in previous columns. The necessary gating is shown in Fig. 2.

In almost all 8080-based systems, interrupts are implemented with an interrupt instruction port and restart instructions. The 8085 has four new interrupts that have been implemented on the chip. These are summarized in Table 1. The overall priority from highest to lowest is as follows: TRAP, RST 7.5, RST 6.5, RST 5.5, and INT. The INT input is the normal 8080-like interrupt input. These interrupts have their vector addresses placed within the address space 000 000 to 000 100, as is the case with the "normal" 8080 interrupts. Some of these addresses are placed between the usual 8080 vector addresses, leaving only four bytes of storage space between interrupt vector addresses. Most programmers will use jump instructions to point to areas of memory that will allow for longer interrupt service programs. These new interrupts act in the same manner as the normal 8080-like interrupts, so a stack is still a necessity. If these interrupt inputs are not to be used, we suggest grounding them.

The 8085 also has a single input pin and a single output pin on the chip that can be controlled directly by software. Of course, the 256 addressable I/O port capability is still maintained. The two single I/O connections may be used for a single sense input and a single control output. They could also be used for serial I/O to a terminal or a teletypewriter, with the actual serialization being done in software.

There are two new, one-byte instructions that are implemented in the 8085. These allow you to manage the new interrupts and the two I/O lines SID and SOD, Serial Input Data and Serial Output Data. These Instructions are Set Interrupt Mask (SIM = 060) and Read Interrupt Mask (RIM = 040). The A register is used as the source or the destination of the data bytes for each operation. This is shown in Table 2.

These instructions are powerful, since they allow you to select certain devices for interrupts, check interrupts, and control an input and an output line. Remember, these instructions do not affect other 8080-type operations, except that the A register or accumulator is used.

These new functions mean that a small microcomputer-based controller can be configured with a few integrated circuits. You will see how this is done, and how 8085-compatible chips are used, in future columns.

Ham Help

I need answers to the following:

- I have a TRS-80 and M-80 interface connected to a FT-101EX. When the cables are connected, there is S-9+ rf interference on my receiver. Is there any way to isolate the TRS-80 from the receiver to stop the rf pickup?
- Is there anyone who has been able to figure out how to use a frequency counter as a display readout for the FT-101?
- Is there anyone with information on using the TRS-80 for SSTV?
- Is there anyone out there who has any information on PC boards and home-brew information on building SSTV monitors, or who has an old monitor which they would like to pass on at a fair price?

Thanks for any help.

John J. Apoka
DA2AW/WB5YHO
HHC 503 AVN BN
APO NY 09165

I need information, schematics, service manuals, etc., on a 713A Power Lab power supply manufactured by Precise Electronics, Mineola NY.

I will pay for reproducing and shipping. Thank you.

Bill Rhoades WD0FRB
Rt. 3, Box 89B
Northfield MN 55057

My friend, Linda, says she would get a ham license if she could talk to people about her interests. In particular, she would like to know if there is an astrology net.

Phil Hughes WA6SWR
PO Box 2047
Olympia WA 98507

I am interested in becoming a radio operator. Does anyone know of any radio classes near me?

Herbert E. Scott
84 Torrey St.
South Weymouth MA 02190

Social Events

from page 52

Talk-in on 146.52 simplex and the local repeater (147.03).

MAUMEE OH
MAR 23

The Toledo Mobile Radio Association will hold its 25th annual auction and hamfest on Sunday, March 23, 1980, at the Lucas County Recreation Center, Key Street, in Maumee, Ohio. Hours are from 8:00 am to 5:00 pm. The free auction starts at 10:00 am. There will be ample free parking all day and overnight. Tickets are $2 in advance and $3 at the door. Flea-market tables are available and displays are limited to electronics and ham gear. There will be commercial exhibits, door prizes, refreshments, and a big raffle—all inside. Prizes include a Kenwood TS-120S with power supply, a Kenwood TR-2400, a Hy-Gain TH3 MK3 3-element tribander beam, and many more. There will be an additional ladies' program. Bring your YL, XYL, or OM and make a day of it. Talk-in on 146.52/52. Area repeaters are 146.01/61, 146.19/79, 146.34/94, 147.87/27, and 147.975/375. For additional information, write: T.M.R.A., Inc., PO Box 24, Temperance MI 48182.

CENTREVILLE MI
MAR 23

The Amateur Radio Public Service Association will hold its annual hamfest on Sunday, March 23, 1980, at Glen Oaks Community College, Shimmel Road, Centreville MI. Doors open at 7:00 am. Tickets may be purchased in advance or at the door for admission and door prizes. Donation in advance is $1.50, and $2.00 at the door. Table reservations are $2.00 per full table. Talk-in on 146.66/.06 or 146.52. For further information and table reservations, contact Sharon Tilbury KA8EGJ, 607 Oak St., Three Rivers MI 49093, phone (616)-273-8301, or Dave McClain WD8RGR, 13926 Riverside Drive, Constantine MI 49042, phone (616)-435-7422.

MUSKEGON MI
MAR 28-29

The Muskegon Area Amateur Radio Council will sponsor the ARRL Great Lakes Division Convention and Hamfest at Muskegon Community College on March 28-29, 1980. On Friday evening, March 28, the "Ham Hospitality" room is open to all at the Muskegon Holiday Inn. There will also be other entertainment that evening at the Inn. Saturday, March 29, doors and registration open at 8:00 am at the college. An interesting ladies' program will be presented as well as many other events. Saturday tickets are $2.50 each, with no advance or mail ticket sales. Swap and Shop table space may also be purchased on Saturday. Advance reservations are required for the Saturday dinner program. Overnight reservations should be made directly. For additional information, write to MAARC, PO Box 691, Muskegon MI 49443, or contact Clarke Cooper K8BP at (616)-865-6198.

SIOUX CITY IA
MAR 29

The 3900 Club of the Sooland Repeater Association will hold its 4th annual hamboree on Saturday, March 29, 1980, at The Oasis, Sioux City Airport, Sioux City, Iowa. Advance registration, including the banquet, is $6.75; $7.75 at the door. Tickets for the hamboree only are $2.00. Featured will be entertainment, exhibitors, a technical problems panel, a flea market, a CW contest, a Novice meeting, a 3900 Club quarterly meeting, technical programs, and a dinner banquet. Talk-in on .37/.97. For advance tickets and motel reservations, write to Loren Barbee WBØYOW, 1518 W. 30th, Sioux City IA 51103.

UPPER SADDLE RIVER NJ
MAR 29

The Chestnut Ridge Radio Club will hold a ham radio and computer flea market on March 29, 1980, at the Education Building, Saddle River Reformed Church, East Saddle River Road at Weiss Road (new site), in Upper Saddle River NJ. Tables will be available for $5.00; tailgating $3.00. There is no admission fee. Food and drink will be available. For further information, contact Jack Meagher W2EHD, (201)-768-8360, or Neil Abitabilo WA2EZN, (201)-767-3575.

STUART FL
MAR 29

The Martin County Amateur Radio Association will hold its annual Stuart Hamfest on Saturday, March 29, 1980, from 8:00 am to 4:00 pm at the Knights of Columbus Hall. (From Route 1 in Stuart, go 6 miles southwest on State Road 76 to Gaines Ave.) Admission is only $1.00 and swap tables will be $5.00. For table reservations or other info, please contact Matt De Carlo KA4GPY, 1900 Palm City Rd., 35-F, Stuart FL 33494, (305)-283-1466.

MENTOR OH
MAR 30

The Lake County Amateur Radio Association will hold its second annual Lake County Hamfest on Sunday, March 30, 1980, at Mentor High School, Mentor OH. The new location includes easy access, over 20,000 square feet, indoors, heated, on one floor, and 200 commercial and flea-market tables available. Doors open to exhibitors at 6:00 am and to the public at 8:00 am. Auction action begins at 12:00. Door prizes will be given away hourly. A computer raffle drawing will be held at 3:00. For county hunters and other collectors of rare and exotic places, special event station WD8IVL will be on the air from 1300-2100Z Saturday and Sunday near 7.25 and 21.375 MHz. Special commemorative QSLs and certificates will be issued. Tickets are $3.00 at the door; $2.50 in advance. For further details, send an SASE to LCARA Hamfest Committee, 37778 Lakeshore Blvd., Eastlake OH 44094, or call (216)-953-9784.

TIMONIUM MD
MAR 30

The Baltimore Amateur Radio Club will hold its greater Baltimore Hamboree and Computerfest on March 30, 1980, at the Maryland State Fairgrounds, just off I-83, 2 miles North of I-695, Timonium, Maryland. There will be plenty of space for dealers, displays, tables, and commercial exhibits. Special events, lectures, and demonstrations will be held. Food service will be provided. There will be acres of space for tailgate sales. Door prizes will be awarded throughout the day. Admission is $3.00 and tables are $5.00. Talk-in on the BARC repeaters, 146.07/.67 and 146.34/

.94. For additional information, tickets, and space reservations, please write to Joseph A. Lochte, Jr., 2136 Pine Valley Drive, Timonium MD 21093, or for a recorded message, dial (301)-HAM-TALK.

ROCHESTER MI
APR 12

The Rochester Amateur Radio Club and the Rochester Repeater Society will sponsor the Rochester Area Hamfest on Saturday, April 12, 1980, at St. John's School gymnasium, 490 W. Center St., Rochester MN. Doors will open at 8:30 am. There will be a large indoor flea market for radio and electronic items, prize raffles, refreshments, and plenty of free parking. Talk-in on 146.22/.82 (WR0SFT). For further information, contact RARC, WB0YEE, 2253 Nordic Ct. N.W., Rochester MN 55901.

WELLESLEY MA
APR 12

The Wellesley Amateur Radio Society will hold its annual auction on Saturday, April 12, 1980, beginning at 11:00 am at the Wellesley High School cafeteria on Rice Street, Wellesley MA. Talk-in on .63/.03, .04/.64, and .52. Doors open at 10:00 am. For further information, contact Kevin P. Kelly WA1YHV, 7 Lawnwood Place, Charlestown MA 02129.

MADISON WI
APR 13

The Madison Area Repeater Association, Inc. (MARA), is pleased to announce its eighth annual Madison Swapfest which will be held on Sunday, April 13, 1980, at the Dane County Exposition Center Forum Building in Madison WI. Doors will be open at 8:00 am for sellers and exhibitors and at 9:00 am for the public. Commercial exhibitors and flea-market vendors will provide a large variety of equipment and components for hams, computer hobbyists, and experimenters. Door prizes will be awarded. An all-you-can-eat pancake breakfast and a barbecue lunch will be available, as well as free movies throughout the day. Admission is $2.50 per person in advance and $3.00 at the door. Children twelve and under are admitted free. Tables are $4.00 each in advance and $5.00 at the door. Be sure to reserve tables early as tables were sold out last year. Talk-in on WR9ABT, 146.16/.76. For reservations, write to MARA, PO Box 3403, Madison WI 53704. For further information, contact Dick Victor WD9GRI, 2314 Rowley Avenue, Madison WI 53705, phone (608)-266-3527 (days) or (608)-238-0153 (evenings and weekends).

DAYTON OH
APR 25-27

The Dayton Amateur Radio Association, Inc., will hold its Hamvention on April 25-27, 1980, at the Hara Arena and Exhibition Center, Dayton OH. Admission is $5.00 in advance; $6.00 at the door. Flea-market space is $11.00 in advance; $14.00 at the gate. The Saturday evening banquet will be $12.00 in advance; $14.00 at the door. Senator Barry M. Goldwater K7UGA will be the banquet speaker. For additional information, write Box 44, Dayton OH 45401, or phone (513)-296-1165 5:00-10:00 pm EST. For special motel rates and reservations, write to Hamvention Housing, 1980 Winters Tower, Dayton OH 45423. There will be no reservations accepted by telephone. Make checks payable to: Dayton Hamvention, Box 333, Dayton OH 45405.

DE KALB IL
MAY 4

The Kishwaukee Radio Club and the De Kalb County Amateur Repeater Club will hold their annual indoor/outdoor hamfest on Sunday, May 4, 1980, from 8:00 am to 3:00 pm at the Notre Dame School (3 miles south of De Kalb, between Highway 23 and South 1st Street on Gurler Road). Tickets are $1.50 in advance and $2.00 at the door. Indoor tables are available, but if you bring your own, the setup is free. Talk-in on 146.13/.73 and .94 simplex. For further information, send an SASE to Howard WA9TXW, PO Box 349, Sycamore IL 60178.

GREEN BAY WI
MAY 10

The Green Bay Mike and Key Club will hold its swapfest from 8:30 am to 3:30 pm on May 10, 1980, at the Ashwaubenon Recreation Center. Admission will be $1.50 advanced and $2.00 at the door. Food and beverages will be served. There will be drawings for door prizes. For more information, contact Bob Duescher KA9BXG, 1011 13th Ave., Green Bay WI 54304. Talk-in on .72/.12.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

radio, but it is annoying to hear that people have been sent out to tell ham clubs that I am intending to kill amateur radio. That's not consistent with their claim that I'm trying to make big bucks out of amateur radio . . . but then who is nitpicking about consistency?

The proposed new bands sound good . . . and I'm glad to see them getting more possible. I do hope that the credit for them goes where it belongs, which I think is with Prose Walker. He was the first one I ever heard propose them and I think we should set up a statue somewhere for his part in this accomplishment. Of course, with the projected date for the ham opening of these bands being 1989, we are not going to get a lot of immediate benefit. One hopes that hints that the U.S. will be able to forestall the promised shortwave broadcast WARC now set for 1985 will pan out. And if the U.S. is not able to pull this off, then the next hope is that we won't lose those new bands even before we get them. Leave it to me to be a worrywart.

It was not only amateur radio that made out like a bandit at WARC. Most of the shortwave users had gone into the conference with their fingers crossed and hoping for the best . . . but not expecting it. The recently past ITU meetings had been so filled with politics and strictly political decisions on frequencies that there were many expressions that this might well be the last ITU meeting. Indeed, if the African countries had continued with the course they had set with the satellite and marine conferences, this was a distinct possibility.

My input from those who participated at WARC was that for some reason, after the first few days, the Third World countries didn't get into further political lathers and all went incredibly smoothly. There are, of course, possibilities for trouble later on, but the consensus of opinion is that all will run as planned If no one upsets the boat with rhetoric.

The shortwave broadcast conference scheduled for a few years hence will probably not entail frequency allocation hassles. The countries will be getting together to decide such matters as whether to shift to single sideband broadcasting, whether some limits should be placed on simultaneous broadcasting on several wavelengths, and administrative matters.

Should the SW broadcasters change to sideband, we might start getting more hams entering the hobby. Before CB, much of the entrance to amateur radio was via shortwave listening. After a few months of tuning in the BBC and Radio Moscow, one finds that, boring as they sometimes are, most of the interesting shortwave action is in the ham bands. A bit of listening and one starts thinking about participation . . . and soon we have a new ham in our ranks.

Since many of the telecommunications people in Third World countries are hams, it is incumbent upon all of us to watch our remarks and to present as good a face to the world as we can. Recent organized attempts to put down African countries as cannibals and Asians as chinks is about as far as one can get from the true spirit of amateur radio . . . though it may appeal to a few Americans with serious inferiority complexes.

You'll be hearing some stories about Geneva being expensive . . . and it is. I visited there recently and it is certainly a little worse than New York . . . but not much. Something goes wrong with some people when they are on an expense account. In business we watch for this syndrome and make sure that people are on very controlled expense accounts. The government has a similar approach. I should think that $100 a day or so would be a reasonable expense for Geneva and much beyond that should call for an investigation by the tax people.

EXTRA CLASS OPPORTUNITY

When the promised new bands are finally available, I would suggest that they be restricted to Extra class licensees. This might, for the first time, offer something of value instead of a callsign change and make this class of license worthwhile. It might even get *me* to move up to Extra.

As I've mentioned before, I am perhaps unusual in that I will generally do just about anything for people who ask . . . and fight to the last ditch when people demand. The FCC's approach to forcing me to go for my Extra in order to get back frequencies I had before still has me resisting stubbornly. I don't want any new call. I've had W2NSD for some 40 years now and I like it, so the FCC can jam the Extra class license as far as I'm concerned.

I still have a disbelieving feeling that something will go wrong before we get any new bands, but should they come along and should they be made an Extra class preserve, I probably would rumble down to the FCC and upgrade.

MEANWHILE

With some assurance of stability in our shortwave bands, we can lay some plans for expanding and improving amateur radio. My own ideas for developing better communications do lie a good deal with mating amateur radio and computers. For instance, wouldn't it be nice if we could get away from the present ghastly systems for working rare DX?

Yes, I know that a few of the *big guns* enjoy the pileup method of working DX. They have the huge towers, big beams, and enormous power amplifiers to whomp on top of the rest of us and get through first. But the pileup system ends up with very few stations being contacted per hour. There certainly must be a more efficient system. After all, if rare DX stations could get the instant contacts out of the way, they could spend a little more time talking and perhaps enjoying amateur radio more. It gets to be a bloody pest to be hounded by DX QSL card seekers *every* time you get on the air.

The list system is not much better. A bit faster, but still slow. I think we can come up with a system which will be fast and fun . . . and which will have a lot of side benefits which will more than repay us for the extra processing equipment we will have to build or buy to keep up. I'll be discussing the details of some proposed systems first with the ham manufacturers and then, once the system is decided upon, we'll be pushing through the magazine for fast development of the idea and its use all over the world.

If I can get even a couple of my ideas into action within the next few years, I promise you that amateur radio will be more fun than anything you've seen yet. You enjoyed FM and repeaters, didn't you? Wait for the next step.

NOVEMBER WINNER

To no one's real surprise, "The Satellite TV Primer" was voted November's most popular article, so author Bob Cooper W5KHT will receive our **$100** bonus check.

Ham Help

For research purposes, I wish to contact anyone who has operated from a country listed on the ARRL Deleted Countries (DXCC) List. Thank you.

Gary Mitchell WA1GXE
Box 1003
Fairfield CT 06430

The East Valley ARC needs equipment for aspiring amateurs and upgraders. All members of the club are disabled. Please contact me, the station trustee, at the address below. Any gear or help will be appreciated. Thanks.

John C. White WB6BLV
East Valley ARC
Box 1809
Porterville CA 93258

Does anyone have any information on modifying the Yaesu CPU-2500R to automatically resume scanning after the absence of a signal?

Mike Larson WDØEZK
Box 307
Stanhope IA 50246

propagation

by
J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	14	7A	7	7	7	7	7	14	14	21	21A
ARGENTINA	21A	14	14	14	7	7	21A	21A	21A	21A	21A	21A
AUSTRALIA	21A	21	14	7B	7B	7B	7B	14B	14	21	21A	21A
CANAL ZONE	21A	14	14	7A	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7A	7	7	7	7	7	14	21A	21A	21A	14A	14
HAWAII	21A	14	14	7	7	7	7	7	14	21A	21A	21A
INDIA	7A	7A	7B	7B	7B	7A	14	21	14A	14	14	7A
JAPAN	21	14	7B	7B	7B	7B	7	7B	7B	7B	14	21
MEXICO	21	14	7	7	7	7	7A	21	21A	21A	21A	21A
PHILIPPINES	21	14	7B	7B	7B	7B	7B	7B	7	14	14	14A
PUERTO RICO	14A	14	7A	7	7	7	14	21	21A	21A	21A	21
SOUTH AFRICA	14	14	7	7B	7B	14	21A	21A	21A	21A	21A	21A
U. S. S. R.	7B	7	7	7	7	7B	14	21A	21A	21	14	7B
WEST COAST	21A	14A	7A	7	7	7	7	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	14A	14	7	7	7	7	7	14	14	21A	21A
ARGENTINA	21A	21	14	14	7	7	14	21A	21A	21A	21A	21A
AUSTRALIA	21A	21A	21	14	7B	7B	7B	7B	14	21	21A	21A
CANAL ZONE	21A	14A	14	7A	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7A	7	7	7	7	7	7B	14	21A	21A	14A	14
HAWAII	21A	21A	14	7	7	7	7	7	14	21A	21A	21A
INDIA	14	14	7B	7B	7B	7B	7B	7A	14	14	14	14
JAPAN	21A	21	14	7B	7B	7B	7	7	7	14B	14	21A
MEXICO	21	14	7	7	7	7	7	14	21	21A	21A	21
PHILIPPINES	21A	21	14	7B	7B	7B	7B	7B	7	14	14	21
PUERTO RICO	21	14	14	7	7	7	14	21A	21A	21A	21A	21A
SOUTH AFRICA	14	14	7	7B	7B	7B	14	21A	21A	21A	21A	21A
U. S. S. R.	7B	7	7	7	7	7B	7B	14	21	14	14B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	21	14	7	7	7	7	7	7A	14A	21	21A
ARGENTINA	21A	21A	14A	14	14	7	7B	14	21A	21A	21A	21A
AUSTRALIA	21A	21A	21A	21	14	14B	7B	7B	14	21	21A	21A
CANAL ZONE	21A	21	14	7A	7	7	7	14A	21A	21A	21A	21A
ENGLAND	7A	7	7	7	7	7	7B	7B	14	21A	14A	14
HAWAII	21A	21A	21	14	7A	7	7	7	14	21A	21A	21A
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	21A	21A	21	14	7B	7B	7	7	7	14	14	21A
MEXICO	21A	21	14	14	7	7	7	14	21A	21A	21A	21A
PHILIPPINES	21A	21A	21	14	7B	7B	7B	7B	7	14	14	21A
PUERTO RICO	21A	14A	14	7	7	7	7	14A	21A	21A	21A	21A
SOUTH AFRICA	14	14	7	7B	7B	7B	7B	14	21A	21A	21A	21A
U. S. S. R.	7B	7B	7	7	7	7B	7B	7B	14A	14	14B	7B
EAST COAST	21A	14A	7A	7	7	7	7	14	21A	21A	21A	21A

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

march '80

sun	mon	tue	wed	thu	fri	sat
						1 G
2 G	3 G	4 F/SF	5 F/SF	6 F/SF	7 F	8 F
9 G	10 G	11 G	12 G	13 G	14 P/SF	15 F
16 F	17 F	18 F	19 G	20 G	21 G	22 G
23 30 G/G	24 31 F/F	25 G	26 G	27 G	28 G	29 G

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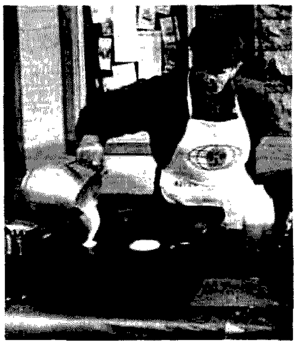
the ham business . . . past, present, and projections for the future.

The big event was my discussion of three proposed new modes of ham communications for the 80s and a new type of ham gear construction which would be geared to the new modes . . . and to working with microprocessors. The firms represented signed non-disclosure contracts which give those signers a six-month minimum lead over other firms toward design-

Continued on page 163

Other toys which Chuck brought along were a couple of the latest Sony stereo players, complete with earphones. The quality of the sound is beyond belief and these were very popular while skiing. Here's Curt getting an earful of Scott Joplin via the Sony during one of our workshop dinners. This, by the way, was at the Copper Kettle restaurant and our waiter was WB0FOR, as in past years. Curt is one hell of a skier . . . and his wife Marge does well, too.



Some of our people opted for breakfast on the sidewalk . . . despite the chilly temperature. Here we see pancakes being poured . . . part of the celebration of Winterskol each January. Actually, it wasn't all that cold, with temperatures into the 40s some days, making skiing hot work. We often find Aspen awash in slush in January, but

Here's Curt Childress W0MNK, the president of Midwest Scientific Industries, coming down the slope at Tiehack on Buttermilk at 42 mph. He is being timed by Eric Williams WA1HON. The radar speed detector is the same as the ones being advertised by JS&A and it works very well indeed. Chuck Martin WA1KPS, the president of Tufts Electronics, had brought the radar unit so we could damned near kill ourselves trying for higher and higher speeds.

Marshall on the left, Sandy Cole K1SC (who comes from my home town, Littleton, New Hampshire, and now lives in Tucson), Jim, Eric, and Chuck. Splendid meal at the Chart House restaurant in Aspen. Note the four HTs on the table . . . par for the course.

Despite rather substantial breakfasts, as well as lunches and dinners, I managed to go home lighter than I arrived in Aspen. This was

RTTY Loop

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

We started looking at some published designs for demodulators last month and covered several which represented the "state of the art" up to the mid-'60s. This month, we will continue to move forward through time and see what progress has wrought.

Designs covered so far were either complex tube types or very simple semiconductor circuits. In August, 1967, *73* published an article by Ken Kokjer KØJXO/9 which used the then-new silicon-controlled rectifier (SCR) as the keying element in his solid-state demodulator. Shown in Fig. 1, the basic design is pretty much as earlier units, with diode limiters, amplification, and non-toroidal inductors used for the filters. However, instead of a high-voltage transistor or tube being used to key the loop, two SCRs are used to form the keying pulses. Certainly a unique application!

Transistors were fine, but the advance of technology brought another new device to our benches: the integrated circuit. The earliest ICs to reach us were linear, i.e., not digital, ICs, called "operational amplifiers" or "op amps." In July, 1969, *73* published an article by C. W. Andreasen WA6JMM which presented one of the first RTTY applications of ICs. This demodulator, diagrammed in Fig. 2, used two ICs, one as an amplifier in the front end and a "710" comparator to decode and feed the pulses to the keying transistor. This is a simple compact unit that appears to perform reasonably well under most conditions. With just two ICs, two toroids, and a few other components, it is quite a bit in a small package.

Integrated circuits were firmly entrenched over the next few years, and more and more projects used them. Complexity grew, and we can see how much by looking back just a few years to the August, 1976, issue of *73* where Bernd Grossman DL2SX/ZS6GG and John S. Reid ZS6JR described their "Safari RTTY Terminal." Take a deep breath and give a look at Fig. 3! Now, we are up to a handful of ICs, transistors, and other odds and ends. What we end up with is a reasonably compact and efficient terminal unit that includes an AFSK generator. Again, op amps are used throughout as both amplifiers and comparators. If you are interested in working with this circuit, the referenced article shows both printed circuit layouts and describes test and setup procedures.

I can't close this month's survey with the monster mentioned above, so take a look at Fig. 4. Yes, this two-IC, one-transistor wonder is an honest-to-goodness demodulator, described by Allan S. Joffe W3KBM in the September, 1976, issue of *73*. Now, with a circuit this simple, you might suspect there is some skulduggery in order to copy RTTY, and there is. This demodulator is set up to decode only the space tone. When it gets a space, it opens the loop. On mark or no signal, the loop is closed. This simulates "markhold" and allows copy on any reasonably clear signal.

Next month we will conclude our look at terminal units with a couple of recent designs. I have picked out a few that span the gap from super simple to complex and complicated. Hope you enjoy them!

Now, turning to a feature that many of you enjoy, let's look in the mailbag. Diane Deibert WA6MVD of Sunnymead, California, writes in concerning the transmitting program for the 6800 published in the July, 1979, issue of *73*. She notes that the stack load address, $A070, interferes with her dual floppy system. Well, Diane, this is merely the address that the stack pointer is set to in order to preserve the program counter. In a nondisk system, this permits reentry into the program after a reset or other exit merely by typing a "G". If you are going to store this program on disk, you will want to assign a "transfer address" in order to begin exe-

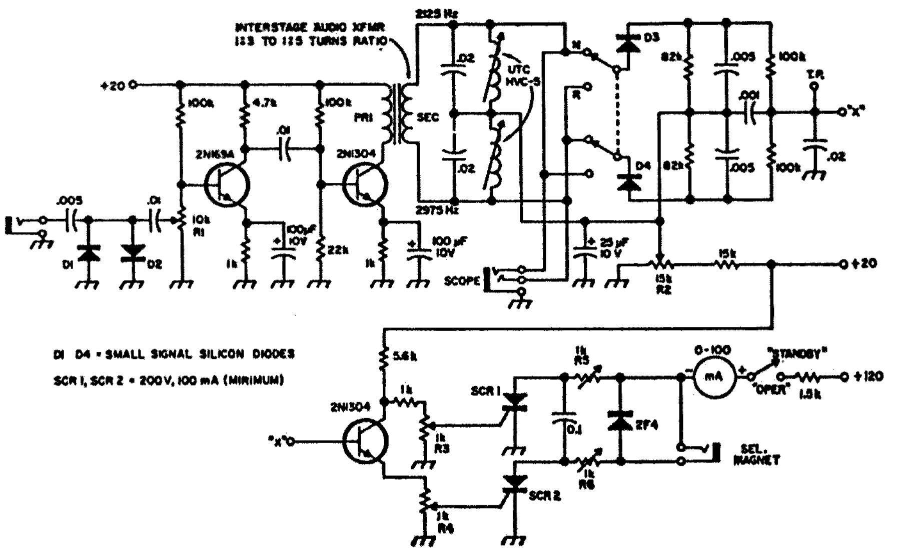


Fig. 1.

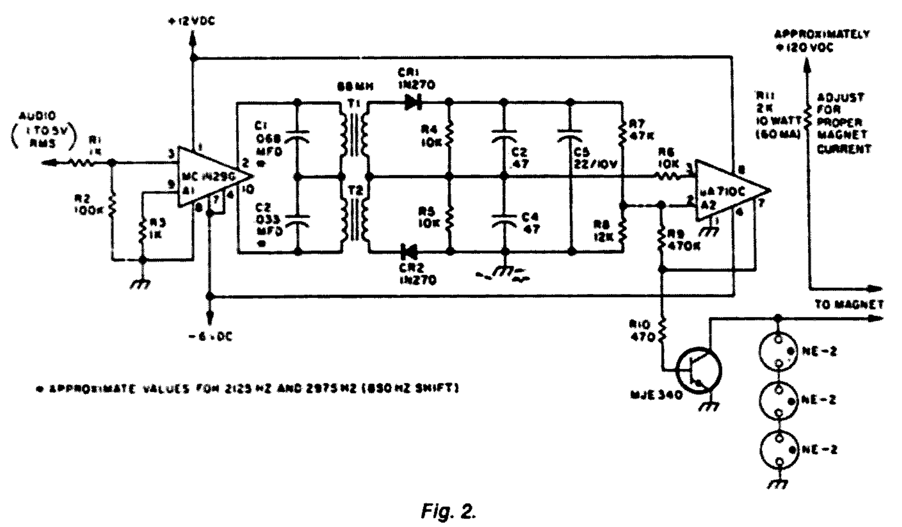


Fig. 2.

Continued on page 138

Contests

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

QRP ARCI ANNUAL QSO PARTY
Starts: 2000 GMT April 5
Ends: 0200 GMT April 7

The contest is open to all amateurs and all are eligible for the awards. Stations may be worked once per band for QSO and multiplier credits.

EXCHANGE:

Members—RST, state/province/country, and QRP number.

Non-members—RST, state/province/country, power input.

SCORING:

Each member QSO counts 3 points. Non-member QSOs are 2 points and stations other than W/VE count 4 points each. Multipliers are as follows: more than 100 Watts input—x1; 25-100 Watts input—x1.5; 5-25 Watts input—x2; 1-5 Watts input—x3; less than 1 Watt input—x5. Final score is total QSO points times total number of states/provinces/countries per band times the power multiplier.

FREQUENCIES:

Novice—3710, 7110, 21110, 28110.

SSB—1810, 3985, 7285, 14285, 21385, 28885, 50385.

CW—1810, 3560, 7060, 14060, 21060, 28060, 50360.

AWARDS:

Certificates to the highest-scoring station in each state, province, or country. Other places will be given depending on activity. One certificate for the station showing three "skip" contacts using the lowest power.

LOGS & ENTRIES:

Send full log data, including full name, address, and bands used plus equipment, antennas, and power used. Entrants desiring results sheet and scores, please enclose a business-size envelope with return postage. Logs must be received by April 30th to qualify. Send all logs and data to: QRP ARCI Contest Chairman, Edwin R. Lappi WD4LOO, 203 Lynn Drive, Carrboro NC 27510.

COUNTY HUNTERS SSB CONTEST
Contest Periods:
0100 to 0800 GMT April 12
1200 GMT April 12 to 0800 GMT April 13
1200 to 2400 GMT April 13
Please note the two 4-hour rest periods.

Mobiles may be worked each time they change counties or bands. Mobiles that are worked again from the same county on a different band count for point credit only. Mobiles that are contacted on a county line count as one contact but 2 multipliers. Fixed stations may be worked by other fixed stations only once during the contest. Repeat QSOs between fixed stations on other bands are not permitted. Fixed stations may be worked by mobiles each time they change counties or bands. Repeat contacts between mobiles are permitted provided they are on a different band or from a different county. Mixed-mode contacts are permitted provided that one station is on SSB. Contacts made on net frequencies will not be allowed for scoring in this year's contest.

EXCHANGE:

Signal report, county, and state or country.

FREQUENCIES:

Suggested frequencies are as follows: 3920-3940, 7220-7240, 14275-14295, 21375-21395, 28575-28595.

There will be a "Mobile Window" of 10 kHz on the following frequencies: 3925-3935, 7225-7235, 14280-14290.

Mobiles will be in this 10-kHz segment and fixed stations are asked to refrain from calling "CQ Contest" in the mobile window. After working mobiles in the window, fixed stations are requested to QSY outside the window to work fixed stations in the contest. This will allow the mobiles running lower power a chance to be heard and worked in the contest.

SCORING:

Contact with a fixed US or Canadian station = 1 point. Contact with a DX station (KL7 and KH6 count as DX) = 5 points. Contact with a mobile station = 15 points. The multiplier is the total number of US counties plus Canadian stations worked. The final score is this multiplier times the total QSO points.

AWARDS:

MARAC plaques to the highest-scoring fixed US or Canadian station, DX station, and top 2 scoring mobile stations. Certificates to the top 10 fixed and mobile stations in the US and Canada and to the highest-scoring station in each DX country.

ENTRIES:

Logs must show date and time, station worked, reports exchanged, county, state, band, and claimed QSO points (1, 5, or 15), and each new multiplier must be numbered. Logs and summary sheets are free for a #10 SASE or SAE and appropriate IRCs. Write to: John Ferguson WØQWS, 3820 Stonewall Ct., Independence MO 64055. All entries must be received by June 1st to be eligible for awards. DX entries should use air mail. Winners will be announced at the 1980 Independent County Hunters Conven-

Continued on page 154

Calendar

Apr 5-6	ARRL Open CD Party
Apr 5-7	QRP ARC International QSO Party
Apr 8-9	DX to North American YL—Phone
Apr 12-13	County Hunters SSB Contest
Apr 15-16	DX to North American YL—CW
Apr 19-20	YL International SSBers QSO Party—Phone
Apr 19-20	ARRL EME Contest I
Apr 26-27	Helvetia Contest
May 3-4	SENARC Totem Pole Contest
May 10	DARC Corona 10-Meter RTTY Contest
May 17-18	Florida QSO Party
May 17-18	ARRL EME Contest II
May 17-19	Massachusetts QSO Party
May 24-25	CQ Worldwide WPX Contest—CW
Jun 14-15	ARRL VHF Contest
Jun 28-29	ARRL Field Day
Jul 12-13	IARU Radiosport Championship
Aug 2-3	ARRL UHF Contest
Aug 9-10	European DX Contest—CW
Sep 13-14	European DX Contest—Phone
Sap 13-14	ARRL VHF Contest
Sep 13-15	Washington State QSO Party
Sep 14	North American Sprint
Sep 27	DARC Corona 10-Meter RTTY Contest
Oct 4-5	California QSO Party
Oct 4-5	ARRL Simulated Emergency Test
Oct 11-12	ARRL CD Party
Nov 1-2	ARRL Sweepstakes—CW
Nov 8-9	European DX Contest—RTTY
Nov 9	International OK DX Contest
Nov 15	DARC Corona 10-Meter RTTY Contest
Nov 15-16	ARRL Sweepstakes—Phone
Dec 6-7	ARRL 160-Meter Contest
Dec 13-14	ARRL 10-Meter Contest

Results

YL HOWDY DAYS, 1979

Score	*Call*	*Name*	*YLRL Member*
156	WB2OHD	Peggy Arciero	yes
115	DL4GA	Christa Elksnat	non
114	DL1MS	Juliane Schuhegger	yes
107	WD4NKP	Martha King	yes
98	WA2NFY	Lia Zwack	yes
85	K4RNS	Marge Campbell	yes
80	G4GAJ	Mary Adams	yes
79	DK9ZL	Ella Grindel	yes
71	N2LA	Joyce Euart	yes
71	DF2KG	Ursel Weiskirchen	yes

Leaky Lines

Dave Mann K2AGZ
3 Daniel Lane
Kinnelon NJ 07405

Now that WARC is over, what happened to all those dire predictions we heard on all sides? The conference ended without any acrimony or major disagreements. And the fight that had been expected between the have countries and the have-not countries never did materialize. Even on the question of orbital frequency slots, since no substantive compromise could be reached, the matter was simply tabled for the future.

There were no particularly vigorous moves to deprive amateur radio of present frequencies; the conference did little to revise present allocations. On the whole, we fared better than other services. In fact, we won a significant victory in that a proposal to deprive us of the 7100-7300 kHz portion of the 40-meter band failed to carry. Moreover, an explicit resolution was adopted, prohibiting fixed services from operating on the 7000-7100 kHz segment and enjoining those who are presently using it from continuing to use it.

As expected, this prohibition was vigorously opposed by the USSR and some of its stooges, but the Region 2 nations stood solidly together on the issue. Although it was somewhat in doubt until almost the adjournment of the conference, it was finally resolved in our favor, and we did not lose the 7100-7300 kHz portion.

From the amateurs' point of view, the most significant change is the new allocation of frequencies in the 10-, 18-, and 25-MHz bands. But it will take a number of years before we can use them, since the fixed stations now operating there must be assigned new frequencies.

One highly important result was the realization that all the paranoia that was expressed in various quarters concerning prejudice against amateur radio proved groundless. The gloomy predictions never did materialize. Prior to the conference, we were warned over and over again that anti-ham interests were sure to stampede the delegates into taking frequencies away from us. Dire and dreary pronunciamentos appeared in all the magazines and were a constant topic of pessimistic conversation on our bands. The apprehensiveness was palpable; you could hardly broach the subject of WARC without hearing someone echoing those catastrophic bleatings of Henny Penny: "The sky is falling down!"

It was completely unjustified. The conference demonstrated no marked anti-ham bias, and amateur radio did not suffer the fate predicted by all the "prophets of doom."

But it would be a serious error to interpret this as a lifetime guarantee. There will always be some element of danger, and it is far more sensible to be aware of potential peril than to underestimate the possibility of its existence. Thus, while the recent conference may not have lived up to its advance billing, there is always a likelihood that some subsequent conference may indeed act to our disadvantage.

This is a very good time to point out that far more amateurs must become involved and interested in more than the mere operation of their ham stations. They must take a more active role in their radio clubs, and they must make sure that they are well informed on all the legislative matters that may affect the hobby. We cannot afford complacence at any time, but it is particularly essential to avoid it at moments of triumph. For in this world of constant and illogical change, no victory can be considered permanent.

In a "Leaky Lines" of some eight years ago, I had occasion to quote a small piece of philosophy often uttered during my childhood by my mother. It goes: "When everybody is somebody, nobody is anybody!" It happens to be one of those epigrams which, like a provable mathematical equation, shines with the brilliance of the sun. Truth is the most irresistible force on Earth or in heaven; it cannot be contravened.

Why, you might ask, do I repeat my mom's little bon mot? Because we have now virtually come to a point in amateur radio when everybody is indeed somebody. Practically all of us *now* own linear amplifiers and directional antennas. And all but a relative few of us (and those are the ubiquitous non-conformists, rugged individualists, iconoclasts, and other hopeless idealists) are running all the power we can manage to generate . . . that is to say, all that we can manage to run without getting nabbed!

I do not wish to discuss the matter in terms of honesty or dishonesty . . . that is for others to concern themselves with. I merely want to point out that there is no absolute, demonstrable rule to prove that legally-powered stations are operated with efficiency and high quality of emission and that illegally-powered ones are operated just the opposite. In fact, it has often been my experience as an Official Observer that one sometimes hears the most abysmally poor audio quality . . . and frequency instability, key clicks, back wave, chirp, unsuppressed carrier, hash and hum . . . on transmitters which operate at or below the legal power limit. By the same token, one hears ultra-high-powered transmitters with audio so superlative that it might be coming from a broadcasting studio . . . with absolutely pure CW note . . . no hash, no hum, no carrier, no motor-boating.

It has always seemed to me that any definition of legality which is based solely upon dc input or output must leave something to be desired. It is as if they hired players for a band on the basis of the high polish of their instruments rather than their quality of musicianship . . . or they accepted ball players according to the way they looked in their uniforms rather than the way they could field and hit.

I know some hams who run high power (and I will never admit it or identify them under oath) who have never been guilty of deliberate interference or of rudeness and inconsiderate behavior on the air. And I know some who run below the legal limit who consistently interfere with others, either through deliberate intention or poorly adjusted equipment. It seems strange to me that the latter are permitted to continue without fear of penalty, while the former live under constant danger of discovery and punishment.

There is something terribly *wrong* with such a standard. We do not bar cars from our highways which are capable of great speed . . . the ordinary kitchen and bathroom contain substances toxic enough to cause death, but they are not outlawed . . . almost all of us carry in our pockets or handbags a single item that could cause a conflagration that could easily destroy a forest or a town—the ordinary match—but it is not declared illegal.

The operative criterion should be the manner in which all these things are used . . . or misused. The same criterion should be applied to radio gear. If I had the power to rewrite the radio regulations, I would make high power illegal only contingent upon absolute proof that it had been misused, and never on the single basis that it merely exceeded a given limit whose parameters had been arbitrarily set generations previously, when power was difficult to manage and equipment was inefficiently designed.

Recognizing that individual examples should never be used to substantiate general conclusions, I nonetheless must report that I have sometimes heard QRP stations running less than five Watts which emitted God-awful clicks which were audible fifteen and twenty kHz up and down the band.

I do not think that it is healthy for amateur radio when the principal violation in the eyes of those who enforce the radio regulations is high power. It is just as senseless as the view among certain police that high speed is the only basis for a traffic summons. What would happen if such a cop allowed cars with faulty brakes, bald tires, inoperable headlights, poor steering control, etc., to operate without regulation as long as they stayed within the speed limit?

High power, in and of itself, should not provoke a vendetta on the part of the licensing authority. Not unless it is used in such a way as to cause problems for others.

As I say, I have heard pairs of 8877s and 4-1000As which sound cleaner and far more acceptable than a single 6146 or sweep tube operated by some dumb space cadet driving the pants off it!

But don't get me wrong; I run an SB-220 . . . strictly legal. Hi!

LETTERS

AUTO-ALARM

I know you are interested in new things, so I thought I would write to tell you about the system which we have established in our county which provides 24-hour monitoring for emergency calls on the Goderich VE3GOD and Hensall VE3OBC two-meter repeaters. I call it the Auto-Alarm.

For several years, I have been testing different tone decoder/alarm devices which mobile stations in our rural area could use to summon help in an emergency late at night when no one is on the repeater. Our group found a suitable circuit and we have a dozen units in service at the homes of various amateurs. The alarm is not connected to the repeater in any way and requires no modification to the two-meter receiver to which it is connected. Cost is around $30.00. To my knowledge, ours was the first operational system in Canada.

I have established a standard tone and timing interval which is simple to generate and to decode but has good immunity to "falsing." I hope that this can become the Standard Canadian Auto-Alarm Tone (SCAAT).

To activate the alarm, one keys a tone of 941 Hz for 3 to 4 seconds over the radio channel. This is produced by pressing any 2 of the "bottom-line" Touchtone® digits—#, 0, or *. Once activated, the alarm remains latched on until manually reset.

I am presently working on a simple PLL single-tone encoder which will enable those without tone pads to access the alarm.

Other repeater clubs may wish to establish similar systems. A group in Saskatchewan has expressed interest in doing so. The London ARC has also introduced a version of the Auto-Alarm which uses the SCAAT. They have 25 operational units.

I propose that anyone setting up a system should use our established tone standard, as it would be much simpler than having a different tone and procedure for each area. In an emergency, it would be easy to forget the access tone and fail to summon help. If participating clubs coordinate this venture now before it expands, we will have few problems in the future with non-standard tones.

I have a collection of reference material on various tone-alarm circuits and am willing to answer any questions readers might have about an Auto-Alarm system. SASE, please.

Glenn F. McMichael VE3CGU
Box 231
Goderich, Ontario
Canada N7A 3Z2

CAN YOU TOP THIS?

Here is a personal story which I think is unsurpassed in originality.

In December last, I received a card from Lydia Johnson WØKJZ of Rapid City, South Dakota, where she is an ARRL SCM. Lydia informed me that a local TV station, KOTA, had recently opened up a "satellite" station in Gillette, Wyoming, which was operating under the announced (sound and video) callsign of K6JM. *My amateur callsign!*

Lydia felt something was amiss, looked me up in the *Callbook*, and mailed me the advice.

Since my license was coming up for renewal in February, 1980, I got bad vibes that somehow I was about to be defranchised.

A telephone call to the engineer on duty at KOTA, Rapid City, brought prompt confirmation that their Gillette station was indeed operating under the call K6JM. They didn't know why, but it was on their license.

Immediately I shot off a letter to the KOTA station manager advising him of the callsign duplication and requesting an explanation—also pointing out this is not a call normally issued to a broadcaster. I sent a similar letter to the Chief, Personal Radio Services Division, FCC, Washington.

To date, I have not received a reply from the station or the FCC. However, another communique from WØKJZ last weekend tells me that the Gillette TV station has just switched its announced call to KØ6JM—still not a regular broadcaster assignment.

I wonder if anyone else has had the dubious experience of sharing their ham call with a TV broadcast station. The assumption is that someone's computer readout goofed, I hope. Meanwhile, I want it known that K6JM Santa Monica accepts no responsibility for the editorial policies of K6JM Gillette, Wyoming. Hi.

Peter A. Lovelock K6JM
Santa Monica CA

NEW REPEATER

The Ottawa Area Radio Club of Ottawa, Ohio, is pleased to announce the operation of its new 2-meter repeater as of January 1, 1980. Located in Ottawa, Ohio, the repeater has an input frequency of 144.630 and an output frequency of 145.230. This repeater is carrier-operated accessed and operates under callsign K8BNS. All area hams and those visiting or traveling through the area are invited to make use of our repeater.

Robert Northrop AK8N
Ottawa OH

VOICE INTERFACE

The October, November, and December issues of *73 Magazine* have been outstanding and I wanted to let you know. I really enjoyed reading about "The Black Art of Antenna Design" in the November issue. *73* is by far the most interesting magazine I get.

I had an idea hit me about the width of voice transmissions. An SSB signal usually takes up about 5 kHz of spectrum. NBVM seems to have lost a lot of support lately, so nothing new is really happening as far as I can tell. I am also a computer nut and own an Apple computer. It seems to me that if a voice interface was used with the computer, you could talk to the computer and have it send out Morse code or RTTY to a similarly equipped station. On receive, a program could convert the Morse back into speech using the computer voice box. With sharp audio filters, it would be possible for 4 to 5 stations to have voice contact in about 2.5 kHz of spectrum!

Arlan Henderson KA4HQI
Saltville VA

P.S. How about a simple 2-meter FM transmitter article someday?

MORE WOODPECKERS?

It is ironic that we have to live with the woodpecker. It seems to me that we have little or no choice. Reporting this deliberate source of interference to the FCC undoubtedly will do no good.

I say this due to a recent article in *Microwaves*, Sept., '79, pages 41-51, in which it was reported that the U.S. has a possible over-the-horizon radar in operation in Cypress and one under construction in Maine by GE, this one with operational tests reportedly to begin this fall.

The fact that this type of radar utilizes frequencies of 10-30 MHz means that our problems are about to be compounded. If the tests in Maine are successful and if a number of these monsters are deployed at a later date, then large segments of the already limited HF spectrum will undoubtedly become useless for normal use.

I do not believe that the FCC has any control over the agencies operating or developing these radars. This further leads me to believe that any complaints directed at the FCC concerning the woodpecker may just fall, or are falling, on deaf ears.

Johannes P. Fassotte WL7AGG
Fairbanks AK

20M CB

I am writing because of the mess on our HF bands. It seems that having to take a theory and code test no longer filters out the lids. In the past two years, I have become totally disgusted with the lack of respect on HF. Many people do not listen before they talk and how many times have you heard someone tuning up on an active frequen-

Continued on page 152

Awards

Bill Gosney WB7BFK
2665 North 1250 East
Whidbey Island
Oak Harbor WA 98277

Through the cooperation of Dr. John Allaway and C. R. Emary of the Radio Society of Great Britain, I was able to obtain complete details of this great organization's awards program.

The following rules and conditions apply to all HF certificates and awards issued by RSGB and should be read in conjunction with those governing awards and certificates individually.

All members of the RSGB will be afforded awards at no charge. Others must enclose at least 6 IRCs for each award. Applicants within the United Kingdom must submit QSL cards directly to RSGB to justify their claim. All others may use the general certification rule with an affiliated society of a national organization.

Endorsements will be given for All Phone, All CW, and/or single-band accomplishments.

COMMONWEALTH DX CERTIFICATE (CDXC)

This certificate may be claimed by any licensed amateur who can produce evidence of having made two-way communication with stations located in at least 50 call areas listed on the Commonwealth call area chart shown in Fig. 1. All contacts have to be made on 14 MHz and an additional 50 contacts must be made in Commonwealth call areas on other bands. In the case of "other" bands, a particular call area may be claimed only once, irrespective of the band on which the call area was worked. The other call areas do not have to be the same as those worked on 14 MHz.

EUROPE

British Isles	
England (including Isle of Wight and Isles of Scilly)	G
Channel Isles Jersey	GJ GC
Guernsey, Alderney & Sark	GU GC
Isle of Man	GD
Northern Ireland	GI
Scotland (including Orkney, Shetland and Western Isles)	GM
Wales	GW
Gibraltar	ZB2
Malta	(ZB1) 9H
Gozo and Comino	9H4

AMERICA

Canada	
Maritime Provinces	VE1
Sable Isle	VE1
St Paul Isle	VE1
Province of Quebec	VE2
Province of Ontario	VE3
Province of Manitoba	VE4
Province of Saskatchewan	VE5
Province of Alberta	VE6
Province of British Columbia	VE7
Yukon Territories	VE8
N W Territories	VE8
Province of Newfoundland (including Labrador)	VO
Bahama Islands	(VP7) C6
Barbados	(VP6) 8P6
Belize	VP1
Bermuda	VP9
Cayman Islands	(VP5) ZF1
Falkland Islands	VP8
Grahamland	VP8
Guyana	(VP3) 8R
Jamaica	6Y5
Leeward Islands	
Anguilla	VP2
Antigua and Barbuda	VP2
British Virgin Is	VP2
Montserrat	VP2
St Kitts—Nevis	VP2
Sandwich Group	VP8
South Georgia	VP8
South Orkney Islands	VP8
South Shetland Islands	VP8
Trinidad and Tobago Islands	(VP4) 9Y4
Turks and Caicos Islands	VP5
Windward Islands	
Dominica	VP2
Grenada and Deps	VP2
St Lucia	VP2
St Vincent	VP2

CALL AREAS WITH RESTRICTED DATE LIMITS

BEFORE 1 JUNE 1962	
Union of South Africa:	
Cape District	ZS1
Cape Province (excluding ZS1)	ZS2
Marion and Prince Edward Is	ZS2
South West Africa	ZS3
Orange Free State	ZS4
Natal (including Zululand)	ZS5
Transvaal	ZS6
BEFORE 1 JULY 1960	
British Somaliland	VQ6
BEFORE 25 APRIL 1964	
Zanzibar and Pemba	VQ1
BEFORE 1 DECEMBER 1967	
Aden	VS9
Kuria Muria	VS9
Kamaran	VS9
BEFORE 1 FEBRUARY 1972	
Pakistan	AP

OCEANIA

Australia	
Australian Capital Territory	VK1
New South Wales	VK2
Victoria	VK3
Queensland	VK4
South Australia	VK5
Western Australia	VK6
Tasmania	VK7
Northern Territories	VK8
New Zealand	
Auckland District	ZL1
Wellington District	ZL2
Canterbury District	ZL3
Otago District	ZL4
Auckland and Campbell Is	ZL
Australian Antarctic Territory	VK0
British Phoenix Islands	VR1
British Solomon Islands	VR4
Brunei	VS5
Chatham Island	ZL3
Christmas Island (Indian Ocean)	VK9
Cocos-Keeling Island	VK9
Cook Islands (including Rarotonga)	ZK1
Fanning Is (including Christmas and Washington Is)	VR3
Fiji Islands	(VR2) 3D2
Gilbert and Ocean Islands	VR1
Heard Island	VK0
Kermadec Group (including Sunday Island)	ZL1
Lord Howe Island	VK2
Macquarie Island	VK0
Malaysia, East	(VS4, ZC5) 9M6 9M8
Manihiki Group	ZK1
Nauru Island	(VK9) C21
New Guinea (inc Bismarck and Admiralty Islands)	(VK9) P29
New Hebrides Condominium	YJ8
New Zealand Antarctic Territory	ZL5
Niue	ZK2
Norfolk Island	VK9
Papua	(VK9) P29
Pitcairn Island	VR6
Samoa	(ZM6) 5W1
Tonga or Friendly Islands	(VR5) A3
Tokelau or Union Islands	ZM7
Tuvalu	VR8
Willis Island	VK4

AFRICA

Agalega and St Brandon	(VQ8) 3B6 3B7
Aldabra Islands	VQ9
Ascension Island	ZD8
Lesotho	(ZS8) 7P
Botswana	(ZS9) A2
Chagos Archipelago	(VQ8) VQ9
Des Roches	VQ9/D
Farquhar	VQ9/F
Gambia	(ZD3) C5
Ghana	(ZD4) 9G1
Kenya	(VQ4) 5Z4
Malawi	(ZD6) 7Q7
Mauritius	(VQ8) 3B8
Nigeria	(ZD2) 5N2
Rhodesia	ZE
Rodriguez Island	(VQ8) 3B9
St Helena	ZD7
Seychelles	(VQ9) S7
Sierra Leone	(ZD1) 9L1
Swaziland	(ZS7) ZD5
Tanzania	(VQ3) 5H3
Tristan da Cunha and Gough Island	ZD9
Uganda	(VQ5) 5X5
Zambia	(VQ2) 9J2

ASIA

Andaman and Nicobar Islands	VU
Bangladesh	S2A
Cyprus	(ZC4) 5B4
Hong Kong	VS6
India	VU2
Laccadive Islands	VU4
Malaysia West	9M2 9M4
Maldive Islands (Gan only)	VS9M
Sikkim	AC3
Singapore	9V1
Sri Lanka	(VS7) 4S7

Fig. 1. List of British Commonwealth call areas.

Mode	UK Stations	European Stations	DX Stations
CW/SSB/AM	1	2	5
FM	½	5	10
SSTV/RTTY/OSCAR	5	10	15

Fig. 2.

BRITISH COMMONWEALTH RADIO TRANSMISSION AWARD (BCRTA)

This award may be claimed by any licensed radio amateur who can produce evidence of having effected two-way communication with stations located in at least 50 of the call areas on any band or combination of bands. A five-band endorsement is available for 50 call areas on 5 bands.

WORKED BRITISH COMMONWEALTH CERTIFICATE (WBC)

This certificate requires the applicant to work at least one British Commonwealth station located in at least five of the recognized continental areas as defined by the ITU and noted on the chart shown in Fig. 1. For the purpose of this award, North and South America count as one continental area.

IARU REGION I AWARD

This award may be claimed by any licensed amateur who can produce evidence of having worked stations located in IARU Region I. There are three levels of operating achievement:

Class I requires contact with all countries In IARU Region 1.

Class II requires contact with 35 countries within IARU Region 1.

Class III requires contact with 20 IARU Region I countries.

To be eligible, all contacts must be made after January 1, 1979. Special endorsements are given for single band or mode achievements.

Members of IARU Region I are: Algeria, Austria, Bahrain, Belgium, Botswana, Bulgaria, Cyprus, Czechoslovakia, Denmark, Federal Republic of Germany, German Democratic Republic, Faeroes, Finland, France, Ghana, Gibraltar, Greece, Hungary, Iceland, Ireland, Israel, Italy, Ivory Coast, Jordan, Kenya, Lebanon, Liberia, Luxembourg, Malta, Mauritius, Monaco, Netherlands, Nigeria, Norway, Oman, Poland, Portugal, Rhodesia, Romania, South Africa, Sierra Leone, Spain, Sweden, Switzerland, United Kingdom, USSR, Yugoslavia, and Zambia.

To apply for any of the awards sponsored by the Radio Society of Great Britain, forward your application along with the award fee of 6 IRCs to: C. R. Emary G5GH, Westbury End, Finmere, Buckingham Bucks, England.

Jeff Maynard G4EJA writes to inform us about a unique award made available by radio amateurs in the England County of Cheshire.

CHESHIRE AWARD

This award is issued in three categories: Applicants receive a gold award for accumulating 50 points, a silver award for accumulating 30 points, and a bronze award for accumulating 15 points.

Contacts must be made with only radio amateurs in the Cheshire County of England and there are no band or mode restriction nor any date limitations.

Points can be claimed for all valid QSOs according to Fig. 2.

Should you contact an amateur who resides in the County Town of Cheshire in Cheshire County, you may claim double point value.

The fee for this award is US $3.00 or 10 IRCs. This includes postage of the award which is attractively printed on parchment with an embossed seal signifying the category.

GCR apply; however, the Award Manager reserves the right to request QSLs prior to issuance of the award.

F. van Greunen ZS1IT recently wrote me on behalf of the South African Radio League (SARL) and provided details for their very popular African awards program. A detailed description follows.

ALL AFRICA AWARD (AAA)

This award, sponsored by SARL, is made available to DXers throughout the world. Below is a list of areas in Africa from which QSL cards will qualify to

obtain this award.

Confirmation must be submitted in respect to one contact from each of the six ZS call areas as well as one contact from Botswana (A2), Lesotho (7P8), and Swaziland (3D6), *plus* one contact from 25 different areas of the remaining groups of country prefixes shown below.

A list indicating callsigns, mode, date, and time must accompany QSL cards submitted. Applicants who belong to IARU affiliated clubs or societies may have their QSLs verified through their affiliated organization.

All stations contacted must be fixed land stations. Islands around Africa or its coast do not count for this award. All contacts must be made after November, 1945, with a minimum CW report of 338 or phone report of 33. This award is issued free to SARL members; it is $.50 US or 10 IRCs for non-members.

Countries List: Algeria, Angola, Sudan, Congo Kinshasa, Burundi, Rwanda, Somali Rep., Cameroons, Egypt, Eritrea, Central Africa Rep., Rep. of Congo Brazzaville, Gabon, Chad, French Morocco, French Somaliland, Ivory Coast, Dahomey Rep., Volta Rep., Mauritania, Senegal, Niger Rep., Rep. of Guinea, Gambia, Ghana, Kenya, Liberia, Libya, Mozambique, Nigeria, Zambia, Malawi, Portuguese Guinea, Sierra Leone, Rhodesia, Spanish Morocco or Ifni or Rio de Oro or Spanish Guinea, Tangier, Tanzania, Tunisia, Togoland, Uganda, Botswana, Lesotho, Swaziland, South West Africa, Rep. of South Africa (ZS1-ZS6), Transkei, Bophuthatswana.

Applications and the appropriate award fee should be addressed to the attention of: F. van Greunen ZS1IT, Awards Manager, South African Radio League, PO Box 3911, Cape Town 8000, South Africa.

AWARDS FROM CERTIFICATE WORLD

I was very pleased to receive a letter from a new subscriber and also to learn of his new adventure of collecting various amateur operating awards. Meet Stu Herring WB5ULD from Fulton, Mississippi. Stu features some very attractive awards for the parchment pursuer.

Representing Certificate World, we find his awards are

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DX

James D. Cain K1TN
306 Vernon Avenue
Vernon CT 06066

January, 1980, not only ushered in a new decade (unless you're progressive and follow the decade-begins-in-'81 theory), but it also may have brought the bad news that the sunspot peak has come and gone. Ted Cohen N4XX says the monthly mean sunspot number from the Zurich observatory for December was 182.2, down from November's 185.0, and the figures for January were lower still. Boo. Hiss. Several more excellent propagation years are in store, however, since the sunspots are always lazier in dropping off than they were when climbing toward the summit, whenever it was. The next minimum is expected in 1986 or 1987, so don't fold up your six-and-ten-meter beams yet!

January's big story in the world of DX was the simultaneous operation from Kingman Reef and Palmyra Island which took place from January 5 to 10. The relative success of the operations from a ham radio standpoint took a backseat to the human drama which unfolded as the group made their way to these two isolated spots. On January 4, WA6YQW, K6LPL, WA2FIJ, W5VAH, KB5FU, WD5FJL, and K2HXF departed Honolulu for Palmyra by chartered plane. The grass landing strip on Palmyra was slick from rain and the landing resulted in a demolished aircraft and serious injuries to Jan Gould WA6YQW. She was airlifted back to Honolulu and hospitalized at the Trippler U.S. Army Hospital with multiple broken bones. No other members of the group were injured, and they went on with the expedition.

The Palmyra team, led by K6LPL, remained to set up and operate K6LPL/KH5; the rest of the group departed by boat for Kingman Reef where, on January 6, WA2FIJ/KH5K appeared on the bands. About 5,000 contacts were made from Kingman, 17,000 from Palmyra. Equipment difficulties on Kingman reduced the efficiency of the operation there; vertical antennas were used and did not work as planned.

As the two groups were preparing to wrap up their operations, with Kingman shutting down for the boat trip back to Palmyra, disaster again befell the operation. Dave Gardner K6LPL, a neurosurgeon, fell and lacerated his hand on a piece of glass. The injury was serious, and once again the U.S. Coast Guard was called in to evacuate the entire party to Honolulu, where K6LPL was treated. He faces further surgery.

QSL card chores for these two operations [illegible]eing handled by WA2FIJ [illegible]LPL; the Southern Califo[illegible]Club will be assisting w[illegible] K6LPL/KH5 confirmation. [illegible] fund has been established f[illegible] Jan Gould WA6YQW, who faces a very long recovery period from the injuries she received in the landing crash. This fund is being administered by Norm Friedman W6ORD, 5400 Lindley Avenue, Apt. 312, Encino CA 91316. The fund is not connected with expenses of the trip per se.

The ARRL's W1AW on-the-air DX bulletin resumed on January 18 after several w[illegible] without a "sponsor." The [illegible]tion was thanks to the [illegible]rn New England DX A[illegible]on, who offered to pro[illegible] weekly news item for [illegible] League's broadcast.

ZL1ADI expected to be in China the first of March, probably accompanied by ZL1AMO. This visit has prompted more speculation on the DX bands than any other in recent memory. When you read this, any operation from China (the call BY2F has been mentioned) will be history. Following last summer's one-hour operation by JA6HOZ/BY, word was that outsiders would not be permitted to operate from China until the Chinese themselves began getting on the air. But it doesn't hurt to hope . . .

Both the Andaman and Laccadive Islands were on last month's "Top 25" l[illegible]t of needed countries. In order for an amateur station to come on from either of those spots, it will require a native islander who has lived there for a period of time. So scratch those two from your DXpedition list. A W[illegible]st German amateur recently received a letter from the Indian Ministry of Home Affairs saying "neither Indian nor foreign nationals are allowed operation from the Laccadives." Don't hold your breath for a VU7 on the bands.

Also on the "Top 25" is Burma, where VE3FXT is presently doing some scientific work and has a license for very low power commercial work, somewhere in the 15-meter band. No reports of anyone hearing him.

Have faith . . . things are looking up for a few of the countries on that list; although ZA3KL is still not verified as having been in Albania at all, much less with permission to operate (he was on the bands briefly in early January), there is hope for an operation from Australia's Heard Island, VKØ, sometime this spring. A scientific expedition left for Heard on February 29 for a short visit, and Jim Smith P29JS contacted the leader of the group with an eye on some sort of operation from Heard. Jim was hoping for a "controlled" type of operation utilizing a non-amateur within the expedition group to provide a few contacts from the island. The time interval between this writing and publication will answer the question of whether the initiative bore fruit.

While we're on the subject, we might as well work our way down those 25 DXCC countries until we get to some positive things. No immediate hope for numbers 7, 8, 9, 10, which are 7O South Yemen, FB8W Crozet, XU Kampuchea, and 3Y Bouvet. Number eleven was the Andamans. And 3X Guinea doesn't look bright, either. But!!! 6O1 Somalia may appear. We had a call from a W6 the other day who needed just that one to have them all, and we tried to cheer him up. With talk of the U.S. establishing a military base of some sort in Somalia, a la Diego Garcia, the chances of amateur radio are increased immeasurably. Could be as early as the end of this year.

As for 14, Glorioso, and 20, Juan de Nova, both FR7-type-callsign islands, odds are against any activity until one of the resident amateurs on the "big" island, Reunion, is able to activate them. As this is written, N2KK, K5CO, and N5AU are on their way to Reunion with hopes of activating the outer islands, but the prospects are dim.

Talk continues of an operation from CEØX San Felix by Chilean amateurs, perhaps this year. But the Navy must be called in to transport a group to San Felix, and the cost is very high.

Number 16, Afghanistan, has seen all operation cancelled by the invasion by the U.S.S.R. Stations have been reported signing such things as UAØAA/YA and the like; even if they are real stations, the DXCC administrators will probably not allow credit. XV5 Viet Nam is, of course, off the air.

At present, at least two amateurs from Belgium are in 9U Burundi, with hopes of licensing. That might move Burundi down from its number 18 slot on the list. Not much hope for 4W N. Yemen, but S9 St. Thomas (formerly CR5 Sao Thome) may be on this spring thanks to D4CBS, who may make a business trip there in March or April. Angelo revealed these plans when he attended a meeting of the Southern New England DX Association in Boston on January 11.

Since we're this far along, we might as well finish out the 25 on the list. HKØ Malpelo is so difficult and dangerous to get to that it is probably out of the question for some time, especially after the problems encountered by the Kingman/Palmyra team. 5A Libya and 7Q Malawi have political circumstances precluding any operations soon. But Uganda could see a 5X5 operation any day, now that Idi Amin is out. It will be fun to look back at that list of 25 at the end of 1980 and mark off the countries which saw amateur radio operations happen. Let's hope for plenty!

During 1979, eleven countries had changes of government as despotic rulers were either exiled or assassinated. Can you name them? They are, by radio prefix, XU, EP, VP2G, 5X5, YN, 3C1, TL, YS, HM, TT, and YA. From the DXer's point of view, the changes were for the good in the cases of 5X5, 3C1, TL, and TT. The changes will not affect us as far as Grenada, Nicaragua, El Salvador, and Korea are concerned. Kampuchea was a lost cause as far as amateur radio goes, so no matter. There may be activity from Iran as time goes along, but YA is probably going to be silent for some time.

IØDUD activated the Vatican

station, HV3SJ, regularly early in the year; QSLs go to his Italian address. He was most often found on 15 SSB. ZS2MI leaves Marion Island at the end of April; he has been very active on 14240 around 04-0600 UTC on various days, often with assistance from his QSL manager, WA2IZN. The Long Island DX Association donated the ZS2MI cards.

More clubs report electing new officers for 1980: The Western Washington DX Club, whose *Totem Tabloid* is one of the finest local club bulletins around, tabbed W7YOZ, N7CY, WA7GRE, K7YDO, W7OTO, and WB7WEI for club duties. The 240-member Southern California DX Club elected W6SP, N6AHU, WA6WZO, and W6PN. The Texas DX Society out of Houston honored N5WW, K5BZU, KA5CHW, and K5NA with work slots.

If you work 4U1ITU, be sure to ask for the operator's own home callsign and send your QSL to him directly. That's the way things are run there in Geneva.

YASME operations by Iris Colvin W6QL and Lloyd Colvin W6KG moved from St. Lucia, where they signed J6LOO, to Dominica, J7DBB, during January. J6LOO made 9,000 contacts with 130 countries; the Colvins also worked all U.S. call areas on 160 from St. Lucia. Their plans to operate *from* FM7 Martinique following St. Lucia were thwarted. While in St. Lucia, two local amateurs, J6LHV and J6LIM (VE2EWS), dropped by the Colvins' operating site with busted rigs. When they left, the rigs were working again.

TF3SG's 6-meter privileges have been extended through 1980; he has been working up and down the East Coast of the U.S. since the first of January. Over 300 Worked All States awards have been awarded for contacts on 50 MHz. Compare that to over 700 5-band DXCC plaques engraved thus far and the relative difficulty of DX becomes apparent.

The ARRL's DX Advisory Committee has several new members, appointed by President W2HD for two-year terms beginning January 1. The entire committee is W1OT, W2QM, W3ZN, N4MM, K5YY (Chairman), N6RJ, K7LAY, WB8EUN,

Continued on page 159

Microcomputer Interfacing

Jonathan A. Titus
Christopher A. Titus
David G. Larsen WB4HYJ
Peter R. Rony

In a previous column, we described the new Intel 8085 microprocessor integrated circuit. This is an upgraded type of 8080 microprocessor chip, since it has features that are not found on the 8080-type device. One of the advantages in using the 8085 device is the availability of "family" devices that may be used with little or no additional, external logic. This makes the 8085 and its family of devices ideal for small controllers, instruments, and games where expansion and the ability to run large programs such as BASIC may not be required.

In this month's column, we will describe two of the 8085-family devices, the 8155 read/write memory chip and the 8355/8755 read-only memory device, the pin configurations and block diagram for which are shown in Figs. 1 and 2. The 8355 and 8755 read-only memory devices are equivalent, as far as the user is concerned. The 8355 device is a mask-programmed device, while the 8755 is a programmable device that may be erased and reprogrammed much like the popular 1702A and 2708 PROM devices. The 8755 contains 2048 (2K) bytes of read-only memory that may be accessed by using eleven address bits and two chip enable inputs, CE and $\overline{CE}$. These two control inputs must be at logic one and logic zero, respectively, for the memory to be accessed. Since the 8755 is an 8085-family device, the low address and data bus signals are multiplexed on the bidirectional address-data bus lines, AD7–AD0. As such, the 8755 is not very exciting. It does contain, however, two eight-bit I/O ports that allow the chip a great deal of flexibility.

M2	M1	Mode of Operation
0	0	Output a logic zero during the second half of the count.
0	1	Output a square wave, same as 00, above, but reload and restart the count at the end of each count sequence.
1	0	Output a single, short pulse at the end of the count sequence.
1	1	Output a single pulse at the end of the count, but reload and restart the count at the end of each count sequence.

Table 1.

The I/O ports on the 8755, and the 8355 as well, may be programmed on a bit-by-bit basis so that the individual I/O bits may be either input bits or output bits. This allows you, the user, to select any combination of input and output bits, from 16 inputs to 16 outputs. Each of the two I/O ports on the 8355/8755 chip has a *control register* that is associated with it so that the bits may be easily programmed. To make our system fairly easy to understand, we have chosen to use the accumulator I/O technique to interface the two I/O ports on the 8355/8755 chip to the 8085. To do this, we have gated together the necessary 8085 control signals to generate the $\overline{IN}$ and $\overline{OUT}$ signals that are necessary for I/O control. These signals are applied to the 8355/8755 chip's $\overline{IOR}$ and $\overline{IOW}$ pins. The device addresses for the I/O ports and their control registers are shown below:

Port A	XXXXXX00
Port B	XXXXXX01
Port A Control Register	XXXXXX10
Port B Control Register	XXXXXX11

The X bits are "don't care" bits, since their states do not have to be known to select one of the four functions. We are allowed this flexibility since the chip is also controlled with the CE and $\overline{CE}$ inputs; these two inputs must be in their proper state before the chip can operate on the ports or the port control registers. It is important for you to note that you cannot read the contents of either control register. The contents of the registers can only be updated and

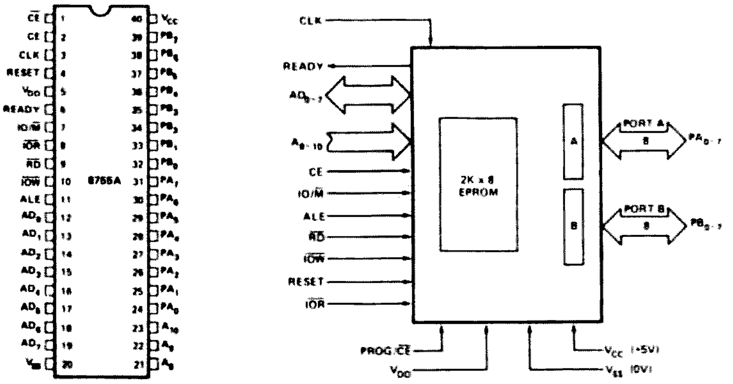
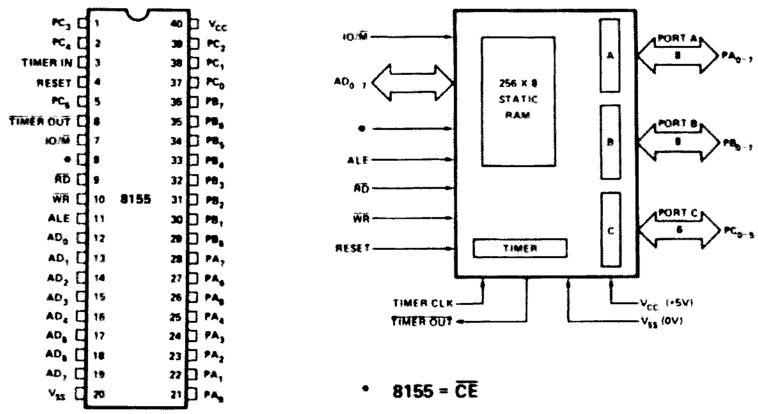


Fig. 1. Block diagram and pin configuration for the 8755 read-only memory used in 8085-based systems.



• 8155 = $\overline{CE}$

Fig. 2. Block diagram and pin configuration for the 8155 read/write memory used in 8085-based systems.

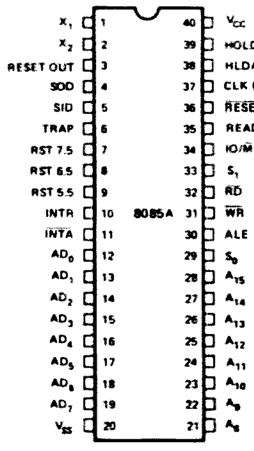


Fig. 3.

not checked.

In our small 8085-based system, we have configured the chips so that the read-only memory in the 8355 or the 8755 chip starts at address 000 000 and continues through address 007 377. The I/O ports have addresses 001 and 002, with the control registers having addresses 002 and 003. Our final system does not have *absolute addressing*, since some of the unused address bits are ignored. More decoding is necessary if you wish to expand the small system that is discussed in this column.

The 8155 read/write memory chip contains 256 bytes of memory, which is probably more than enough for a small system. In most cases, the read/write memory will be used for temporary storage of data or results, as well as register and address information. The 8155 is also bus-compatible with the 8085 system, through the use of the bidirectional address/data bus and standard control signals. In this case, the $IO/\overline{M}$, $\overline{RD}$, and $\overline{WR}$ signals are all that are needed for memory control. The ALE, CLOCK, and RESET signals from the 8085 are also provided for internal control of the chip.

The 8155, like the 8355 and 8755 chips, has some I/O lines. In fact, there are two eight-bit I/O ports and one six-bit I/O port on the 8155 chip. The two eight-bit I/O ports may be operated in either the input or output mode. Individual bits can not be selected, as was the case with the 8355/8755 device. These two ports are called ports A and B. The six-bit I/O port, port C, may be operated in a number of ways, but these are beyond our present discussion. Let us just say that they allow the I/O ports to operate in a manner that is similar to that encountered in the mode 1 and mode 2 operation of the 8255 programmable peripheral interface chip.

The 8155 read/write memory chip also contains a 14-bit programmable counter, referred to as a timer. The timer may use either the 8085's clock output or an externally applied clock signal. The timer's output is available as a pin on the 8155 chip and it may be used in a number of ways, depending upon your needs. It could be connected to the Serial Input Data pin (SID,

Continued on page 122

New Products

KLM'S KT-34XA

KLM Electronics' new KT-34XA tribander delivers broadband coverage on 20, 15, and 10 meters at performance levels equal to or exceeding many stacked monoband systems. With reduced weight and wind load, and tower and rotator requirements, overall system costs can be kept to a minimum with no sacrifice in performance.

KLM's field-proven 4-element KT-34 is the heart of the new "X" tribander. But, doubling the boom length, adding one more tri-resonant element, and one full-sized 10-meter element has increased the gain to 11–11.3 dBd on 10 meters, 9–9.5 dBd on 15 meters, and 8.5–9 dBd on 20. Two driven elements are used to make the KT-34XA unusually broadbanded (a concept applied to many KLM antennas). Gain is virtually flat across each band except for 10 meters which has been optimized for the DX'er at 28–29 MHz.

The traps, coils, and capacitors of conventional tribanders have been discarded in favor of integral linear loading and Hi-Q air capacitors, all composed of aluminum tubing. These give the KT-34XA a conservative power-handling capability of 4 kW PEP and a high level of operating efficiency. Linear loading also makes full ¼-wave elements possible on 10 and 15 meters, and brings 20 meters much closer to the desirable ¼-wavelength than any conventional tribander.

Mechanically, the KT-34XA has been built to survive. All aluminum, including the boom, is tough weather-resistant 6063-T832 alloy. All electrical hardware and guy cables are stainless steel. Virtually indestructable lexan insulators, just like those used on KLM's linear-loaded 40-meter Big Sticker, are used for mounting the elements and insulating them from the boom. KLM's 3-60-MHz 4:1 ferrite balun is supplied with the KT-34XA for direct connection to any 50-Ohm coaxial feedline. Special kits to upgrade the KT-34 are also available.

For more information, contact *KLM Electronics, 17025 Laurel Road, Morgan Hill CA 95037*. Reader Service number 40.

5820-437-1918 TRANSMITTER, RADIO T-1151 (V) / USQ FORKED STICK, PRAT MOSS

The disgustingly decrepit dab of doggie-doo distastefully depicted does indeed deceive. Delicately encapsulated within a husk of camouflaged epoxy is a VHF transmitter! Operating in the 150-MHz range, this aesthetically appealing little unit is actually a "seismic intrusion detector"—a sophisticated surveillance monitor which was used in Viet Nam to detect troop movements.

The luscious looking lump of fecal foolery contains several discrete transistors and a seismic detector. The instrument is powered by three mercury cells and is armed by withdrawing a small plastic pin which closes a switch.

In actual use, seismic intrusion detectors are scattered throughout an area suspected of being in the route of the enemy; ground vibrations cause an inertial device to close a circuit, activating the transmitter. The pulse-coded signals are picked up by a remote VHF monitor receiver, alerting personnel to the presence of intruders.

Range of the radiated signal is approximately 300 meters, limited by its relatively low power (a few milliwatts) and its built-in copper-foil dipole. After 15 years, the batteries are dead, but the circuit is still very much active. Who will be the first to key up the local repeater with digital doo-doo?

Weighing only about an ounce, the detectors were made in several different sizes and shapes. Their cruddy appearance was deliberately designed to blend in with native ground litter. While some look like droppings from a passing puppy, others resemble nondescript globs of mud.

If anyone would like to own his very own transmitting atrocity, he may order one for only $5 postpaid from *John Meshna, PO Box 62, 19 Allerton Street, East Lynn MA 01904*. Reader Service number 478.

Robert B. Grove WA4PYQ
Brasstown NC

JUST WRAP KIT

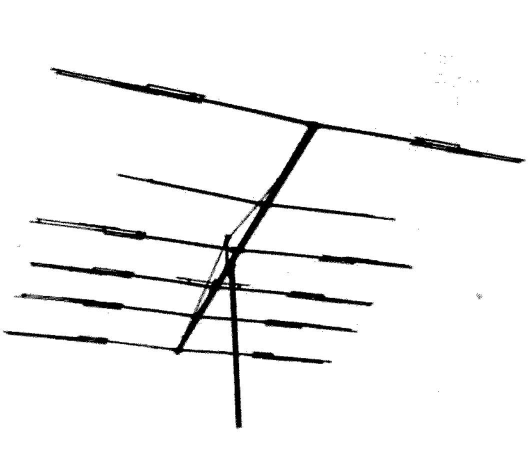
Complementing the introduction of its new Just Wrap wire wrapping tool, O.K. Machine and Tool Corp. has announced its new Just Wrap Kit. The Just Wrap tool wraps 30 AWG wire onto standard .025"-square posts without stripping or slitting the insulation. The tool can daisy chain continuously through several points or can be used in the point-to-point mode. It contains a built-in wire cutoff device for terminating the final connection of each chain. The JWK-6 Kit contains the Just Wrap wrapping tool, the JUW-1 unwrapping tool, and four 50-ft. wire refill cartridges, 1 each in red, white, blue, and yellow, all packaged in a sturdy, reusable clear plastic box. The JWK-6 Just Wrap Kit is available from stock at local electronics retailer or directly from *O.K. Machine and Tool Corp., 3455 Conner Street, Bronx, NY 10475*. Reader Service number 54.

DENTRON ANNOUNCES NEW GLA-1000B LINEAR

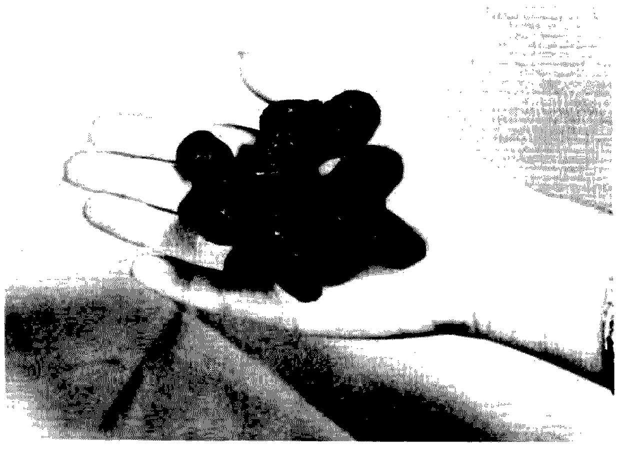
DenTron Radio Company has introduced an improved model of its popular GLA-1000 linear amplifier, the GLA-1000B. Featuring a tuned input circuit for consistent 50-Ohm input impedances, the new unit is the smallest and most economical 1200-Watt SSB (800-Watt CW) linear amplifier ever offered to amateurs.

DenTron has also added a new innovation in amateur linear amplifiers, namely a front-panel antenna switch, designed to allow user selection of either a dummy load (such as a DenTron Big Dummy) or an alternate antenna system.

Additional improvements include the use of LED status indicators for standby and transmit, thus ending the need for replacement of incandescent light



The new KLM KT-34XA.



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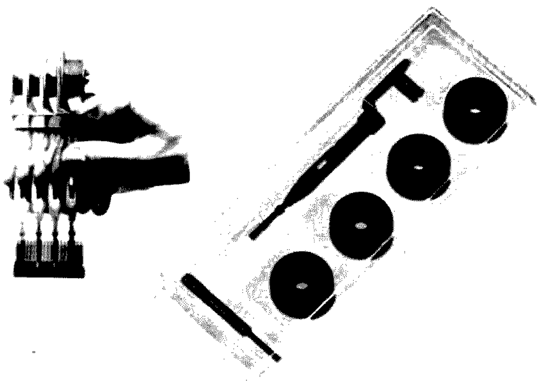

The Just Wrap Kit from O.K. Machine and Tool Corp.

DenTron's new GLA-1000B.

bulbs, and greatly enhanced tube life through design refinements.

Retained in the new GLA are the basic features of the original unit: compact size, complete metering of essential voltages, currents, and relative power output with a large back-lite meter, easy conversion to 10 meters by a licensed amateur, economical D-50A finals that cost less than $40.00 to replace the full complement, a built-in power supply, user selectable for 117 V ac or 234 V ac primary voltage, and FCC type acceptance.

The most exciting news, however, is the price, with DenTron offering the new GLA-1000B at a price which makes it the most economical linear amplifier of the decade! The new GLA-1000B is available now from DenTron Dealers worldwide. *DenTron Radio Company, 1605 Commerce Drive, Stow OH 44224.* Reader Service number 476.

HEATH INTRODUCES NEW REMOTE COAX SWITCH

Heath Company has announced a new remote coax switch. The Heathkit SA-1480 allows the amateur radio operator to select any of 5 antennas by simply turning a knob at his bench.

Used with the SA-1480, one feedline from the inside control box to the outside switching box replaces 5 separate antenna cables, saving coaxial cable. A special grounding position grounds all antennas for lightning protection.

A specially shielded switching box protects the switching circuitry from the elements. Silverplated switch contacts help reduce swr and the SA-1480 operates on frequencies up to 150 MHz at full legal power.

Heath engineers say the new remote coax switch can be easily assembled in 6 to 8 hours. A U-bolt assembly is included to facilitate mounting the outside switching box on an antenna mast or tower leg.

Heath Company, Benton Harbor MI 49022. Reader Service number 303.

DIGITAL RF WATTMETERS

A new era in rf power measurement was announced by THRULINE® wattmeter designer Bird Electronic Corp. with the introduction of the new series 4380 RF Power Analyst™. First of the series, portable model 4381 is a m[illegible]i-purpose digital directiona[illegible]tmeter for power levels f[illegible] Watt to 10,000 Watts, an[illegible]/2 to 2300 MHz. CW or FM p[illegible] in both forward or reflected directions is displayed in Watts or dBm at the push of a button. Vswr is calculated continuously and indicated through a fifth button, as is dB return loss. Buttons seven and eight are for peak envelope power (as in SSB transmissions) in Watts, and the ninth button calls up percent modulation. The final set of three buttons makes tuning a transmitter, matching an antenna, or tweaking rf components a fast and simple task: A delta (Δ) function identifies either rise or fall in displayed values, while a minimum or maximum memory recalls optimum conditions during adjustments. Other models in the 4380 series measure to 250 kW or are panel mounted.

This new generation of rf wattmeters with nine-mode system versatility was designed around existing Bird Plug-in Elements, which determine full-scale power and frequency range. Once a set of two Elements is chosen (for incident and reflected power), the large LED display places the decimal point correctly, making mental multipliers superfluous. Overranging of up to 120% in Watts, and 400% in dBm often obviates changing to a higher-power Ele-

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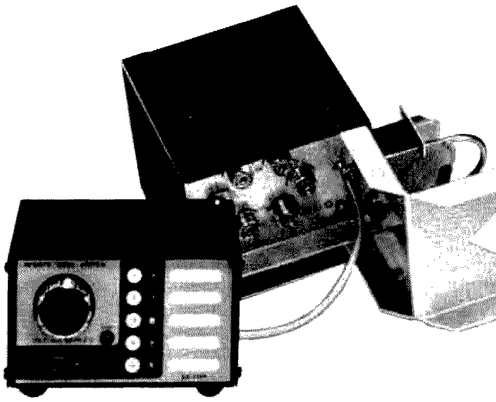
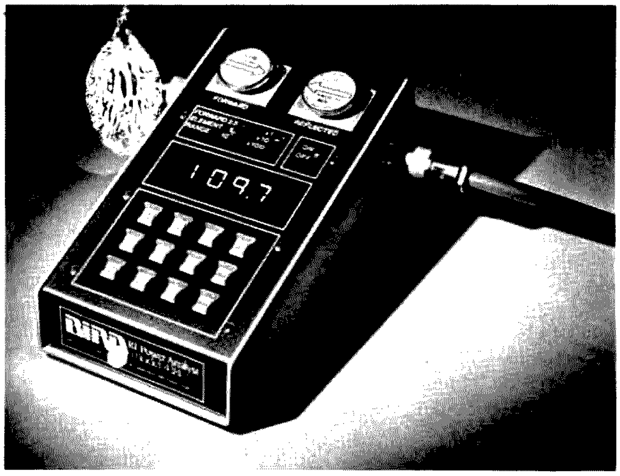


The Heathkit SA-1480 Remote Coax Switch.



The RF Power Analyst™ from Bird.

Sunspots . . . What Do They Mean?

—your guess is as good as mine

The setup at G2UK.

Terry F. Weatherley G3WDI
16, Beverley Court
Carlton Colville
Lowestoft, Suffolk
Great Britain

That the sun affects radio propagation has been known and taken advantage of for many years, and the radio amateurs' rule of thumb can be written: lots of spots = lots of DX.

The science (?) of predicting both the year of maximum and the number of spots at that time is a fascinating one. There are many false trails and intriguing features. Can there really be a connection between such diverse events as harsh winters in the US, monsoons in India, earthquakes in China, aurora, the number of runs scored by cricketeers in the UK, and the position of Jupiter in the night sky? Scientists would have us believe that there is a connection and that it is the sun and its spots. If this be so, amateurs ought to have an easy time predicting DX! This article will explore some of these theories, and the bibliography at the end will lead the interested reader to further fascinating reading.

It was in 1611 that Galileo turned his newly-invented telescope toward the sun and discovered sunspots. Being a cautious man, he did not announce this discovery until 1612 when he wrote, "Having made repeated observations I am at last convinced that the spots are objects close to the surface of the solar globe, where they are continually being produced and then dissolved, some quickly and some slowly; also that they are carried around the sun by its rotation, which is completed in a period of about one lunar month." This discovery was not universally popular or accepted. Some churchmen objected, notably Fr. Scheiner, who wrote that "spots were not a fit subject for the sun's surface."

What are sunspots? Simply defined, a sunspot is a disturbance on the sun's surface, which is connected in some way with the sun's magnetic field. Studies of groups of sunspots show that they tend to occur in pairs of opposite polarity. Two areas can be seen in a fully-developed spot: The uninformly dark central region, called the umbra, and the less-dark surrounding area, called the penumbra. The spots rotate with the sun. It is not uncommon for large spot-groups to reappear two or three times. The number of spots visible on the sun varies from day to day; for establishing long-term trends a formula was developed by the astronomer, R. Wolf, of the Zurich Observatory. The Wolf number is calculated as follows: relative Number (R) = 10 x number of sunspot groups + number of single spots.

Records of sunspot numbers have been kept yearly since 1610. Using these records it is easy to show that the mean sunspot-period is 11.1 years long, but that period variations are from as short as eight years to as long as 16 years. That is the prediction problem.

Other data can be discovered in the 450-year, 195-year, and 27-day cycles.

In the *Annals* of the New York Academy of Sciences, 1961, in his paper on "Sunspot Cycle Correlation," D. Williams states, "The use of mathematical techniques to derive cycles from data poses the question of whether the cycles are not introduced by the technique used." Various mathematicians obtained different results from the same data! In other words, your guess is as good as mine!

A recent spanner introduced into the works was the suggestion that there was a period prior to 1610 when for many years there were no sunspots at all. There are notes in old manuscripts stating, "It is ten years since we saw a sunspot." This used to be put down to poor observation, but a recent report in the *Daily Telegraph* said that studies of ice cores from Antarctica seem to confirm these records. Whether or not this period was simply an allowable variable in a complex cycle has yet to be determined. Don't sell that HF gear yet!

Anyone can, of course, join in the prediction game, and in the next few paragraphs we will look at the data available and some of the conclusions drawn from it. From there, we will look at other apparently similar data drawn from different fields.

First, the raw data. Regular recording of yearly sunspot numbers has taken place since 1749, and the yearly mean Wolf numbers from 1749 to 1954 are shown in Table 1. These figures are plotted out in Fig. 1. They show quite clearly the 11.1-year periods.

This view is somewhat simplistic, and individual cycles are not as smooth as the yearly figures would suggest. If we take a closer look at the last cycle (Fig. 2), solar cycle 20 (from 1964 to 1976), and plot a three-monthly mean rather than a yearly one, considerable variations can be seen. This again highlights the unpredictability of the monthly sunspot number—even when we know the position of the month in question within a cycle.

The ultimate number of the sunspot maximum is also of interest to DXers. As can be seen from the figures, the value of the maximum increases and decreases over a period of

Year	R	Year	R	Year	R	Year	R
1749	80·9	1799	6·8	1849	95·9	1899	12·1
1750	83·4	1800	14·5	1850	66·5	1900	9·5
1751	47·7	1801	34·0	1851	64·5	1901	2·7
1752	47·8	1802	45·0	1852	54·2	1902	5·0
1753	30·7	1803	43·1	1853	39·0	1903	24·4
1754	12·2	1804	47·5	1854	20·6	1904	42·0
1755	9·6	1805	42·2	1855	6·7	1905	63·5
1756	10·2	1806	28·1	1856	4·3	1906	53·8
1757	32·4	1807	10·1	1857	22·8	1907	62·0
1758	47·6	1808	8·1	1858	54·8	1908	48·5
1759	54·0	1809	2·5	1859	93·8	1909	43·9
1760	62·6	1810	0·0	1860	95·7	1910	18·6
1761	85·9	1811	1·4	1861	77·2	1911	5·7
1762	61·2	1812	5·0	1862	59·1	1912	3·6
1763	45·1	1813	12·2	1863	44·0	1913	1·4
1764	36·4	1814	13·9	1864	47·0	1914	9·6
1765	20·9	1815	35·4	1865	30·5	1915	47·4
1766	11·4	1816	45·8	1866	16·3	1916	57·1
1767	37·8	1817	41·1	1867	7·3	1917	103·9
1768	69·8	1818	30·4	1868	37·3	1918	80·6
1769	106·1	1819	23·9	1869	73·9	1919	63·6
1770	100·8	1820	15·7	1870	139·1	1920	37·6
1771	81·6	1821	6·6	1871	111·2	1921	26·1
1772	66·5	1822	4·0	1872	101·7	1922	14·2
1773	34·8	1823	1·8	1873	66·3	1923	5·8
1774	30·6	1824	8·5	1874	44·7	1924	16·7
1775	7·0	1825	16·6	1875	17·1	1925	44·3
1776	19·8	1826	36·3	1876	11·3	1926	63·9
1777	92·5	1827	49·7	1877	12·3	1927	69·0
1778	154·4	1828	64·2	1878	3·4	1928	77·8
1779	125·9	1829	67·0	1879	6·0	1929	65·0
1780	84·8	1830	71·0	1880	32·3	1930	35·7
1781	68·1	1831	47·8	1881	54·3	1931	21·2
1782	38·5	1832	27·5	1882	59·7	1932	11·1
1783	22·8	1833	8·5	1883	63·7	1933	5·7
1784	10·2	1834	13·2	1884	63·5	1934	8·7
1785	24·1	1835	56·9	1885	52·2	1935	36·1
1786	82·9	1836	121·5	1886	25·4	1936	79·7
1787	132·0	1837	138·3	1887	13·1	1937	114·4
1788	130·9	1838	103·2	1888	6·8	1938	109·6
1789	118·1	1839	85·8	1889	6·3	1939	88·8
1790	89·9	1840	63·2	1890	7·1	1940	67·8
1791	66·6	1841	36·8	1891	35·6	1941	47·5
1792	60·0	1842	24·2	1892	73·0	1942	30·6
1793	46·9	1843	10·7	1893	84·9	1943	16·3
1794	41·0	1844	15·0	1894	78·0	1944	9·6
1795	21·3	1845	40·1	1895	64·0	1945	33·2
1796	16·0	1846	61·5	1896	41·8	1946	92·6
1797	6·4	1847	98·5	1897	26·2	1947	151·6
1798	4·1	1848	124·3	1898	26·7	1948	136·3
						1949	134·7
						1950	83·9
						1951	69·4
						1952	31·5
						1953	13·9
						1954	4·4

Table 1. Sunspot numbers (R) from 1749 through 1954 (Wolf numbers).

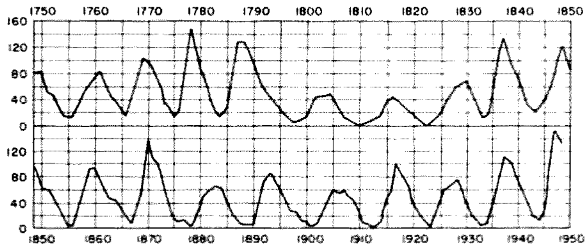


Fig. 1. The 11-year cycles of solar activity from 1750 to 1950. Ordinates: relative numbers, or Wolf numbers.

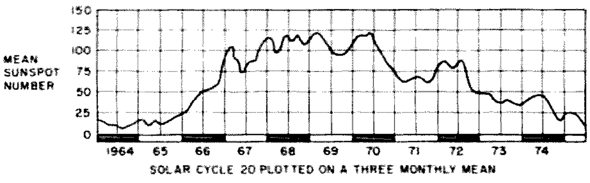


Fig. 2. Solar Cycle 20, plotted on a three-monthly mean.

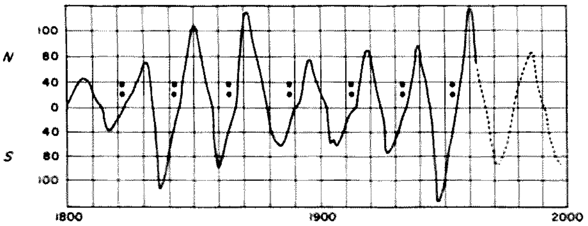
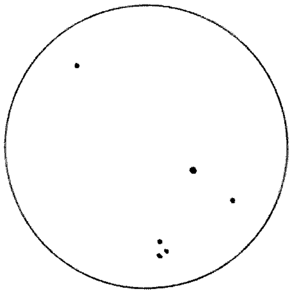


Fig. 3. Anderson's 22-year sunspot cycle. Spots of each new cycle appear in the N and S hemispheres alternately. The economic depressions of 1823, 1843, 1867, 1889, 1913, 1933, and 1954 are located by the twin dots.


One drawing of sunspots, made with the G2UK setup.

seven cycles with super-maximums occurring in 1778, 1860, and 1937.

Some recent research has tried to look beyond past records to predict both the length and height of future cycles. The work of K. D. Wood, of the University of Colorado, falls into this category. His research attempts to relate the tides raised on the sun by the planets—principally Jupiter—to the formation of sunspots. His figures show that each of the three planets—Earth, Venus, and Jupiter—is able to raise tides on the sun. Their combined effect, depending on whether or not they are aligned with each other, causes a variation in the height of the tide, with a period of 11.08 years. This is very close to that of the sunspot cycle. Futhermore, the peaks and troughs of the tidal cycle are very similar to the peaks and troughs of the sunspot cycle.

The tidal trough just past (1976.2) led F. M. Smith G8KG, in his article in *Radio Communication* for July, 1976, to predict that the sunspot trough would occur in 1976.5—that is, July, 1976. We can now test that prediction against the data supplied by Zurich for July, 1976. This stated, "The provisional sunspot number was 2.1 following a month of virtually no solar activity, and the following months showed higher figures." All this seems to fit quite well. Smith then proceeded to attempt to predict date and height of the next maximum. He predicted a maximum of 150, at best, from late in 1980, for about two years.

John H. Nelson, writing in *73 Magazine* in March, 1977, suggested that the forthcoming cycle-high would be in 1979-82 and would be about 20-25 spots higher than the cycle-high that took place between 1802 and 1805. This prediction gave 1979—65/70, 1980—63/68, 1981—68/73, and 1982—62/67. Nelson did not give his reasons for choosing the 1802 to 1805 period for comparison, but, being from a propagation analyst for RCA, they must be scientifically based. He reiterated his prediction in a letter to *73* in February, 1978.

O. Okleshen W9RX, the propagation editor for *HR Report*, drew attention to a method of prediction developed by A. I. Ohl, a Soviet scientist, first reported in *Solnechnaya Dannyye*, and since modified by H. H. Sargent, of the Space Environment Services Center, Denver, Colorado. The theory is based upon using the regression of recurrent geomagnetic activity recorded from the prior cycle, to predict the sunspot maximum for the coming cycle. Thus, from the Ohl/Sargent predictions, the following emerge: predicted sunspot maximum—153.6; date of maximum—May 1980.

The theory also gave some 1978 monthly predictions which could be compared with the actual figures from Zurich:

January—prediction, 58.6; actual, 49.3;
February—prediction, 64.4; actual, 89.8;
March—prediction, 69.6; actual, 73.5
April—prediction, 75.0; actual, 94.7;
May—prediction, 80.6; actual, 79.3.

The Zurich Observatory also joined in the predictions game, and in the July, 1978, edition of *Radio Communication*, predicted the time of maximum for August, 1979, and the number of sunspots—150.

Other research points to other ways of predicting sunspot maxima than simply looking at the sun. The Williams paper, cited earlier, draws attention to some of them. Wolf reported in 1852 that the years 1000 to 1800, which were rich in solar spots, were in general drier and more fruitful. In 1933, Clough stated that 11-, 37-, 83-, and 300-year sunspot cycles correlate with frequency of severe winters, Chinese earthquakes, flood- and low-stages of the Nile, tree growth in Arizona, and wheat prices in England, over a 1400-year period. Wood suggests that it is the extremes of a sunspot cycle—the trough or the peak—that lead to extreme weather conditions (either good or bad), and Williams links economic depressions in the US to 11-year cycle starts with spots in the opposite hemisphere.) This is shown in Fig. 3.

It might be useful here to discuss how the interested amateur can see these all-influential spots—the setup at G2UK is shown in the photograph.

Never, never, never look at the sun directly through a telescope or binoculars! The only safe way is to point the telescope towards the sun and project the image onto a white screen. A shield around the telescope is useful. If the sun's image is recorded on drawing paper, a permanent record can be kept. (A drawing by G2UK is shown.) If, at the same time, a note of band conditions is made, then some useful data can be accumulated.

It would appear from all available data that we are in for an interesting time. DX will be good, winters cold, summers hot (or wet, as in the UK!) But look out for more violent hurricanes and more earth tremors! Nothing is certain, however, and only time will tell! ■

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More on Jammer Nabbing

—hints on equipment and strategy

After publication of my article, "How to Nab a Jammer," I have received many inquiries concerning our DF techniques. The following is in response to a letter which I received. The writer was not sure if the interference had been deliberate and malicious or was simply the kerchunking of a local repeater. It also contained a request for information about the types of antennas used in catching "Red Rider."

We didn't use any fancy antennas to find our turkey. The most exotic was a four-element beam on a broomstick; the simplest was a 5/8-wave Larsen magnetic mount held perpendicular to the belly button of a rotating body. With a bit of trial and error on 52, its pattern can be determined within a few degrees. A rubber ducky in a horizontal position works nearly as well. If you know you're within a few blocks of your turkey, you can turn to an adjacent channel. If he's on 34, go to 37, 31, or 40 receive, and home in on the white noise. Your antenna will have the same pattern. We helped ourselves by getting off 2m for coordination and by having a pair of 2m receivers per team, one on the repeater input and one on the output. Fingerprints were probably the most important single aid in our search. They are especially helpful when the jammer is a ham. Every transmitter has its own set, and if one knows what to look for, they are as different as human prints. All one needs for this is an SSB receiver.

Things to look for in the sideband mode on an FM signal:

1. Exact frequency referenced to the SSB receiver if a better standard is not available.
2. Chirp: If a carrier has a characteristically bad CW chirp, it is a crystal radio, and every crystal has its own peculiar chirp or settling time. It is usually less than one hundred milliseconds, but may be as long as ten seconds.
3. Flutter: If the carrier has a slight frequency jitter (typically plus or minus 50 Hz at a random rate—sounds like a warble on SSB—the rig is a PLL type and therefore synthesized. These types may also chirp, but a well-designed one won't. (The Drake UV-3 is typically plus or minus 1.5 kHz.)
4. On longer transmissions: Frequency drift. . .does it drift high or low?
5. Transmitter rise time: How long does it take the carrier to get to full strength? (This is best seen on a triggered scope hooked to the last i-f on the SSB receiver.)
6. If he has PL, what is the exact PL frequency? This can be measured to .01 Hz and the tolerance of most PL is plus or minus .5 Hz.
7. Signal strength: You will know (within a few blocks radius) where the turkey is by comparing his signal and distance to a known transmitter's power. The signal, distance, and estimate of his transmitter power can then be made.
8. On FM: Background sounds may give a clue to where he is. For example, if there is a baby crying, he's probably home.

Two or three base stations with SSB and beams (vertical or horizontal polarization makes little difference, as long as it's consistent) can make all of the above measurements for comparison to legal transmissions. If the guy's a ham, he probably will have fits of legal operation, and if you get a match, you will know where to set up a stake-out. If you intend to bring in the FCC, documentation is the key word. Look for patterns of operation (the turkey may be an 8 to 5er) and note the times. If you ID a vehicle, get the tag numbers and run them through DMV. If audio is used, get tapes of the patterns. Retired, unemployed, disabled, or self-employed people are the best sleuths, because they can listen at all hours and adjust their schedules to fit any given situation.

The system you choose is also important. Our best system consisted of a base station with two operators, a set of city or area maps, and three to five mobile teams. Two mobile teams are adequate; more than five will clutter up the coordination channel and step on each other. If you have too many people for five teams, put three or four people on each team. Two people per team seems to be the minimum, having one drive and kibbitz and the other run all the gear. A three-person team also works well, with the third person running the coordination channel while the second is DFing. A fourth person can hold the coffee cups and take turns on the other tasks. There should be at least two base operators

per base station. One should run the strings, circles, markers, pins, etc., on the map while the other coordinates the mobile teams. Base DFing can be shared by a third person. It was also convenient to have a wife or sweetheart available to make sandwiches and coffee during the ordeal.

All situations are different. A friendly reminder (on the air) that button-pushing without ID is illegal may be sufficient to solve the problem for the average ham who wants to follow the rules. If your problem is simply kerchunking, a series of fingerprints will often reveal many different transmitters. Good PR can usually cut this problem drastically. We need wider publicity at ham meetings and in club publications to convince people that kerchunking a repeater with no callsign or ID: (a) is illegal; (b) creates unnecessary wear and tear on the repeater; (c) is a nuisance and annoying to people who monitor; (d) is a crutch to the button-pusher to reassure him that the repeater is still there; and (e) is unnecessary.

An example: One Saturday I sat on 34 and 94 receive and in a ten-minute period the repeater kerchunked thirty-five times. Of that thirty-five, there were twenty-seven different transmitters. The last five occurred during a fifteen-second span and were all from the same transmitter. I simply picked up my mike, turned down the 34 receiver, and said, "If you like to push buttons so much, why don't you go into the bathroom and poke yourself in the navel; then you'll never have to ID." This had occurred about fifteen minutes earlier when I said something to the effect that making transmissions without identification is illegal—will the button-pusher please give his callsign? After I signed clear of the repeater, I didn't hear anything for an hour and a quarter.

Another line that works well (if the first friendly warning is ignored) is, "When are you going to get a license, so that you can identify legally when you kerchunk the repeater?" The first friendly warning should be a mandatory courtesy, because the offender may be a newcomer and totally unaware that he is doing anything illegal.

Finally—if you know the offender—don't chew him out on the air. Phone him and inform him privately, and you'll get much more cooperation.

The club in Omaha found that kerchunking was cut approximately 70% by removing the hang time on the repeater (no squelch tail).

I hope I've covered your situation. The procedures discussed here have solved all problems that were not electronically induced (intermod, equipment failure, etc.). Hopefully, your problem can be minimized with a good PR campaign. You will never eliminate it totally because hams are, after all, not perfect. I hear a lot on our local repeater that is fun to listen to, a lot that's boring, and a lot I just can't stand. As long as it's not illegal, I refuse to say anything or condemn anyone for any transmission (even "10-4 Good Buddy" lingo), because I don't have to listen to it. I simply use the VOL knob or the QSY switch and the problem, for me, is solved. This solution is all too often forgotten or doesn't even occur to the offended station. ■

✓ Reader Service—see page 195

Cheapy Scanner for the Memorizer

—is $5 cheap enough for you?

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The Yaesu 227R Memorizer is an excellent rig with very few shortcomings. One of these shortcomings is the selector knob. It is quite a job to switch from, say, 144.9 to 147.9 while driving or when you are on a long trip and are forever turning the selector knob in hope of finding a live repeater. Help is on the way. For about $5.00 and some scrounging around in your junk box, you can build this excellent scanner.

About The Circuit

The circuit consists of an NE555 in the astable mode and four switches, some hookup wire, 10-conductor cable, one LED (optional) and one minibox. The output of the 555 (pin 3) is connected via a 1-uF capacitor to the emitter of Q3 which, in turn, clocks the clock input of Q710 pin 5. Now, by switching the output from the emitter of Q2, which is the up or down input of Q710 pin 10, the counter will count either up or down, depending upon the position of switch 1. Switch 2 is the scan-rate switch and switches one of two capacitors in or out of the circuit. The speed can also be trimmed via R1. The pushbutton switch, S3 (normally closed), is connected to the collector of Q115 via a 500-Ohm resistor and the other wire to pin 4 of the 555. Whenever there is a signal present at the base of Q115, the device conducts and puts a low on pin 4 of the 555 which, in turn, disables the clock pulses. This will stop the scanning for as long as the signal is present. One can defeat this by depressing the defeat switch momentarily. This will cause pin 4 to go high again and the scanner will continue to scan until it sees another busy channel. One can stop the scanner by switching the on-off switch, S4, to the off position. (Note that for manual operation, the up-down switch must be in the up position.)

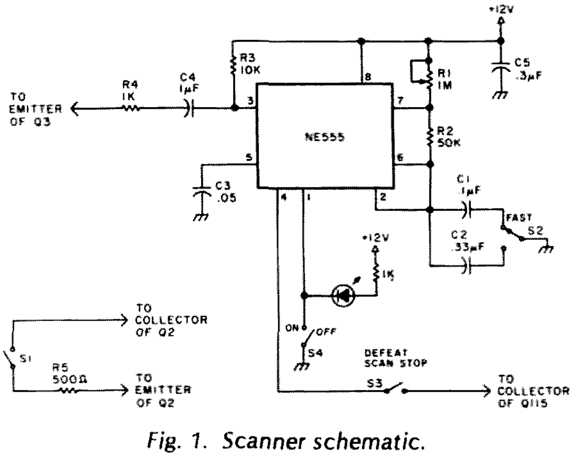

Fig. 1. Scanner schematic.

The objective of this project was to use a minimum number of parts, yet achieve the same results one might expect from commercial scanners. An auto-reverse feature can be added by decoding the 4 and 8 of the 144 and 148 and feeding them into a flip-flop. This is easily done by tapping into Q711 for high and Q712 for the low end.

Construction

Refer to the schematic. Work slowly and double-check all your connections before applying power to the rig. The 555 and associated components were placed on a small PC board about 1" x 1" and wrapped in non-conductive foam. This was tucked next to the speaker depression of the lower cover. Leave enough wire between the cover and the rig so that the cover can be easily removed for service. A small connector was used to exit from the rig to the control box. I used a Cinch No. DB25P, but any miniature 12-pin, or more, connector can be used. It is always good to have a few extra pins for future modifications like remote control of PLs, etc.

In conclusion, the scanner works like a charm and I am sure it will delight all you knob and switch nuts.

Good luck and happy scanning! ■

Back to School

—we can still learn a thing or two about basic electricity

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During a QSO the other evening, a ham was indulging in woeful lamentations as he speculated the worth of his fortune had he but deployed a different stratagem in the stock market. As for me, several successive market devastations finally illumined the path of absolute reliability for the avoidance of such mishaps on Wall Street—absolute abstinence!

Of course, my belated advice could not restore my ham friend's bank account. Indeed, I myself succumbed to the contagion of fantasizing lost economic opportunities. After we QRT'd, I began speculating about my tax bracket had I received a measly buck for every unheeded admonition I have sounded for the Young Squirt's benefit. For one thing, I have repeatedly urged him to pursue a vocation which commands popular respect and holds promise of secure remuneration. He could have directed his quest for education to plumbing, barbering, or to truck piloting. As to whether it was pure perversity or not-so-pure rebellion, I confess ignorance. All I know is that he is adamantly chasing after an elusive degree in Electrical Engineering. (At times, I ponder my own guilt in the matter, having presented him with that birthday gift several years ago—a hi-fi kit!)

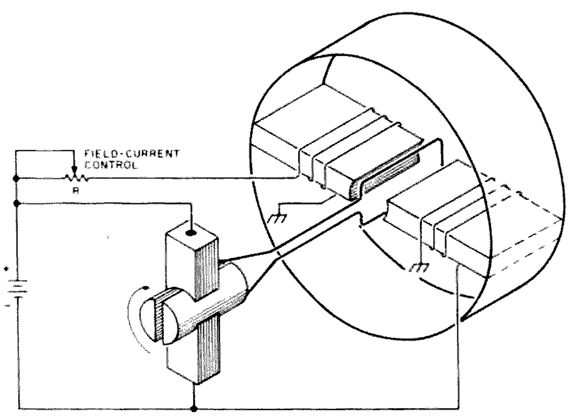

Fig. 1. Simple dc shunt motor with field-current rheostat for speed control. An elementary setup, to be sure, but which way should R be adjusted to increase motor speed?

On second thought, there may well be a good measure of method in his madness. After all, he has his unemployed pop, an EE of venerable vintage, to assist with the homework. Be that as it may, my diligent efforts with job resume number 122 were rudely interrupted.

"Hey, Dad, these three problems should be right up your alley, especially this first one because you've been monkeying around with motors on that rotary beam of yours!"

I found myself scanning the problem sheet which he had disrespectfully but accurately cast into my field of vision. Of the three problems presented, the first dealt with a dc shunt motor. An illustration such as indicated in Fig. 1 was provided. A slew of operating conditions was given, but I construed these to be so much smoke-screening intended to obscure the nitty-gritty of the problem. Suffice it to say the motor was lightly loaded and was operating well within its ratings in all other respects. The kindergartenish problem questioned how one should adjust the rheostat in the field circuit in order to cause the motor to run faster. I couldn't help reflect upon the soft life these Young Squirts had—for sure, my EE studies had been incomparably tougher!

After admonishing the Young Squirt that he would never cultivate the ability to analyze difficult problems if he was too lazy to apply his noggin to such cinch problems as this one, I authoritatively expounded the obvious answer.

"Naturally, you'd crank resistance out of the rheostat. Then there would be more current in the field winding, more field current

in the field for the armature conductors to react with. Inasmuch as the rheostat is connected to adjust field current only, it follows that the interaction between the current-carrying armature conductors and the shunt field will be stronger, which is to say, more electromagnetic torque will be developed. And, since the mechanical load on the motor remains constant, this increased torque can do only one thing—speed up the rotation of the armature!"

A look of astonishment surfaced on the countenance of the Young Squirt. "But, Dad . . ." he protested.

Nipping his response in the bud lest the proverbial molehill grow into a mountain, I interrupted with, "There just aren't any ifs, ands, or buts. Certainly, it must be clear to you that if you had no magnetic field at all, you wouldn't even have a motor. In other words, the armature wouldn't even rotate. If there is a field for the armature current to react with, you'd have some rate of rotation. Naturally, then, if the field is made stronger, you'd expect an even higher rate of rotation. What could be simpler?"

"Yeah, Dad," replied the Young Squirt, apparently coming to his senses. "That sure is a simpler explanation than my Prof coughed up. Maybe you should go in for teaching."

This compliment instantly dissolved any insecurity I might have harbored in recalling the behavior of those long-forgotten motors. So, with a burst of gusto, I plowed into the second problem. This brain teaser involved the elementary three-phase circuit shown in Fig. 2. As can be seen, a voltmeter and an ammeter are connected to indicate ac voltage and current of one phase of a three-phase resistive load. (The load was stipulated to be balanced.) The question before the house: What is the total power consumed by the load? Here, I sniffed a rodent. But, if such a critter were indeed involved, its whereabouts eluded me.

Partially rescuing myself from having spent the better part of three minutes in deep meditation, I answered the question with another question: "Well, why don't you just multiply the phase voltage by the phase current, then times three for the total power in all three phases?"

Inasmuch as my query wasn't in the least wishy-washy, but resounded with boldness and much resolve, the Young Squirt limited his comments to a brief under-the-breath murmur of unintelligible gibberish. Assuming this to be some oral equivalent of "thank you," I focused my attention on the third, and final, problem.

An inspection of Fig. 3 revealed a simple charging circuit in which a one-microfarad capacitor, C1, can be charged through a resistance from a 100-volt dc source. After capacitor C1 is fully charged, its charge may then be shared with a similar capacitor, C2. This is accomplished via switch SW by moving the blade from contact no. 1 to contact no. 2. (Once this has been done, the 100-volt source is no longer involved.) Actually, the problem had two parts. First, the amount of energy stored in C1 is required. Then the inquisitor wants to know what happens to this electrostatic energy when the switch is set in its no. 2 position.

With renewed confidence, I informed the Young Squirt that such problems weren't often encountered outside of a physics class. From the vague recesses of my subconscious mind, I managed to extricate the formula for electrostatic energy (which had been stored in "condensers" when I was a Young Squirt). That formula, $W = \frac{1}{2}CV^2$, expresses a "classical" relationship—the energy, W, is in joules, the capacitance, C, is in farads, and V is in volts.

"Duck soup," I exclaimed. "Your instructor is just trying to see if he can snow you with that million-times-too-big a quantity of farads; also, he figures you will panic when you are forced to fool around with joules."

To drive home the basic simplicity of the problem, I didn't even resort to my highly-esteemed scientific calculator. (Much of the esteem stems from the high price I shelled out when these fancy gadgets first became available.) On a piece of scrap paper, I pencilled the following arithmetic: $W = \frac{1}{2} \times 1 \times 10^{-6} \times 100^2$. With a little crank-grinding, W came out to be .005 joules. "This," I announced, "is the energy stored in C1 after it becomes fully charged with the switch set in its no. 1 position."

This time, the response from the now awe-stricken Young Squirt was a clearly audible "Wow!"

With the culmination of my tutorial activities in sight, I eagerly sought a face-to-face encounter with the second part of this problem. Its benign aspect evoked no need to muster latent resources of courage. What the heck! One simply dumps a charged capacitor into a like-sized uncharged one—where's the problem? In an attempt to "dress up" the explanation so as to impress the Young Squirt, I groped for an elegant postulate of classical physics. Did not Einstein, Newton, Tesla, or some other scientific sage inform us that energy could be either piled up at one place or parcelled out in the same total amount elsewhere? Despite my strenuous efforts to pinpoint the relevant axiom or hypothesis, its origin and identity tantalizingly eluded me. Finally, falling back on good old common sense, I divulged my solution to the Young Squirt.

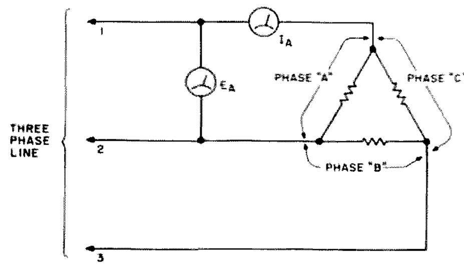

Fig. 2. A three-phase balanced load with a voltmeter and ammeter in one phase. A little common sense suggests that the total power consumed by the delta-connected load is 3 x E_A x I_A. A more adequate dose of common sense refutes this simplistic solution!

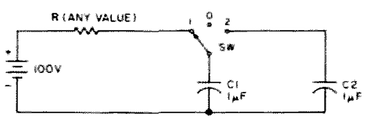

Fig. 3. Circuit for redistributing energy stored in a capacitor. After C1 is charged up, its energy is then shared with C2 by setting the switch in its no. 2 position. If the result is obvious, beware!

"Look," I said. "When you place the switch in position no. 2, the charge stored in capacitor C1 simply redistributes itself between C1 and C2. Obviously, since the capacitors are the same size, the final result has to be that the total available energy, .005 joules, remains .005 joules but now is stored on a 50-50 basis in the two capacitors. In other words, C1 and C2 each wind up with .0025 joules."

The Young Squirt's retort really made my day. "Gee, Dad, you old-timers sure do know your stuff. That Prof of mine took about ten times longer than you did to explain it and it just went in one ear and out the other."

And so this brief parley was terminated. I recalled how my own EE studies used to drive me up the wall those many moons ago, and I pondered with amazement that seemingly long-forgotten learning could be pulled out of the subconscious on demand! I peacefully returned to my job resumes. Then, after mailing a three-inch stack of these, I spent several days debugging my recently completed home-brew receiver. It appeared to be operable right off the bat, but closer scrutiny showed it to be plagued by numerous spurious responses. These were quite amenable to being moved around on the dial, but seemingly could not be eliminated. Neither theory nor cut-and-try sufficed to eradicate the offending signals. So challenging did this unexpected defect become that I became totally immersed in its interpretation and correction. The keen analysis, together with the earthy horsesense that enabled me to promptly dispatch the Young Squirt's problems, were mysteriously proving ineffective now. Ever a seeker of challenge, I resolutely determined to measure up to the magnitude of my tasks. I am sure I was on the brink of a breakthrough when I was rudely interrupted by raucous noises from the Young Squirt.

"Ye gods, Dad, are you trying to make me flunk out?" Only too clearly, the question conveyed more accusation than interrogation. "I was the only one who missed those three problems! The Prof says I'm not sharp enough to come up with such dumb answers, so he figures someone's been feeding me a bunch of baloney!"

As you probably suspect, the Young Squirt wasn't merely blowing bubbles through his beard! With appropriate manifestations of well-deserved embarrassment, I repented and apologized right then and there. What else could I do? With beautiful consistency, I had, indeed, swallowed the hook on all three "simple" problems!

And now, just in case *your* Young Squirt inflates your professional pride with similar "commonsense" problems, I herewith reproduce the correct answers as written by the Young Squirt's professor, beneath the large red "F" on the homework papers.

"1. In the dc shunt motor, there is some tendency for speed increase as the magnetic field is made stronger. However, this tendency is completely overshadowed by another effect accompanying the strengthened field. As you should know, such a machine simultaneously operates as a generator, even though we describe its function as that of a motor. This is true because we have armature conductors rotating in a magnetic field, as is the case when a dc machine is deliberately used as a generator (that is, when mechanical power is *supplied* to the shaft and electrical power is *extracted* from the armature). The effect of such generator action during motor operation is to oppose the current delivered to the armature. Because of the iron in the magnetic 'circuit' of the machine, a little increase in field current produces a relatively large increase in the internally generated voltage, or counter EMF.' The resultant opposition to the armature current then overwhelms the effect on speed of the stronger magnetic field per se. Inasmuch as the torque developed in the rotating armature is proportional to field strength and to armature current, the predominantly large reduction in armature current actually decreases the torque and thereby causes the speed to decrease. Accordingly, if we wish to *increase* motor speed, we must insert *more* resistance in the field circuit so that field current and field strength are decreased!

"Where were you when I requested anyone failing to grasp this aspect of motor operation to see me after class?

"2. It may appear correct to state that the product of E_A and I_A in Fig. 2 yields the power consumed by the phase A section of the load. Yet, caution is required in the interpretation of such a statement because phase B and phase C also make contributions to the line current, I_A. That is why one cannot solve for the total load power by merely multiplying the product of E_A and I_A by three! Rather, the total load power is given by $E_A \times I_A \times \sqrt{3}$.

"Where were you when I carefully explained this?

"Inasmuch as $\sqrt{3}$ is 1.73, we can write $P_{TOTAL} = E_A \times I_A \times 1.73$. And because we are dealing with a balanced three-phase system, it is also true that $P_{TOTAL} = E_B \times I_B \times 1.73$ as well as $E_C \times I_C \times 1.73$. All this comes about because the three-phase voltages differ from one another by 120 degrees. The three-phase currents also differ from one another by 120 degrees. That is why you can't use the logic of ordinary arithmetic in computing total power in this problem!

"Note that if connecting lead no. 3 is interrupted, phases B and C will no longer be active. Under this condition, three times the product $E_A \times I_A$ will give the total power in the load when phases B and C are restored by reconnecting lead 3.

"3. There is a certain mystique about this 'trap'—it never fails to catch prey! It is commonly recognized that the capacitance will be doubled when the switch, SW, is placed in its no. 2 position. And most students (but not you) perceive that the stored voltage will be halved. This derives from the relationship $V = Q/C$, where V is the voltage developed across the plates of a capacitor or a capacitance system, Q is the amount of charge, and C is the capacitance. We do not need to enumerate Q in this problem—it is sufficient to know that it remains the same whether stored in the signal capacitor, C1, or in the parallel capacitors, C1 and C2. That being so, the voltage across the parallel combination of capacitors must be one-half that originally developed across C1 alone.

"What is the significance, then, of the situation where we have half the original voltage and twice the original capacitance? Does the stored energy remain constant? It certainly does not. Consider the formula for electrostatic energy, $W = \frac{1}{2}CV^2$. A little arithmetical experimentation quickly shows that only one-half the initial

energy stored in C1 alone is available from the parallel combination of C1 and C2 after switch SW is placed in its no. 2 position.

"Where have you been? And, what became of the lost energy?

"As your instructor, I find it easier to answer the second question. The lost energy dissipated itself as heat in the resistance of the connecting leads and in the resistance within the capacitors themselves. Also, some of the energy entered entropy, that land of no return, via the acoustics of the spark and through electromagnetic radiation.

"Interestingly, it is found that the ultimate result of this experiment is substantially the same whether the connecting leads have a small fraction of an Ohm or thousands of Ohms of resistance. In all cases, the 'new' storage system (SW position no. 2) will contain very close to one-half the stored electrostatic energy of the original system (SW position no. 1).

"Does such behavior appear strange? It very well might, for in most electrical circuits, increased resistance is accompanied by increased losses. How can you reconcile this apparently devious feature of our capacitor circuit?

"Extra credit will be given for good answers to this paradox, providing reasonable proof can be tendered that no *outside assistance was obtained*!!"

Well, I'm sure we can agree that the Young Squirt's professor is a literary bug par excellence. And, I gotta hand it to him; those electrons don't put anything over on him. But, his sense of humor—that, I don't dig! ■

Moving Display ASCII Readout

—works with UARTs, keyboards, and micros

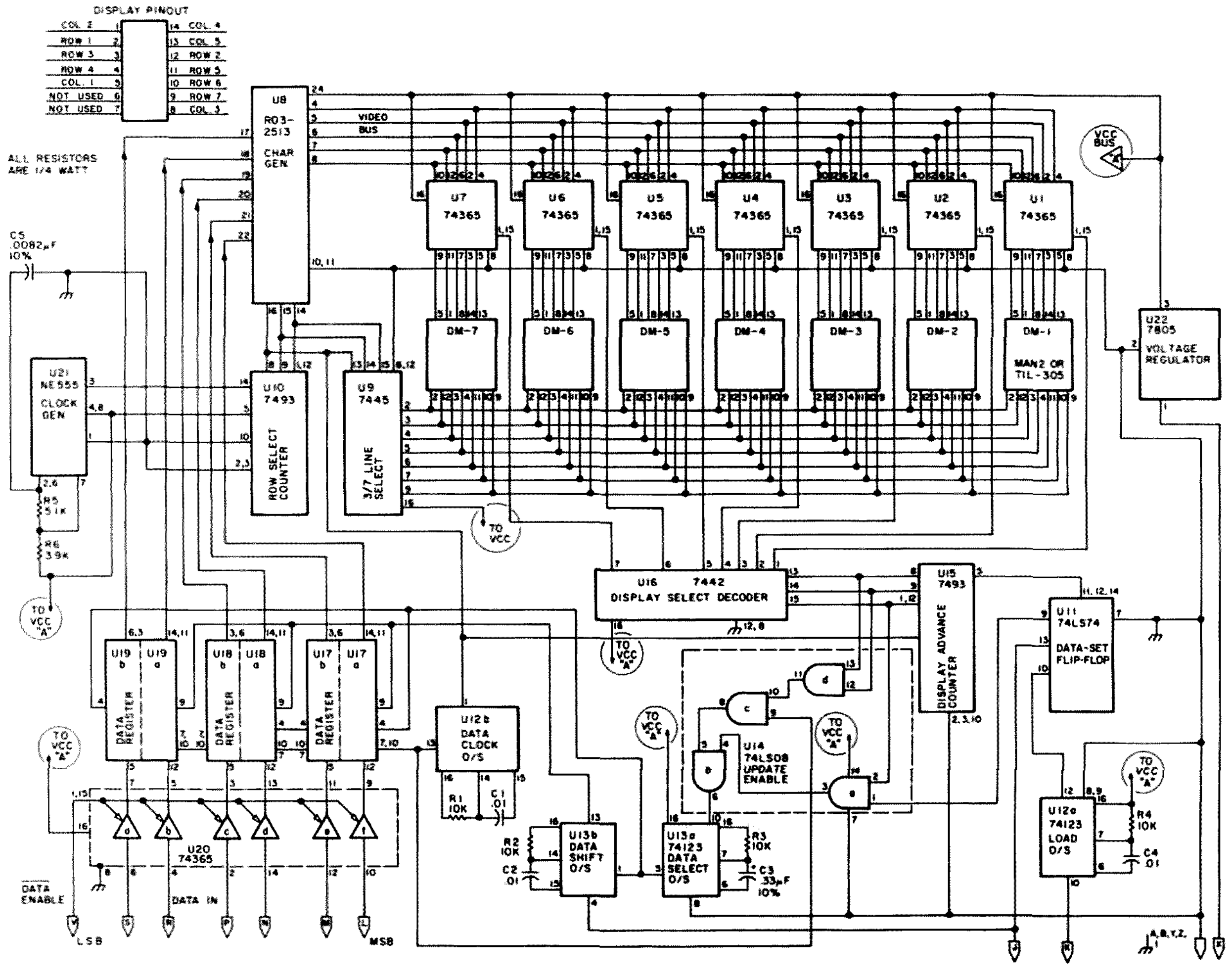

Fig. 1. Display schematic.

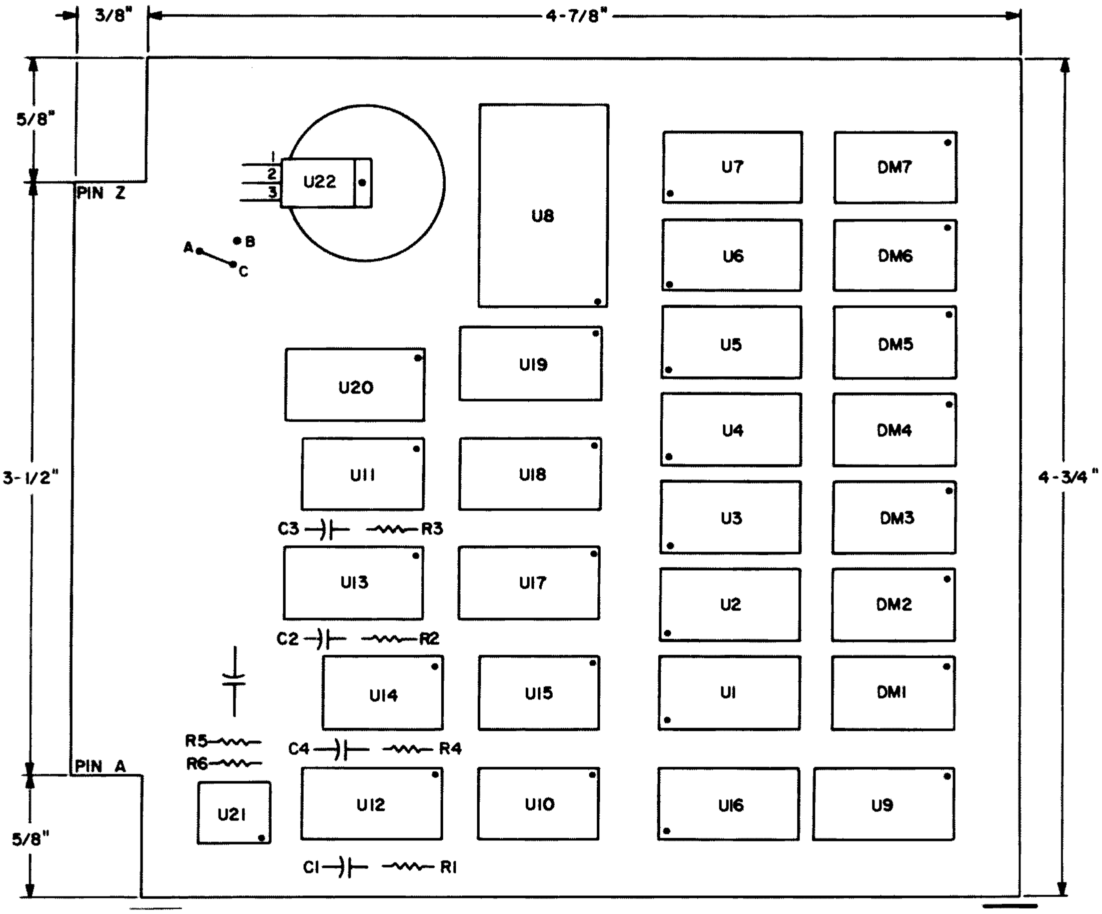

Fig. 2. Printed circuit board component layout and dimensions.

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The great deal of mail received in response to the article "Moving Display RTTY Readout," September, 1977, *73 Magazine*, gave me considerable food for thought concerning a redesign of the readout section.

A number of specific comments and suggestions regarding the original system have been incorporated into this new layout, which simplifies the display section by sharply reducing the chip count and eliminating all of the cumbersome drive transistors. The end result is a compact, ASCII-compatible, almost stand-alone alphanumeric display board, which requires only a 5-volt power supply, a parallel data source, and a strobe pulse. Results obtained have been so encouraging that a printed circuit board has been layed out and is now available.

The first change made was a reduction in the number of readouts. At approximately $5 for each readout, building a large display rapidly becomes an expen-

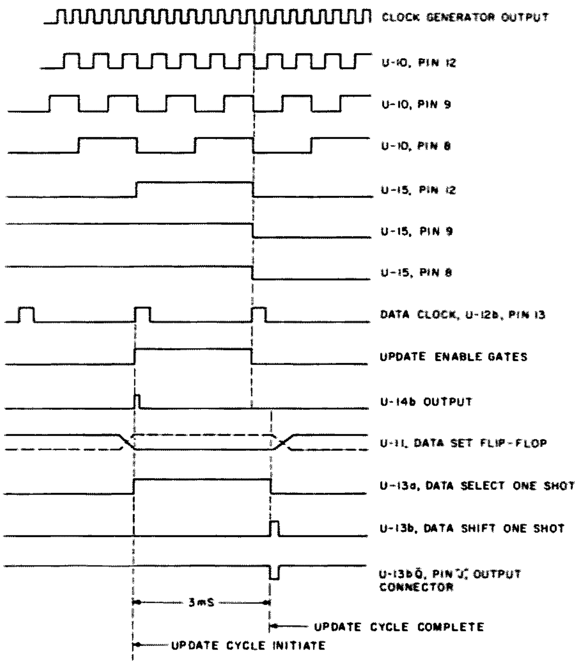

Fig. 3. System timing diagram.

sive undertaking. Seven characters have proved to be sufficient, and will read out many words in their entirety. I have never experienced any difficulty in deciphering words longer than this.

Redesign of the Data Register Section

The original terminal served well as a hardware test bed, but lacked overall efficiency; some changes were definitely in order. Too many parts was the main problem. The unit required a shift-register and multiplexer chain which totaled 22 separate ICs. Upon completion of testing with various types of chips, it was concluded that the multiplex and shift functions could be done in a single step with recirculating shift registers, operated in a dynamic mode, by tying the inputs and outputs together and clocking them in parallel from a single source. The outputs are branched off to address a character generator, and, starting at display 1 on Fig. 1, are held steady until the display has been scanned through 7 rows by the row-select counter, U10. At that time, the shift-register bank is pulsed, which causes the data for the next word to appear, and also increments the display advance counter, U15. This in turn causes the display select decoder, U16, to enable the next readout. The process continues until all 7 readouts have been refreshed, and then starts over again. The readout scan rate is approximately 50 times per second, determined by U21. In case you are wondering why only 7 displays are used even though the shift registers are capable of storing 8 positions, the inputs are tied to the outputs so that the data in positions 1 and 8 become the same, causing the overall length of the registers to be reduced by 1 bit.

From a timing standpoint, the most critical function is the introduction of new data. This was not a problem on the original unit because new data always entered the first chip at the beginning of the shift-register chain, but updating a recirculating register is not as easy. If data enters the circuit in the middle of a scan, it might wind up appearing on any one of the displays. To prevent this from occurring, a specific updating sequence must be followed. At the end of each display scan, the Data Set flip-flop, U11, is interrogated by ANDing its Q output with the sum of the data clocks. If there is no new data present, nothing will occur, and the scan will resume. But if the Q has been set high by a new data strobe through the Load one-shot, U12a, the sum of the update enable gates, U14a and U14d, and the flip-flop Q, will initiate the update sequence. Once fired, the Data Select one-shot, U13a, takes the shift registers out of the circulate mode and allows the new data to be present at the beginning of the shift-register data-stream inputs. During the time that the Data Select one-shot Q is high, one clock pulse through the Data Clock one-shot, U12b, will occur, and it is this pulse which causes the new data to actually be entered into the shift-register bank, U17a-U19b. At this time, the new character address is located in position 7, and would be displayed there if nothing more were done. However, the falling edge of the Data Select one-shot fires the Data Shift one-shot, U13b, which, in turn, pulses only the shift-register bank. The Display Select Decoder chip, U16, is unaffected. The net result of this operation is that the (new) data which had been present in position 7 is moved to position 1; that which was in 1 is moved to 2, 2 to 3, 3 to 4, etc., and the last character moves off the board. The entire update cycle occurs between scans; therefore, the movement of data being entered into position 7 and then shifted to position 1 is imperceptible.

The $\overline{Q}$ of the Data Shift one-shot, U13b, is available at pin J of the board edge connector. It normally sits in the high state, and will pulse low when the update cycle is completed. It can be used to, say, reset the DAV flag on a UART. Once the update cycle has been initiated, incidentally, data present at the inputs must remain steady until this pulse occurs, which may

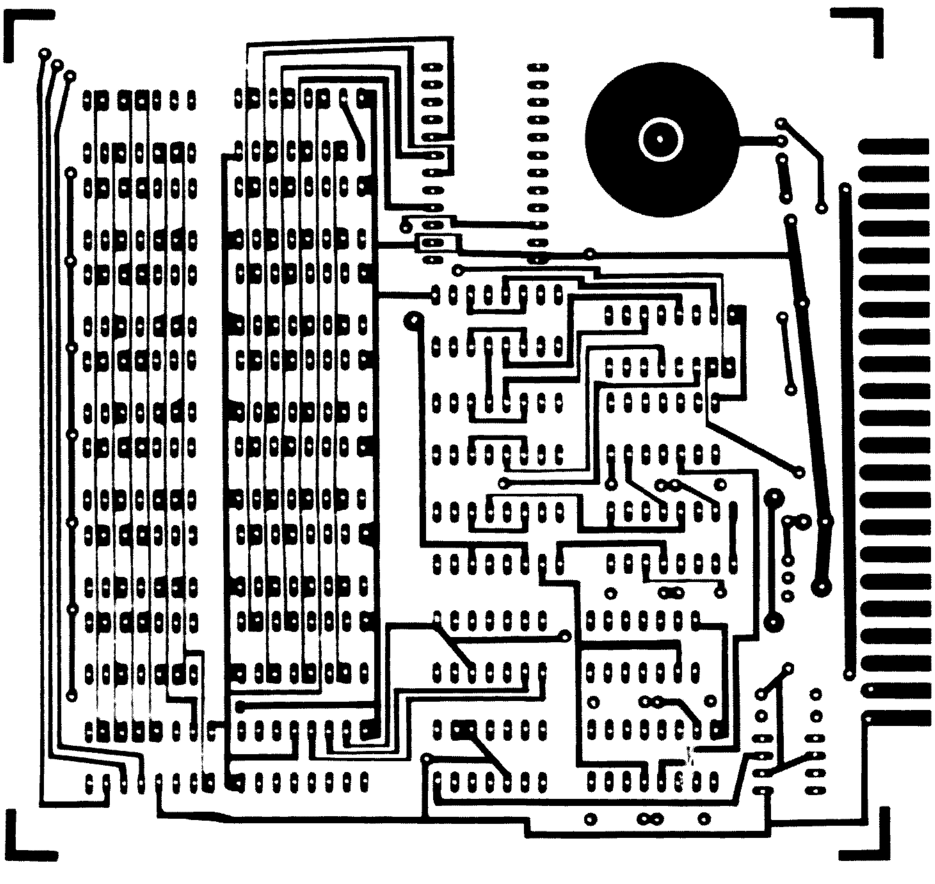

Fig. 4(a). Printed circuit board layout, top side.

take as long as 3 ms after the data strobe. Operating directly from the data bus of a microprocessor normally will require the use of an output port or a latch of the 74LS174 or 74LS374 variety.

The 9328/93L28 shift registers are manufactured by Fairchild, and are pin-for-pin compatible with the Signetics 8277. This chip was selected for ease of implementation, due to on-chip multiplexing between input sources, separate and common clocking, and two-register-to-a-chip packaging. Only three devices are required for the shift-register section.

Redesign of the Display Section

A little more experimentation resulted in the readout section also being improved. The original unit required 87 drive transistors—a bit much. Playing around with some more chips and a suggestion from Bob Kissell WD8ILI resulted in discovering that ICs could directly handle the current requirements of the displays. The line-select chip, U9, a 7445, is a higher-power version of the original 7442, and also has open collector outputs. It is not necessary to tie the collectors to any voltage source, for when a particular line is selected it is switched to ground. The source current is supplied by the column drivers, U1-U7, 74365s, which are ideal for this application since they easily interface with the character-generator output bus. They are also tri-state, having neither output nor loading when de-selected. The character generator is the RO-3-2513, made by General Instruments, and requires only a single 5-volt power supply. Current-limiting for the display diode matrices, DM-1 through DM-7, has been found to be unnecessary, essentially because the driver chips are self-limiting due to the voltage drops across the internal output transistors. A prototype display board has been in operation for more than six months, and probably has more than a thousand hours of operating time on it. To this date, there have been no display failures.

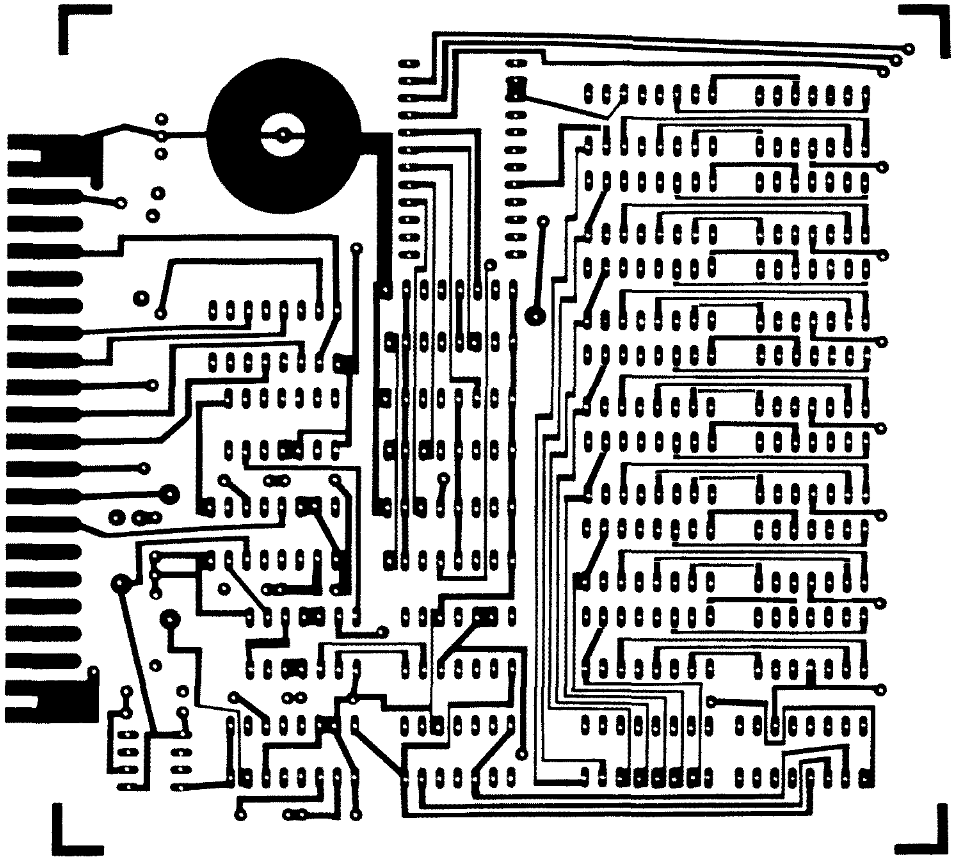

Fig. 4(b). Printed circuit board layout, bottom side.

Construction

The layout is relatively straightforward, and construction should not be difficult. Wire-wrap can be used for experimental units, with discrete parts mounted on component carriers. If the printed circuit board layout is used, care should be exercised to avoid solder bridges between traces. The use of sockets for mounting chips and the displays is highly recommended, as repairs to a board of this type can be very difficult.

The only two critical components are capacitors

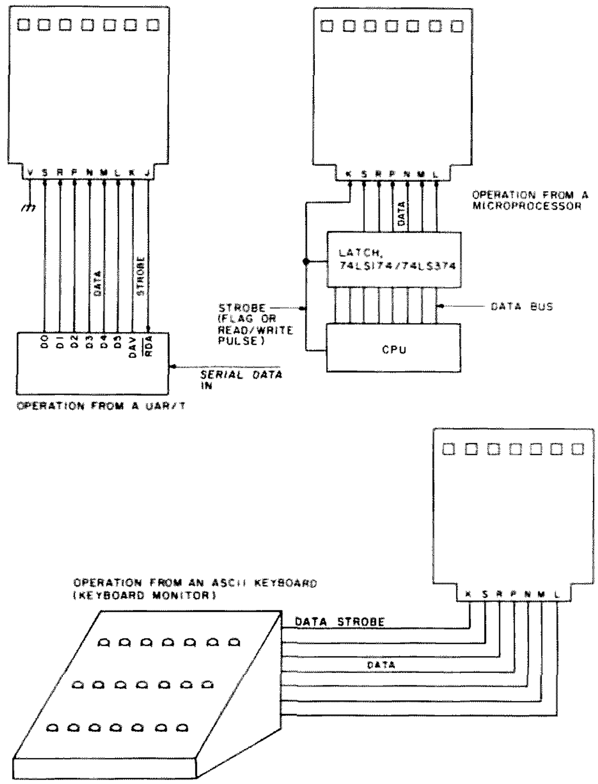

Fig. 5. Typical applications.

Parts List

Quantity	Description
7	Readouts, type MAN-2 or TIL-305 or equivalent
3	Shift registers, 9328/93L28 or type 8277
8	74365 tri-state buffer (Note: do *not* use low-power Schottky devices in positions U1 through U7.)
1	7442 decade decoder
1	7445 decade decoder (Do not substitute.)
2	7493 binary counter
1	RO-3-2513-001 5-volt character generator (General Instrument)
2	74123 dual one-shot
1	74LS08 quad AND gate
1	74LS74 dual-D flip-flop
1	LM555CN timer or equivalent
1	7805 voltage regulator
4	10k-Ohm, ¼-Watt resistor
1	5.1k-Ohm, ¼-Watt resistor
1	3.9k-Ohm, ¼-Watt resistor
3	.01-uF ceramic disc capacitor
1	.33-uF ± 10% tantalum capacitor
1	.0082-uF ± 10% capacitor
1	44-pin edge connector
1	Printed circuit board (Note: a double-sided plated-through hole PC board for this project is available for $30 through Digiscann, PO Box 56, Enon OH 45323. Contact the above address regarding the availability of the other components on this list.)
11	14-pin integrated circuit sockets
15	16-pin integrated circuit sockets
1	8-pin integrated circuit socket
1	24-pin integrated circuit socket

Misc.—1" piece of wire for jumper; screw, washer, and nut for mounting U22.

C3 and C5, each of which should have a tolerance of no greater than 10%. C3 should be a tantalum type, for compactness. Any voltage rating greater than 5 is satisfactory.

The board may be operated directly from a +5-volt power supply, or run from a +7-10-volt source, by using the on-card regulator. If this mode is selected, remove the jumper wire from points A and C and connect it to points B and C. Supply voltage is still applied to pin X of the edge connector.

In most applications, pin V of the edge connector must be grounded to enable the data inputs. However, if the display is placed on a data bus where timing or loading might be a factor, pin V may be strobed low, taking into account the constraints discussed earlier.

To test the display before placing it into operation, place all of the chips except U8, the character generator, into their respective sockets and apply power. At this point, all of the displays should appear to be on. If not, check for defective components and/or soldering errors. If the board passes this test, insertion of the character generator should bring about normal operation.

The board itself can be mounted vertically in an edge connector and, if desired, it can be supported with circuit-card guides, spaced according to the dimensions in Fig. 2.

Incidentally, for the sake of economy, it is not necessary to use all 7 readout positions. Indeed, the display will function quite normally with just one readout in place. To run it in this manner, place all of the components on the board except for drivers U1 through U7 and diode matrices DM-1 through DM-7, and then, starting from the right, put on as many or as few displays as desired, making sure that each readout has a driver chip. Additional displays may be added to the board at any time. ■

ASCII Address Of:	Will Display:	ASCII Address Of:	Will Display:
000000-LSB	@	100000-LSB	(SPACE)
000001	A	100001	!
000010	B	100010	"
000011	C	100011	#
000100	D	100100	$
000101	E	100101	%
000110	F	100110	&
000111	G	100111	'
001000	H	101000	(
001001	I	101001	)
001010	J	101010	*
001011	K	101011	+
001100	L	101100	,
001101	M	101101	—
001110	N	101110	.
001111	O	101111	/
010000	P	110000	0
010001	Q	110001	1
010010	R	110010	2
010011	S	110011	3
010100	T	110100	4
010101	U	110101	5
010110	V	110110	6
010111	W	110111	7
011000	X	111000	8
011001	Y	111001	9
011010	Z	111010	:
011011	[	111011	;
011100	\	111100	<
011101	]	111101	=
011110	^	111110	>
011111	—	111111	?

Fig. 6. Address/display truth table.

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Lab-Quality Hi I Supply
—part II

I hope that by now you have finished assembling your power supply as presented in part I of this article, and are ready to put the finishing touches on your project. In this installment, I will describe the construction of the digital panel meters (DPMs) used to display voltage and current and describe a few circuit improvements. As mentioned in part I, the DPMs are optional, and if you used analog panel meters, simply skip to the "Improvements" section below.

First, a few words about the DPMs used in this project. They feature simple circuitry, high accuracy, and relatively low cost. We chose to "roll our own" because good commercial instruments cost almost twice as much to buy. Since the DPMs are the most expensive part of the project, this was the natural way to go.

As you can see from the schematic, the circuitry of the DPMs is quite simple. A single IC chip from Intersil contains an A/D converter with a 3½-digit counter capable of directly driving an LED display. An input filter, consisting of R101 and C101, filters any noise off the input voltage being measured, and then the chip takes over. Analog signals appearing on pins 30 and 31 are internally processed by the chip. Resistor R103 and capacitor C105 determine the rate at which the processing takes place—normally about five times a second. Resistors R104, R105, and R106 form the meter calibration circuitry, and divide an internal reference to 1.000 volt for the A/D converter. These parts set the accuracy of the meter. Capacitors C106 and C107 serve as on-board noise filters, and the rest of the parts are related to the analog circuitry.

Inside the chip, the analog voltage is converted to a corresponding train of pulses and counted up by an internal 3½-digit counter. The counter section then drives LED displays. Not to be overlooked, diodes D101 and D102 serve to limit the voltage applied to the display. This sharply reduces the current drain required

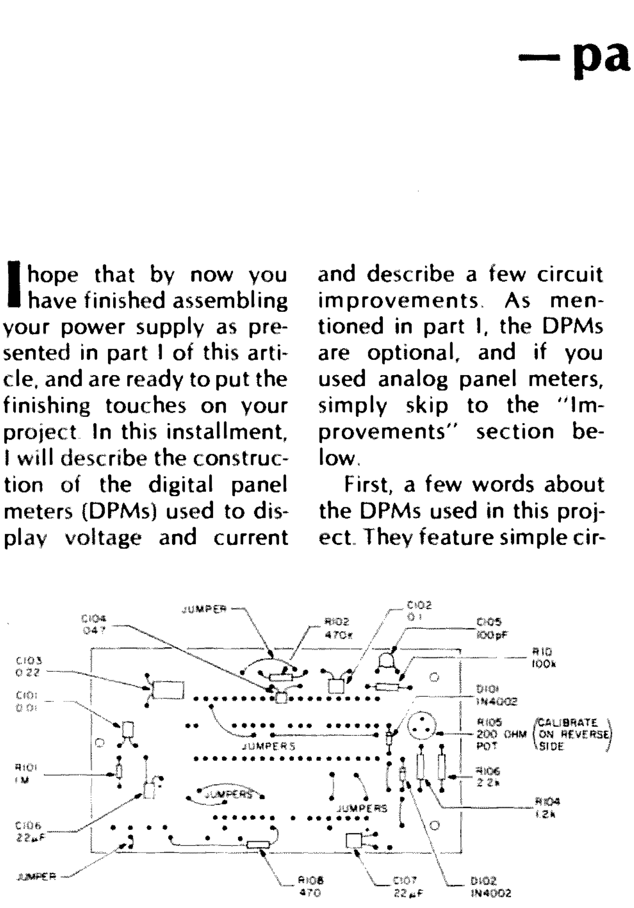

Fig. 1. Front view of the DPM showing how parts are installed.

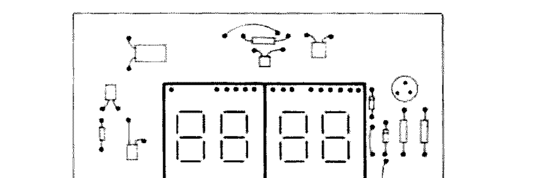

Fig. 2. Another view of the DPM, showing installation of the LEDs.

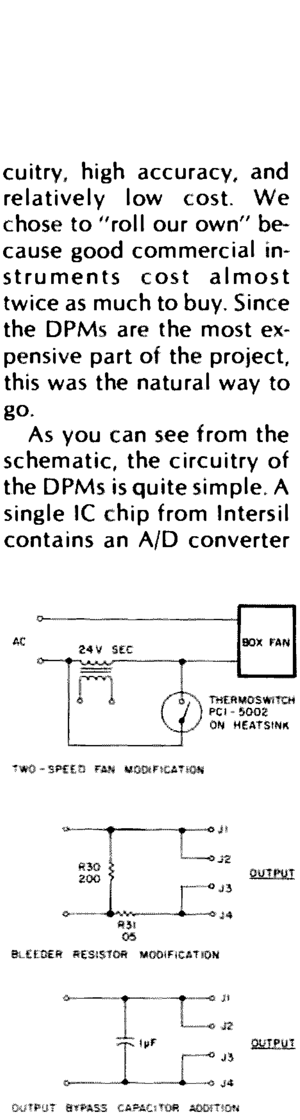

Fig. 3. Modifications you can make to your power supply.

by the DPM and results in cooler, more reliable operation. The theory has been simplified greatly to allow more room for discussing construction, but the basic operation of the DPMs has been described. Suffice it to say, that's enough for practical purposes!

The first step in putting the DPMs together is to find all the parts. Good sources for the National dual-digit common-anode LED display include the Digi-Key Corporation of Thief River Falls, Minnesota, and a good source for the Intersil DVM chip has been Poly Paks, of East Lynn, Massachusetts. The Poly Paks chips are prime units as of this writing, and sell for less than from most commercial distributors. The rest of the parts are standard and should be easy to get. Do not sub capacitors C102 and C103 if you can help it. Use the green Japanese mylar® caps. If you sub these caps, the DPMs will tend to give jittery readings and, in general, be less accurate. Pot R105 is a Beckman model 82PFR200 trimmer—a type often found on surplus PC boards. If desired, a conventional trimmer may be mounted on the rear of the board if the Beckman TO-5-sized unit can't be located.

The next step is to make up the PC board. As you can see, full-sized artwork has been provided for you to do this. Use transfer film such as PCP Type A, available from hobby electronics houses, to transfer the pattern to the board. Expose, develop, and etch the board according to manufacturer's instructions. Then cut to size and drill all holes with a no. 65 drill. Also, drill the three holes along the PC board edges with a 1/8" drill. These are the mounting holes. With that, let's turn to the construction.

Building the DPMs is easy if you follow instruc-

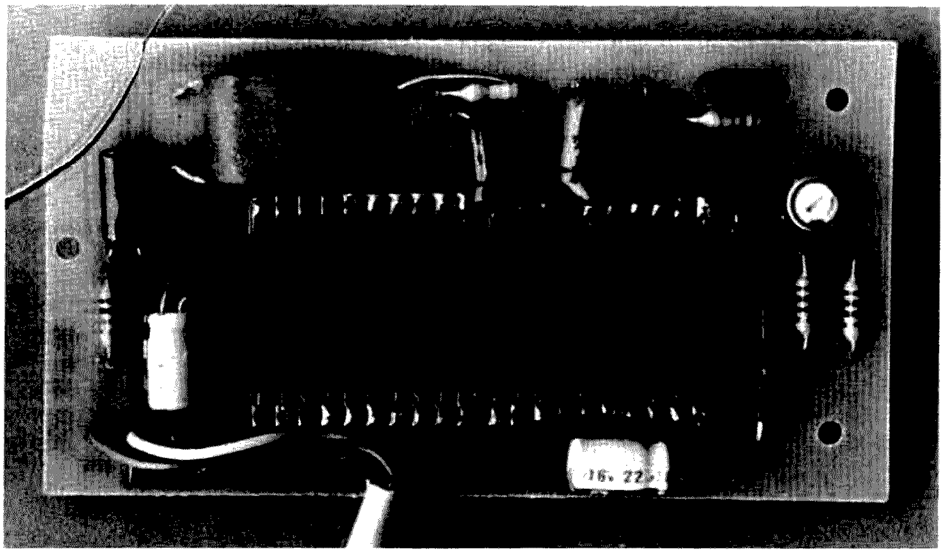

Photo A. DPM component side.

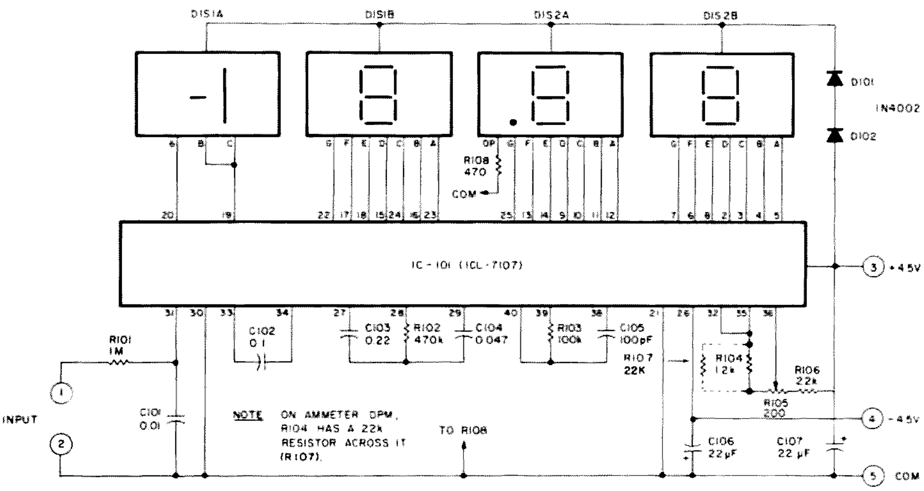

Fig. 4. DPM assembly. (DS1AB, DS2AB = NSN-584.)

Parts List

C101—0.01-uF, 50-volt mylar capacitor*
C102—0.1-uF, 50-volt mylar capacitor*
C103—0.22-uF, 50-volt mylar capacitor*
C104—0.047-uF, 50-volt mylar capacitor*
C105—100-pF disc capacitor
C106, C107—22-uF, 6.3-volt electrolytic or disc capacitors
D101, D102—1N4002 silicon diodes
DIS1, DIS2—National NSN-584 common-anode LED displays (Do not substitute.)
IC1—Intersil ICL-7107CPL DVM chip
(All resistors, ¼-Watt, 5% film.)
R101—1-meg resistor
R102—470k resistor
R103—100k resistor
R104—1.2k resistor
R105—200-Ohm pot (See text.)
R106—2.2k resistor
R107—22k resistor (Connected across R104 in ammeter DPM *only*.)
R108—470-Ohm resistor
Misc: 5-pin plugs, PC boards, wire, etc.
*Use imported, green-dipped capacitors

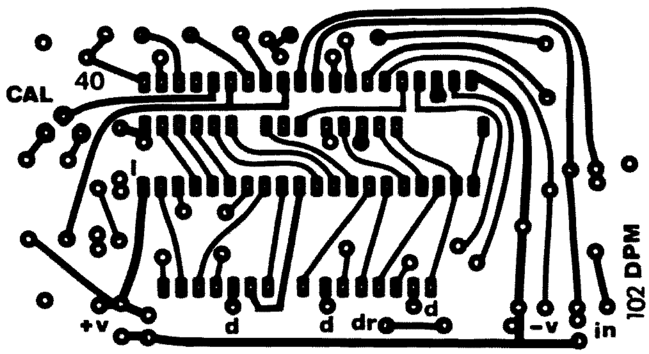

Fig. 5. PC board (foil side).

tions. This is important because there is a definite sequence of assembly steps for them. Goof up, and you might be running external jumper wires from one side to the other! Start by referring to the side without foil; from now on, this will be called the "component side." Install the wire jumpers as shown in Fig. 1. Be sure they go in the right places, as an IC and LEDs will cover most of them. Then install the resistors from left to right, starting with R101 (1 meg). If you look at the photos, you can't see R108 because the 470-Ohm resistor is hidden by the power cable.

After the resistors have been installed properly (check!), turn to the capacitors. Start with C101 (0.01 uF) and work your way to the right, referring to Fig. 1 often. Then install diodes D101 and D102, bands pointing up as in the photo and Fig. 1. Now you can finish up the component side by installing the LED displays. *Important*: There is a small 1 in gold near an end pin of each display; position this pin so it faces the power cable. You might be able to just make out the 1 in the photos if you look carefully along the bottom edge of the LEDs, in the left corner.

The LEDs are installed with short (½") pieces of tinned solid wire, as shown in Fig. 2. First, one of the LEDs is positioned over the mating holes in the board, then wires are passed through board and display and then soldered quickly in both places. Note from the photos that not all of the pins are used. When the wires are installed and soldered (try to solder the wires flush against the board on the component side), clip off excess wire. Repeat the process with the other LED. Very carefully check over your wiring at this point, especially the LED installation, and turn the board over. Carefully install the IC chip with the dot on the case pointing toward the 1 on the PC board. When you are sure all pins are in the proper holes and the IC is oriented right, solder the pins with the minimum of solder. Finish up the construction by installing the power cable (about 6" of 5-conductor wire) to the points along the bottom edge. Then connect a plug to the free end, with the wires going to the proper pin locations. That's it for the DPM construction! It generally won't take more than 2-3 hours for the first one, and under 2 hours for the second.

Just before installing the DPMs in the power supply cabinet and checking them out, pick up the unit reserved for the Amps display and solder a 22k film resistor across R104. Do this on the foil side. This modification allows you to read 20 Amps with only a 1-volt input; in effect you are doubling the sensitivity! Turn to the voltmeter and connect the power plug. Turn on the power supply and the meter should display voltage. Your supply should be working properly at this point; if not, fix it, and then test out the DPM.

Connect an external digital multimeter across the output terminals and set the power supply for 15 volts. Then adjust R105 for the same reading as the DMM you connected. That finishes calibration of the voltmeter. Turn next to the ammeter, and connect it to the supply. Connect a heavy load across the power supply and measure the voltage drop across R31 (0.05-Ohm resistor) with your DMM. Then adjust the ammeter calibration for the same reading. This is sufficient for most purposes. Or, if you prefer, draw a known current from the power supply with a known resistor (I used a 1-Ohm, 1%, 100-Watt resistor) and adjust the ammeter's R105 for the correct current reading. Install the DPMs in the cabinet if you haven't done so, and you are finished!

At this point you should be proud of your power supply; it works like some of the finest, cost a fraction of the best, and is extremely handy. But, if you are like

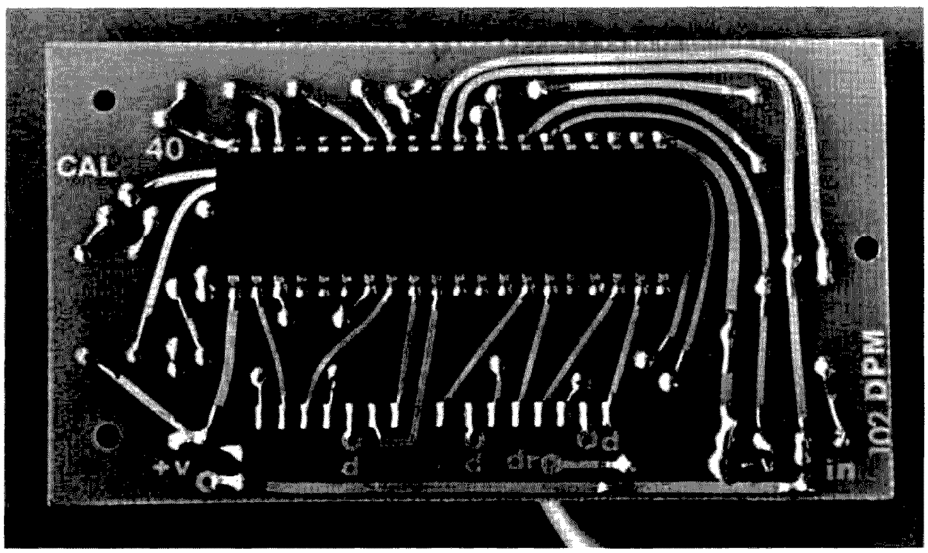

Photo B. DPM foil side.

me, you may want to tidy up a few loose ends.

Improvements

There are several things you can do to improve your power supply at little or no cost. These improvements were not included in part I of this article because they were made after it was written. The first improvement is to change the fan to a two-speed model, and is necessary only if you were unlucky enough to find a standard noisy-type fan. The drone of a standard fan is quite annoying after a time. The modification is simple, and is done as shown in Fig. 3. An old 24-volt, 1-Amp filament transformer serves as the voltage drop in series with the fan. Only the secondary winding is used. If you prefer, select an old filter choke from your junk box to do the same job. Connected across the transformer is a PCI (Protective Controls, Inc., Husky Park, Frederick MD 21701) model 5002 thermoswitch mounted on the heat sink. When the heat sink temperature rises to about 85° C, the switch closes and the fan runs at full speed providing extra cooling.

Another modification you can make is to the output circuitry. First, move the negative lead of R30, 200 Ohms, from J3/J4 as shown originally in the schematic, to the other side of R31, 0.05 Ohms. This will stop the current reading residual that shows up in the Amps display.

And one final modification you can make is to connect a 1-uF, 25-volt mylar capacitor across J1/J2 and J3/J4. This modification will decrease the rf output impedance of the power supply and possibly give better performance when working with critical rf circuitry. ■

✓ Reader Service—see page 195

A Better Car Regulator

—improved reliability

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Albuquerque NM 87105

The problem: In the March, 1977, issue of *73 Magazine*, an article appeared claiming a reliable, high performance automotive voltage regulator.[1]

The regulator described has a major design flaw and is definitely not reliable. This design flaw caused my regulator to fail (putting 17 volts on my car's electrical system) after only 2 months of operation.

Subsequent circuit analysis and study of the LM723 specs[2] showed that the LM723 was being grossly overstressed and subject to catastrophic failure in the circuit as described in the original article.

The assumption that the LM723 has a current output of 150 mA applies only to the output transistor, not the internal zener, Vz. The data sheet lists, under Absolute Maximum Ratings, that the current through the Vz zener is 25 mA, worst case. Mr. Prudhomme, in the original circuit, has over 130 mA flowing through this zener. The failure of the output stage, where Vz is located, was evident in my failed LM723 as the internal reference supply still operated properly, as measured at pin 6 of the DIP package.

The solution: Fig. 1 is the circuit I used to correct the design flaw. This improved design requires an additional transistor and resistor. I elected not to change the 51-Ω resistor used in the original article, so I placed a 6.2-volt, 1-Watt zener in series with the 51-Ω resistor to substitute for the voltage drop of the Vz zener in the LM723.

Now the maximum current through the output transistor and the Vz zener is about 16 mA, well within the 25-mA rating of the Vz zener. This arangement also allows the LM723 to run much cooler. The 51-Ω resistor in the original article should be a 1-Watt unit, not a ½-Watt one.

The original article suggests installing the regulator in a mini-box with barrier terminal connections and an additional relay to operate the dash ALT lamp. I suggest a saner, cheaper solution: Obtain a defunct regulator of the same general type as in your car. Disassemble the unit (mine is a Delco) and there will be two relay-type devices inside. The more complicated of the two is the regulator and the other is the ALT lamp relay. The regulator can be removed by drilling out a rivet in the base of the housing. Also, remove the resistors mounted to the base of the housing by pulling them off.

Now you have a nice, watertight housing with a connector that mates to your car's electrical system with *no* modification, and a relay for operating the ALT lamp. All for free.

The space formerly filled by the regulator coil is filled with a small vectorboard (about 1" x 2") which has all the regulator circuitry except the pass transistor, which is mounted with an insulating washer to the base of the regulator housing. See Fig. 2 for a sketch of the mounting arrangement used.

I also changed the voltage divider values in my unit to eliminate the 500-Ω pot, a potential troublemaker in the harsh temperature environment of an automobile. I found that the .5-uF condenser normally used with the former mechanical regulator is not required and can be removed if desired.

My unit has been in operation for almost a year with no problem after the design was improved as described in this article. ■

Footnotes

1. "Build Your Own Car Regulator," W. J. Prudhomme, *73 Magazine*, March, 1977, p. 160.
2. *National Linear Data Book*, National Semiconductor Corp.

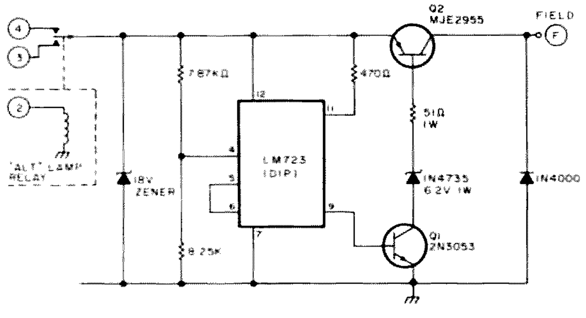

Fig. 1. Improved regulator.

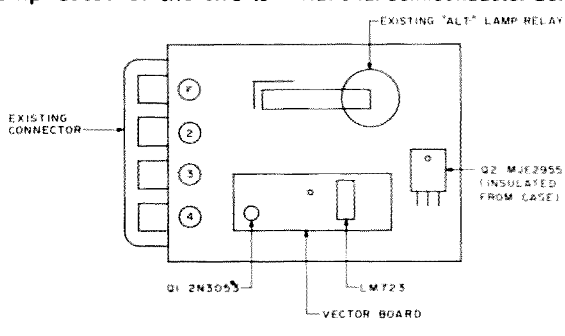

Fig. 2. Mounting arrangement in "stock" housing.

73 Magazine *Staff*

Test Gear Bargain from Heath

—a multi-purpose RCL bridge

The new Heath 5280 series of test instruments appeared, at first glance, as probably not offering very much because of the low prices. One of the first pieces of the series that we noticed was the IB-5281 RCL Bridge. It claimed the following measurement ranges: Resistance—10 Ohms to 10 megohms; Inductance—10 uH to 10 henrys; and Capacitance—10 pF to 10 μF.

This is a fairly good range of measurement. Much more expensive test equipment, such as even the Heath IB-3128, hardly offers much more, and in some cases less, of a measurement range. The measurement ranges for the IB-3128, for example, are: Resistance—0.1 to 10 megohms; Inductance—0.1 mH to 100 henrys; and Capacitance—100 pF to 100 uF.

Of course, there are many other factors to be considered than just the measurement ranges—the accuracy of measurement being an obvious one.

As it turns out, however, the IB-5281 is much more of a sophisticated little piece of test equipment than meets the eye. Perhaps the first thing one notices when looking at the kit is that there are a fair number of parts involved for the 10-transistor circuitry used. In fact, the average amateur would probably find it difficult to buy the electronic parts for the cost of the whole kit.

The circuitry used in the kit is not new in basic principles, but it has been very neatly implemented. The bridge operates on the basic Wheatstone bridge applied to RCL components as shown in Fig. 1. A reference R, C, or L component is used which is compared with an unknown component by balancing a bridge circuit. When the bridge circuit is balanced, the meter reads zero. The balancing potentiometer's rotation can be calibrated in terms of how far in value the unknown component's value is above or below the value of the reference component. Theoretically, any value component can be measured, but in practice there are many limitations, particularly when either very small value or very large value components are involved.

A partial diagram of the Heath bridge is shown in Fig. 2 and illustrates some of the very interesting features found in the unit. The ac source, or oscillator, is a rather elaborate five-transistor FET type. Part of the

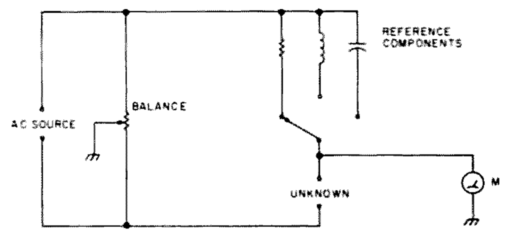

Fig. 1. Basic Wheatstone bridge type of circuit used with reference R, L, and C components compared to an unknown component to determine its value.

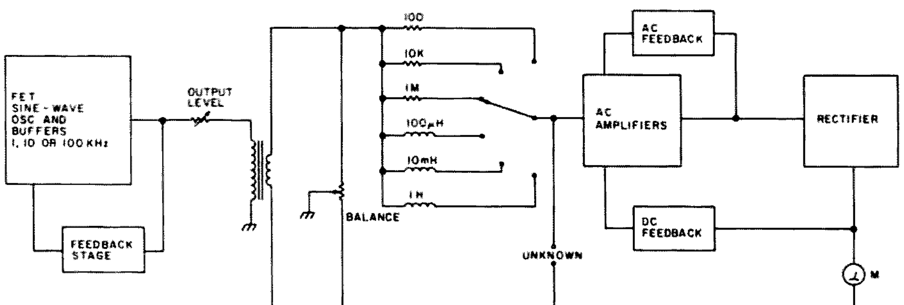

Fig. 2. As this partial diagram shows, quite a bit of design work has gone into the circuitry of the IB-5281. Only the R and L reference components are shown; there are also three reference capacitors in the actual circuit. In addition, provision is made for the use of an external reference R, L, or C component, if desired.

output is rectified, and a feedback arrangement is employed to control the gain of the oscillator. This provides better control than the usual lamp arrangement found in simpler oscillators. The oscillator also operates at three different frequencies: 1, 10, or 100 kHz, depending on the range selected for each R, L, or C component. This is a great improvement over simpler bridges which have just a 1-kHz oscillator. It becomes very difficult with such oscillators to measure small values of inductance or capacitance since one is basically trying to measure component values used at rf frequencies in a low-frequency audio-type test arrangement.

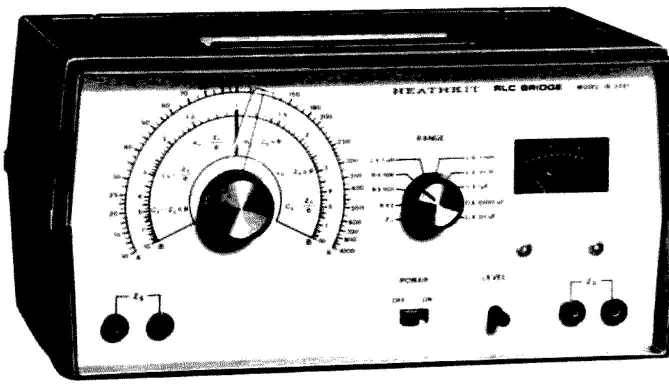

Photo A. The Heath IB-5281.

The oscillator output is coupled through the transformer, T1. The secondary of this transformer forms a balanced ac source arrangement for the actual bridge circuit. The transformer has a very low impedance, and this plays a major role in the good performance of the bridge. The actual bridge circuit is formed by the rest of the components shown. There are three ranges for each type of component. Although to simplify the diagram only three reference components are shown for resistance and inductance measurements, there are also three reference capacitors in the actual circuit.

The output of the bridge goes to a five-stage ac amplifier and rectifier which drive a meter for a null indication. The amplifier stages are relatively sophisticated in design, with both ac and dc feedback incorporated to enhance circuit stability.

The construction of the bridge is relatively straightforward. Most of the components mount on a single PC board. Perhaps the only area where a newcomer should take time and be especially careful in construction is in wiring up the range switch. A number of components mount on the switch itself and if one doesn't get this four-wafer switch wired correctly, it could cost a lot of troubleshooting time to correct it.

If it were not for the switch, one could rate the construction as simple. However, the assembly manual is very detailed, and anyone who has a basic proficiency in soldering should be able to assemble the kit. An experienced builder can assemble the kit in two evenings, while others might take up to double that time.

Performance, considering the price of the bridge, can be termed as excellent. It is not a super-accurate bridge, where one can read the difference between 100 Ohms and 102 Ohms, for instance, but one certainly can find quickly the approximate value of any components. The bridge was tried with a variety of unmarked capacitors and coils, and the values obtained compared with those obtained on a laboratory bridge. In all cases, the values checked out closely enough for most experimental uses, and there is absolutely no doubt about separating standard-size component values (.005-, .01-, .02-, .05-, and .1-uF capacitors, for example). The bridge was particularly good when measuring a variety of inductors. Air-wound coils, ferrite-core coils, slug-tuned coils, rf chokes, etc., all produced clear null indications quickly. In fact, some of the inductors tried could not be measured on the laboratory bridge (unless one wanted to spend hours at it) because of trying to compensate for their different Qs.

A look at the rear of the unit reveals that there is a lot of unused volume in the enclosure. Heath undoubtedly took the route of using a standard-size enclosure for all the IB-5280 series test instruments, for economy reasons. There is room in the enclosure to store two extra of the 9-volt transistor radio batteries which are needed to power the bridge. However, one could also easily build a dual 9-volt ac supply in the enclosure and have room to spare.

The bridge as it stands is a fine little test instrument and nicely fills the gap for those who like to do a bit of circuit experimenting where component values need to be measured, but do not have the need for a laboratory-grade bridge. In trying to think of ancillary uses for the bridge, the use of the audio oscillator and ac amplifier came to mind.

The audio oscillator probably could be made variable by the use of a dual potentiometer to augment the fixed value resistors which are switched in for 1-, 10-, or 100-kHz output. As it stands, the fixed frequencies could provide very stable sine-wave test signals with very low distortion. The ac amplifier/rectifier was measured to be able to detect rf signals all the way up to 17 MHz! So, it could be used as it stands as a tuning indicator for low-frequency rf signals and probably could be turned into a very sensitive field-strength meter by augmenting the bypassing for rf frequencies. The input to the amplifier/rectifier can be accessed from the front panel, without modification, via the "Z's" terminals.■

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Semiconductor Test Gadget

—use with your scope

Transistor testers come in many assorted kits and variations providing confusing data such as BV_{cbo}, BV_{ces}, BV_{evo}, R2D2, $C3_{po}$, and so on. All I want to know is if the transistor or diode is good or bad.

This transistor/diode tester tells you just that. With a glance at an oscilloscope face, you can see shorts, opens, and leakage between collector and emitter and determine the overall quality of the transistor in a matter of seconds.

All you need is an oscilloscope that works reasonably well, a 110/6.3-volt transformer, 2 resistors, an SPST switch, and a set of probes.

The transformer provides low power to the transistor or diode to be tested and is read directly on the oscilloscope face.

An In-Circuit or Out-of-Circuit switch is provided so that the transistor or diode does not have to be removed from the circuit to be checked. However, I feel the transistor is checked best if removed; this is a matter of personal preference.

At the In-Circuit position, both resistors are in series providing the lowest current applied to the circuit. This low current, 1 mA or less, should not harm surrounding components associated with the transistor or diode being tested.

This transistor/diode tester is to be used on de-energized circuits only. I have not used it on an energized circuit, but I feel it will be of no real value there.

I built two transistor/diode testers. The first was a portable model encased in a metal box which I hooked up to a friend's oscilloscope. When I got my own oscilloscope, I hooked to the filament transformer, installed an on/off switch, mounted the resistors, wired directly to the vertical and horizontal inputs, and then ran the test probes out the side of the case. Now, with the flip of a switch, I have the transistor/diode tester ready to use.

After the tester is installed, touch the probes together. The scope will go from its normal horizontal line to a vertical line. Adjust the horizontal and vertical gains so that the line will be the same length both vertically and horizontally. Adjust the centering of both vertical and horizontal positioning so that the line will be in the center of the scope. You are now ready to check transistors and diodes.

Select a transistor from the junk box; determine if it is silicon or germanium and hold one probe on the base and touch the other probe to the collector or emitter. If the transistor is good, the screen should show a right angle. (If it is inverted, it doesn't matter; just turn your probes around.) Now read from collector to emitter. A straight line should show. This is a good silicon transistor.

Germanium transistors give a reading that will be slightly different. From collector to emitter only, they will give some type of right angle. With germanium transistors, I recommend that you compare them with others of the same number out of the circuit.

Figs. 2 and 3 will give you an idea of what to expect on your oscilloscope. Some of them can be confusing when checking transistors or diodes at the In-Circuit position; this is why I feel that Out-of-Circuit is best used to check transistors and diodes. However, after some experience using this device and a little circuit tracing to find resistors and capacitors used in conjunction with the transistor or diode, you should be able to determine with some degree of accuracy if the circuit is operational. ■

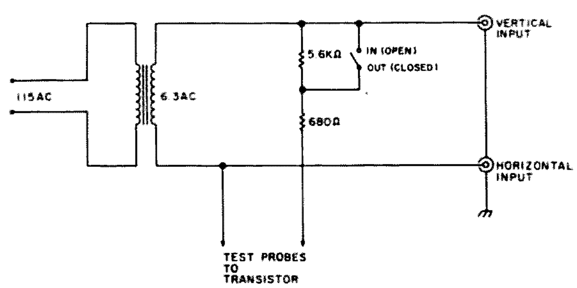

Fig. 1.

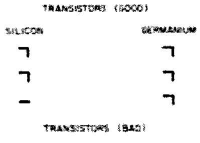

Fig. 2. In-Circuit readings.

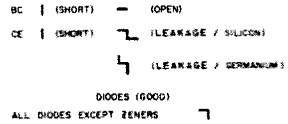

Fig. 3. Out-of-Circuit readings.

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Shoes and Socks for the IC-502

—when your vacation ends, you'll appreciate this amplifier/PS combo

Well, at last, my "vacation 6 meter special" radio had arrived—an Icom IC-502. I have now put it into action with my 6 meter beam (a Hilltopper) and have managed to work some good groundwave from our local mountaintop and some occasional skip contacts. I have been mightily impressed with what 3 puny Watts can do. As usual, back at the vacation special home, 3 Watts isn't putting me in the big time, so more power is contemplated. My first impression was to procure the 10-Watt amp/power supply from Icom, but I could think of better ways to spend $169 (like beer for the vacation).

The most logical answer was to build an amp and power supply combination. Now, how to do it. The first problem is the power source. I can remember in my CB radio service days how many manufacturers used one transformer for the 12 V vibrator supply and 117 V ac. After scrounging one of these transformers from an old Conset CB rig, I applied 117 V ac to the primary and discovered that the vibrator winding now had 19-20 V ac coming out—a center-tapped winding even! How perfect for obtaining 13 V dc from a full-wave rectifier. The other 2 windings had 12 V ac for filament and 250 V ac (no c-t). The 250 V ac with a full-wave bridge rectifier would net me 350 V dc at 80 mA—just perfect for a 30-Watt input amplifier! Now, with 350 V of B+, 12 V for filament, and 3 Watts of rf drive, I figured a 12JB6 tube would be perfect. They come cheap and I have plenty of spares from my Drake TR-3.

As one can see from Fig. 1, the circuit is simple and straightforward. A 12JB6 tube is used in a grounded-grid configuration with a shunt-fed tank output for ease of adjustment and

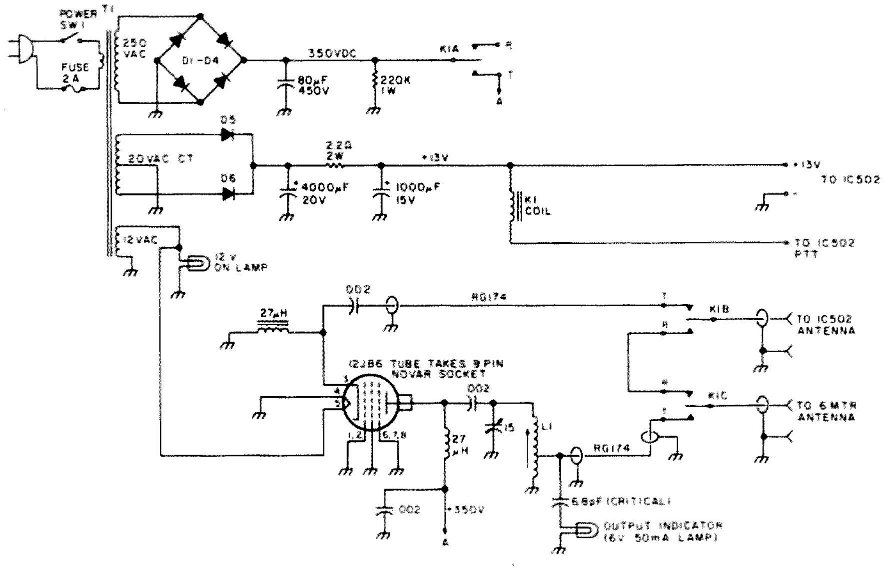

Fig. 1. Circuit diagram. T1—vibrator/ac power transformer from 12 V CB tube radio with 250 V ac, 20 V ac c-t, and 12 V ac secondaries. K1—3PDT miniature relay with 12 V dc coil. D1-4—1000 piv 1-Amp diodes. D5, 6—50 piv 3-Amp diodes. L1—8 turns #20 on 3/8" slug form tapped 1½ to 3 turns from ground end (adjust for max output).

simplicity. Mechanically, I used 2 chassis, 3" x 5" x 7" and 2" x 5" x 7". I bolted both chassis together top to top. I used 2 bottom plates, one for the bottom of the lower chassis (2" x 5" x 7") and one to cover the now top of the upper chassis (3" x 5" x 7"). This made a nice cabinet for the whole ball of wax. The 121B6 stands upright into the 3" x 5" x 7" chassis from the 2" x 5" x 7" chassis, being countersunk about ¼" to accommodate the plate cap of the tube. Parts placement is not critical, but keep rf leads short. The plate circuit was mounted on the now "front panel" of the upper 3" x 5" x 7" chassis, along with the output indicator lamp (meters are too expensive for me). Leads for 13 V dc are brought out the back of the cabinet for IC-502 power, along with the keying lead. The keying lead goes into the IC-502 CW key jack and fastens to the mic jack inside the K502 at the PTT line. Obviously, you must open up the 502 to accomplish this task.

After building the amplifier, carefully check your wiring and solder joints. Apply 117 V ac, turn switch S1 on, and check all voltages. If the power supply passes the smoke test, hook up the IC-502 and apply drive. You should have immediate success. Peak the final plate for maximum output (maximum brilliance on output lamp). If the final plate capacitor doesn't peak near center mesh, adjust coil L1. With a full 3 Watts drive, you should obtain up to 16 big-time Watts output. One model I built netted me 20 Watts output. Good DXing. ■

Hams on the Trail of UFOs

—the Army's "flying saucer" movie . . . did you see it?

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"The bodies appeared little by human standards. Most notable were the heads, all looking alike, and all being large compared to their body sizes. They looked mongoloid, with small noses and mouths and eyes that were shut. Their skin was leathery, and ashen in color."

Len Stringfield, veteran UFO researcher and author of *Situation Red, The UFO Siege*, held the audience spellbound and on the edge of its seat at the Ninth Annual Symposium of MUFON, the Mutual UFO Network. The place: Dayton, Ohio, Convention Center. Date: July 29, 1978. Other hams were in the crowd, listening as intently as I. After being part of their UFO nets for more than a year, it had been great to eyeball WØNC and N1JS at last. I'd met K9PAW, and WA5RON was somewhere back in the crowd with my son, WD8IAM. Seated up on the stage was Walt Andrus W5VRN, director of MUFON.

Carefully, patiently, Stringfield was putting together for us a jigsaw puzzle of strange events which went back 31 years, building a possibility which was stranger than fiction. "Retrievals of the Third Kind," the title read in the MUFON *Symposium Proceedings* in which I was making marginal notes, "—A Case Study of Alleged UFOs and Occupants in Military Custody." Len was presenting Abstract 5, in which a civilian, now in a high technical position, related to him a fascinating experience which occurred in 1953.

A young radar specialist, Mr. T. was stationed at Fort Monmouth, New Jersey, at that time. It was in the spring of the year when he, along with a number of other radar specialists, were told to report to the base theater to view a special film.

When the group was seat-

Fig. 1. Alien humanoid head, drawn by L. H. Stringfield, based on descriptions by witnesses, July, 1978.

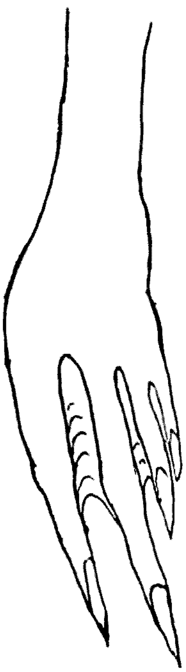

Fig. 2. Alien humanoid hand, drawn by L. H. Stringfield, based on a description by a witness.

ed, the lights went out with no briefing. A 16 mm movie projector filled the screen with light, showing all the flaws and scratches generally common to combat film. "Suddenly," as Stringfield describes the revelation, "without any titles or credits or music, there appeared a desert scene dominated by a silver disc-shaped object imbedded in the sand, with a domed section at the top. At the bottom was a hatch or door that was open."

Mr. T. recalled the next scene as showing 10 to 15 military personnel in fatigues without identification patches, standing around the disabled craft. From their height relative to the disc, he estimated it to be 15 to 20 feet in diameter. The open hatch was judged to be about 2½ feet wide and about 3 feet high.

Puzzled about the purpose of the movie, the young soldier watched the scene switch to the interior of the object. A close-up showed a panel with a few simple levers. The observer recalled noting the muted colors and sudden glares of white which characterize poor photography.

Startled, the young man viewed the next scene. Inside what appeared to be a tent were two tables—with dead bodies lying on them! Two lay on one table, and one on the other. Len was continuing with the description of the bodies now, concluding, "Each wore a tight-fitting suit in a pastel color." Strangely, the sight of the dead bodies was the end of the movie!

Contrary to most military movies which credit the Signal Corps or some other source, this one just "stopped cold," Mr. T related. The lights came on, and the officer in charge told the men, "Think about the movie. But don't relate its contents to anyone." Mr. T. didn't even tell his wife about it!

Two weeks later, he was approached by an intelligence officer on the base. "Forget the movie," he was told. "It was a hoax."

Commenting on the movie 23 years later, Mr. T. advised Stringfield that it was about five minutes long and that he felt that it in all probability was shot by an inexperienced cameraman because it was full of scratches and had poor coloring and texture. He believes that the craft and bodies he saw were real. As he put it, "The movie was certainly not a Walt Disney production." Although he has never been particularly interested in UFOs, he has always remained curious about the purpose of the film. This was accentuated when, years later, he met an old Army acquaintance who told him about seeing this same film at a different base under similar conditions.

Len Stringfield went on, abstract after abstract, to build a very impressive body of evidence, circumstantial though it may be at present, that there indeed may have been many "retrievals of the third kind" over the years.

What do you think? Was the movie reality or a hoax? And what purpose did it have?

I'd be willing to bet that a lot of young radar specialists, trained by the military in electronics, later became hams. Who knows, you may have one of them in the next QSO. "Break. KG1UR, this is NE1C. About that movie you guys were talking about. Back in '53, when I was stationed at - - - - ."

Better reach for an 807. It's going to be a long evening, and an interesting one!

Section	Day	EST	CST	Control	QTH
40 meter	Saturday	0800	0700	N1JS	MA
75 meter	Saturday	0900	0800	WA9ARG	IL

Table 1. Mutual UFO Network amateur radio SSB nets.

Addendum

It has been learned that the ex-radar specialist who viewed this movie in 1953 is a member of the amateur radio fraternity. Stringfield also has received confirmation that the same movie was shown to a group of radar specialists at a Naval base in Maine at a somewhat later date. In this case, they were not subsequently told that it was a hoax.

There may have been other UFO movies shown as well. Ray Stanford, whose instrumented UFO research was described in "Close Encounters," *73 Magazine*, December, 1978, alludes to this in his book, *Socorro "Saucer" in a Pentagon Pantry*. Several years prior to 1964, an officer informed Ray that his group of radar operators had been shown movies of UFOs so close that "we could see right into the windows."

This appears to be very strange treatment of a phenomenon which NASA declined to investigate because of "an absence of tangible evidence." That's my opinion, OM. What's yours? ■

References

1. *Situation Red, The UFO Siege*, Leonard H. Stringfield, Fawcett Crest Books, New York, 1977, 254 pps., paperback, $1.75.
2. *1978 MUFON Symposium Proceedings*, MUFON, 103 Oldtowne Road, Seguin TX 78155, 131 pps., $6.00.
3. Sketches by Leonard H. Stringfield, reproduced with permission.

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Hi-Fi CW for the TS-820

—the SSB filter copes with numbing noise

Here is a modification for the Kenwood TS-820 that will allow you to use either the CW or SSB filter when you are on CW.

I have found the modification very useful at my QTH where I am plagued sometimes by an S5 line noise from leaky power-line insulators in my neighborhood. On 160 and 80 meters especially, this noise is very harsh when using the CW filter; after 30 or 45 minutes, my ear and brain would become numb from listening to it. I soon found it easier to copy the other fellow on the SSB filter—which reduced the harshness of the noise—and then switch back to the CW mode to transmit.

After using my 820 for a while, I was envious of some of my friends who owned rigs such as the Drake TR4-CW, Heath SB-102, or HW-101, which have the switch-selectable i-f filter to use on CW. While using their rigs, I found it easier to hear a comeback to my CQ from someone slightly off-frequency (one you wouldn't have heard through the sharp CW filter), and I could enjoy a QSO on a "quiet" band where the QRM was not very bad and the CW filter was not really necessary.

Their rigs were also much easier to use while in a CW net. If you have ever been net control of a CW net, or if you just check in once in a while, you know that not every station is exactly on the same frequency. The SSB filter allows you to copy most of the off-frequency stations without retuning. Of course, the CW filter on these rigs is available at the flip of a switch, if needed.

DXers using one of the new 250-Hz CW filters that are now available for their TS-820 also may find this mod useful. With it, you can tune around the bands looking for a new country while listening through the SSB filter. You might hear a rare one signing on a frequency about 2 kHz away (that the sharp CW filter wouldn't let through), quickly return to the DX station's frequency, and dump in your callsign. Then you can switch in your CW filter if it is needed.

Operators who have one of the newer variable-bandwidth audio filters, such as the Autek QF-1, now can use the SSB filter on CW, and use the audio filter to reduce slight QRM. You now can enjoy a long QSO by tuning in the other station in the 1000-1400-Hz bandwidth range, which seems easier on the ears to listen to.

Cross-mode operation is now easier, of course. A DX station can be in the foreign phone band on SSB, and you can return to him on CW without having to change the mode switch on every turnover. On 160, 80, or 40 meters, you will have to ask the DX station to go to the upper sideband for you to copy him, but it shouldn't be any problem if the DX station is agreeable.

Now on to the modification. I purchased the repair manual for the TS-820, and studied the schematic diagram of the i-f board and band switch assembly. Fig.

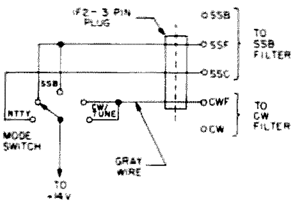

Fig. 1. Original wiring hookup.

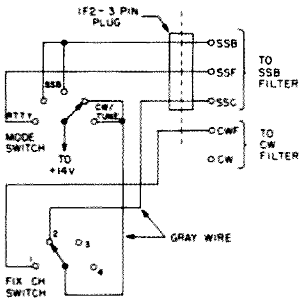

Fig. 2. Revised wiring hookup.

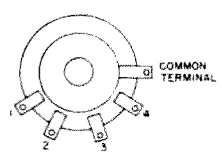

Fig. 3. FIX CH switch as seen from the front.

1 is the schematic diagram of the present hookup to the i-f board from the mode switch with the CW filter installed. In the CW mode, 14 volts is removed from the switching diodes on the SSB filter, and applied to the switching diodes on the CW filter. It appeared that all that was needed to utilize the SSB filter in the CW mode was a method to switch the 14 volts between the filters. Since I did not have any crystals installed in the FIX CH board, I decided to use the front panel FIX CH selector switch to do the switching.

Fig. 2 shows the revised hookup. The 3-pin plug is installed back to the original (no-CW filter) position. The wire carrying the 14-volt switching voltage, when in the CW mode (pin 3), is now sent to the FIX CH switch's common terminal. Selecting either CH1 or CH2 allows you to use the filter of your choice—CH1 for CW, CH2 for SSB.

The modification involves unsoldering three wires, installing three wires, and cutting one wire. You may want to refer to Fig. 25 on page 34 of the TS-820 operating manual for the location of the 3-pin plug (IF2), and "position A" (referred to later). It took me about 45 minutes to complete the job, so it should not be a very long chore for anyone. Fig. 3 is a front panel view of the FIX CH switch to help you locate the proper pins.

(1) Remove the top and bottom covers of the TS-820. Be careful of the speaker leads.

(2) Unsolder the two red wires from the common terminal of the FIX CH switch. Solder the two wires together, wrap with tape, and dress neatly to one side.

(3) Unsolder the purple and blue wires from the CH1 and CH2 terminals of the FIX CH switch Cut off the exposed wire, twist together, and dress neatly to one side.

(4) Remove the 3-pin plug (IF2) from the i-f board. Cut the gray wire (pin 3) about 1½ inches from the plug.

(5) Solder a new wire from the common terminal of the FIX CH switch to the end of the gray wire that goes to the mode switch. There is a space between the chassis and front panel below the switch that the wire can be routed through.

(6) Solder a new wire to pin 2 (CH2) of the FIX CH switch. Route the same way as suggested in step 5. Solder the other end to the end of the gray wire from the 3-pin plug (IF2).

(7) Obtain a Molex® pin if possible. Solder it to the end of the third new wire. Push it on the CWF terminal of the i-f board (terminal 4). Route the wire the same way as above. Solder it to pin 1 (CH1) of the FIX CH switch. If you cannot obtain a Molex pin or something similar, you can solder the new wire directly to the CWF terminal of the i-f board. The Molex pin makes removal of the i-f board easier at a later date.

(8) Install the 3-pin plug (IF2) back to the original no-CW filter position. This is position A in the operating manual. Wrap tape around all soldered connections on the wires to prevent shorts.

That's it! Now you can select either filter via the front panel switch. Install the top and bottom covers, (don't forget the speaker leads), and give it a test run.

I hope you find this mod as useful as I do. If you perform the mod, send me your QSL and let me know why you decided to try it. ■

Going 2m All-Mode with Yaesu's FT-225RD

—not just another pretty face

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FM has been around since 1920, give or take a few years. It has been just in recent years that the current crop of hams discovered how extremely useful FM equipment is when used mobile. All the noise and racket that plagued AM mobile rigs is gone.

Actually, the amateur type of FM is really phase modulation, such as a lot of us old-timers used in the 1950s on ten meters to avoid buying or building a large and expensive modulator. The problem in those days, however, was that the guy listening to us just had too much trouble slope-detecting our PM on his AM receiver, and so it was that phase modulation died on the HF bands.

Now, with two meters having been reborn, thanks to frequency modulation, it makes no difference whether it is true FM with an old Motorola unit or the latest amateur phase modulation. They are compatible.

So it was that I got into two-meter mobile activity. Then I decided that a base station would really be nice to have. I wanted SSB and CW capabilities also, because I intended to have one beam horizontal to be able to work two-meter DX. I also wanted AM because I belong to the Golden Poppies net and the National Award Hunter's net—which keeps me out of the pool halls six nights a week. AM is a long way from being dead on two meters out here in the Los Angeles area.

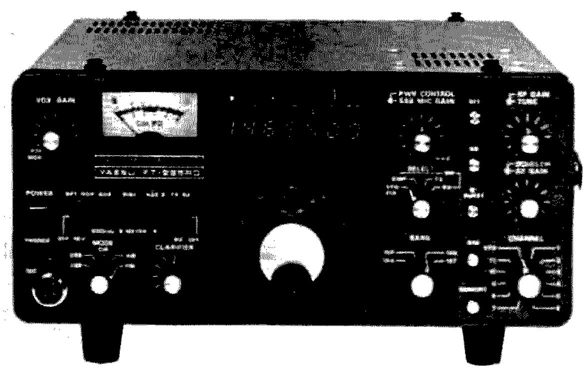

Photo A.

This was how I came to discover a new Yaesu FT-225RD at the local candy store. I saw a bewildering array of two-meter transceivers, and it took some time for me to sort out the pluses and minuses of the competitive units.

I will admit that at first I fell for a pretty face. But after a thorough test over one weekend, the FT-225RD took root on my operating table. For one thing, it covers the entire two-meter band in 1-MHz segments and provides USB, LSB, CW, AM and FM. In the FM mode, you have the standard 600 kHz, up or down, depending upon which segment of the band you are working. And for those odd-ball repeaters that are not standard in their shift, you have 11 crystal positions to keep you happy. Repeater shift, which is normally 600 kHz, may be set to an alternative split of up to 1 MHz by the addition of an optional crystal or Yaesu's unique "memory system," also an optional feature.

The rig provides one- to 25-Watt variable output on all modes with 8 Watts on AM. The readout is digital. For example, suppose you are listening to an FM repeater on 147.09 MHz. As soon as you key your mike, the transmit frequency of 147.69 is shown on the digital dial, thus eliminating the problem some fellows have in forgetting to reset a panel switch from simplex to RPTR.

The Yaesu FT-225RD also offers something no one else's equipment does—plug-in printed circuit boards. This simplifies correcting any problems that might develop and makes it possible for you to do the work yourself instead of sending it out for repairs.

If, like me, you're a fussy guy on frequency readout, the transceiver will delight you. Readout is to 0.1 kHz; analog display resolution is better than 1 kHz. Receiver sensitivity is 0.3 microvolts for 10-dB S/N on SSB and CW. On FM it is 0.35 for 20-dB quieting and 1.0 for 10-dB S/N on AM. What this means, fellas, is that if the station is there, you will copy him.

Selectivity is ideal in all modes. On SSB and CW it is 2.3 kHz at 6 dB down and 4.1 kHz at 60 dB down. It is 12 kHz at 6 dB down on FM and 28 kHz at 60 dB down.

The transmitter is very clean, with spurious radiation better than a minus 60 dB and unwanted sideband suppression a minus 40 dB.

The audio reports I have been getting in all modes have been excellent. The 50 or so fellas on the Golden Poppies AM net (145.75 MHz weekday nights at 7:30 pm PST) gave audio-excellent reports, as was the case in SSB and FM as well.

A microphone properly tailored for voice frequencies, and matching the transceiver's requirements, comes with the equipment.

The large, illuminated meter can be set to serve as an FM discriminator readout, or as an S-meter, as well as used for tune-up. Did I say transmitter tune-up? Once you have peaked your station to receive, a one-knob adjustment, the transmitter is all set to go—no dipping and loading required. This makes it possible to scoot all over in just a split second.

To list all of the goodies would take many pages. Suffice it to say that the rig has a beautiful VOX as well as PTT. You can select slow or fast agc. And, if you want to go mobile with the unit, it's all set to connect to your car battery. The noise blanker really works when pulse-type noise gives you trouble, and there is a clarifier which allows offset on both transmitter and receiver at your choice. This is handy when you want to stay on a net frequency but have to scoot off to pick up someone who isn't right on.

All in all, it is my opinion that the Yaesu FT-225RD is certainly state-of-the-art and is a completely satisfactory do-everything, two-meter transceiver. ■

The PL-259 Connection

—reducing adapters need not try your patience

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Since getting into ham radio, one of the minor hassles for me has been to assure myself of making a good shield connection to the standard PL-259 coax plug with the smaller RG-58 series coax feedlines. The first method, that of trying to solder through the holes of the PL-259 sleeve to the shield underneath, was quickly discarded as unsatisfactory to me since to ensure good solder flow on the shell, it has to be heated to the point where the dielectric would be melting.

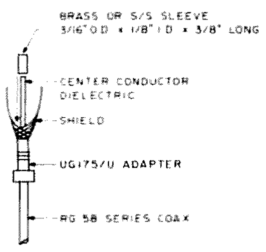

Fig. 1.

The second method tried, which is much superior, was to cut a slot with a hacksaw in the UG-175/U reducing adapter, then separate the shield into two equal strands, pulling down into the slots and soldering. The excess shield was trimmed off, and then the PL-259 could be screwed on with only the center conductor to be soldered to complete the job.

The third method, shown in the diagram, is a further improvement in that no soldering of the shield, thus no melting or changing of the dielectric, is required. A 3/8-inch length of 3/16-inch OD by 1/8-inch ID brass or stainless tubing is cut with a hacksaw. The sharp edges are deburred with a small screwdriver and sandpaper or fine file. Slip the UG-175 adapter over the coax and strip back about 1½ to 2 inches of the outer jacket only. Slightly spread the shield out so the sleeve can be slipped down between the center conductor and shield. Slide the sleeve down to about 1/8 inch or so from the outside jacket. Wedge the shield and sleeve down into the inside of the adapter.

In my case, it has been necessary to clamp the adapter in a vise and, by using a longer piece of the same size tubing (slipped over the center conductor only) and gently tapping with a hammer, to drive the sleeve on down flush with the top of the adapter. The excess shield above the adapter is now carefully trimmed off with a sharp knife, and assembly is completed by stripping the center conductor and adding the PL-259 as above. You will find that the shield makes a good tight connection all the way around, compressed between the sleeve and the inside of the adapter. Be sure to tighten the adapter to the PL-259 with pliers to assure a reliable and good mechanical and electrical connection. ■

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A Micro-Controlled Ham Station

—TRS-80 does it

Having built a TTL chip CW and RTTY system, as described in *QST* and other ham magazines a few years ago, the system described here is our first effort at putting together a microcomputer controlled ham station. What began as only a very modest effort in writing a simple software program for our 16K memory Level II BASIC TRS-80, to send and receive RTTY, has grown like Topsy and now threatens to engulf the entire ham shack! Further, the recent availability of ready-to-plug-in, low-cost, ancillary ham-oriented modules specifically for the TRS-80 has lead us to abandon the "reinventing the wheel syndrome." We quit trying to write our own software for every function, and began to play the part of a systems-organizer by using off-the-shelf modules/kits/software.

This article is not a detailed how-to-do-it, or wire-point-A-to-point-B story. It is a general description of the approach we used to achieve our objectives, plus an appendix listing suppliers and prices. Also, our approach to the problems and choices of solutions are not necessarily the best or only way to go. Indeed, there are as many different approaches and solutions, probably, as there are licensed hams in the U.S.

Before getting into the nitty-gritty, parts-and-pieces of our system, a brief review of exactly what a TRS-80 microcomputer is and does is in order. It was introduced to the marketplace during August, 1977, by the Radio Shack Division of Tandy Corporation. The design and development team at Tandy Advanced Products was led by Steve Leininger, a relatively young genius who previously had been with National Semiconductor, where he designed the highly-regarded SC/MP microcomputer. Today, only a bit more than 2 years after its introduction, more TRS-80s have been sold and delivered than any other microcomputer in the world. Soon, Tandy will announce that more TRS-80s have been sold and delivered than *all* other microcomputers in the world! There must be a reason for this, when one considers the highly competitive marketplace, brimming-over with PETs, APPLEs, and KIMs, to name a few. The answer is cost-effectiveness, plus the virtually unlimited growth capability that was designed into the TRS-80 from scratch.

The TRS-80 utilizes the Zilog Z-80 microprocessor, a third-generation chip that was designed and developed by another genius, Fred Faggin. He led the Intel design team that invented the world's first microprocessor, and then went on to develop the world-famous second-generation microprocessor, the 8080. The Z-80 will do everything the 8080 does, but faster, and has an instruction set over 100 percent larger.

It is difficult to maintain perspective when discussing microcomputers today, when one remembers that only 12 years ago a computer with the same capability as a TRS-80, but with lower throughput (speed), cost over one million dollars.

This article is not long enough to describe all the versions and options available to a TRS-80 purchaser. It is enough to say that unless you are an experienced programmer, well versed in BASIC, you will be doing yourself a disservice not to start with the TRS-80 with Level I BASIC installed, as the self-programmed, self-teaching manual included with the Level I system is one of the finest computer texts ever written. It was authored by Dr. Dave Lien W6OVP and Dr. Ron Lodewyck N6EE, who have made your introduction to the TRS-80 and BASIC programming language truly a pleasure instead of hard work. Their "User's Manual For Level I" is recommended whether you are a high school student, or graduate engineer writing college microwave textbooks.

Radio Shack will upgrade your TRS-80 to Level II BASIC (written by Micro Soft) for $99.00, and guarantee two-day turnaround repair time at any of the 50 TRS-80 repair centers in the U.S. One comment on Radio Shack's Level II BASIC and Disk BASIC: These two programs will do everything, will do more than IBM's "VS BASIC," and do it faster, too, for about $50k less! Hewlett-Packard BASIC and General Electric BASIC are certainly good programs, though on a cost-effective basis they are only runners-up to Radio Shack's Level II and Disc BASIC.

Let's get down to business and examine "Uncle Charlie How's" TRS-80-controlled ham station. See the block diagram. However: With a few exceptions, it is rather self-explanatory.

One: There is no noisy TTY machine (which the author abominates, and feels should be in a museum with steam cars).

Two: What is a word-processing system doing in the ham shack? Answer: Why not, since you already have a general-purpose computer and Selectric printer. The TRS-80 electric pencil software program,

written by Michael Shrayer, and adapted for the TRS-80 by Small System Software, will give your ham shack better word and text processing capability than if you had a zillion dollar IBM MT/ST or Mag Card system.

Three: What is an old Hallicrafters HT-37 transmitter doing there with all those goodies like the ITT #3021 digital tune receiver? Answer: The author has an on-going HT-37 love affair, and this is his third one. In phase two, what will serve the ITT #3021 digital receiver as a programmable vfo and drive? You guessed it. The venerable phase-quadrature SSB-generating HT-37. One does not kick one's wife or mistress out of the house because of grey hair. Same with the author's HT-37.

Four: Why are Radio Shack CTR-21A cassettes used instead of the CTR-41 cassettes that come with the TRS-80? Will not the CTR-21A extra current drain "melt" the TRS-80's Ry-1 which is only rated at 500 mA? Answer: A Radio Shack 6 V dc relay, 9 V dc transistor radio battery, and dropping resistor, serve to isolate the CTR-21A from Ry-1; the reason for using the CTR-21A cassette is that it has an S-meter built in which greatly simplifies loading cassette tapes into the TRS-80. It works the first time, instead of after 3 or 4 tries and much diddling with the cassette volume control.

Five: In the upper left corner of Fig. 1 are shown HA-160, HA-6, HA-2, HA-1¼, and HA-¾ transverters. Didn't Hallicrafters make only HA-6 and HA-2 transverters? Answer: You are correct. The author has been a VHF/UHF nut for 30 years; he buys over-the-hill HA-6s at hamfests and rebuilds them to the VHF/UHF bands. He even has an HA-¼; anyone with his aberration for HT-37s and the matching decor the HA transverter cabinets offer, would be kooky enough to build an HA-160, too, even if he uses it only once every five years.

Before digging deeper into TRS-80-controlled subsystems, a few words about memory expansion that may or may not cause Radio Shack pain when they read this. 16K RAM memory kits go for $120 each (installation included, at Radio Shack; for a "full house" 48K memory this comes to $360 above the original 4K memory price. Our friends at Apparat, Inc. (see Appendix), sell exactly the same memory package, new from Mostek, with installation instructions, for $79 per 16K memory. Installation time is approximately 10 minutes for the TRS-80 (including jumpers) and about 5 minutes for the 32K expansion interface (no jumpers). It appears that 15 minutes of your time can save you $120. Even for heart and brain surgeons, this would be a considerable savings.

Comment on TRS-80 reliability: though our TRS-80 was one of the very first ever built, it has operated two years with NO failures of any variety. It often has run 4 or 5 days in a row, 24 hours a day, with no external cooling and never a failure. The TRS-80 is undoubtedly the Rolls-Royce Dart engine of the microcomputer community!

TRS-80-Controlled Subsystems

Microtronics Model M-80 CW/RTTY Software-Hardware Subsystem. This system designed by Dr. Ron Lodewyck N6EE, is about the ultimate any dedicated RTTYer could desire. It offers narrow- or wide-shift keyboard-selectable speeds of 60, 66, 75, and 100 wpm, plus ten preprogrammed message memories, plus single-key actuation. Automatic shift, unshift, line feed, unshift-on-space, and automatic CW ID also are provided, as is provision for external TU, if more sophisticated TU is desired. Five separate keying circuits (2 relay contacts and 3 xstrs), allow maximum flexibility in interfacing FSK, AFSK, and TTY (ugh) equipment. In the CW mode, 3 options are provided the user: send, receive, and code practice. In the receive mode, the CW signal is automatically decoded and displayed on the screen. In all modes, the code speed is adjustable for 1-100 wpm and, when receiving, the sending station's speed may vary plus or minus 10 wpm with automatic compensation.

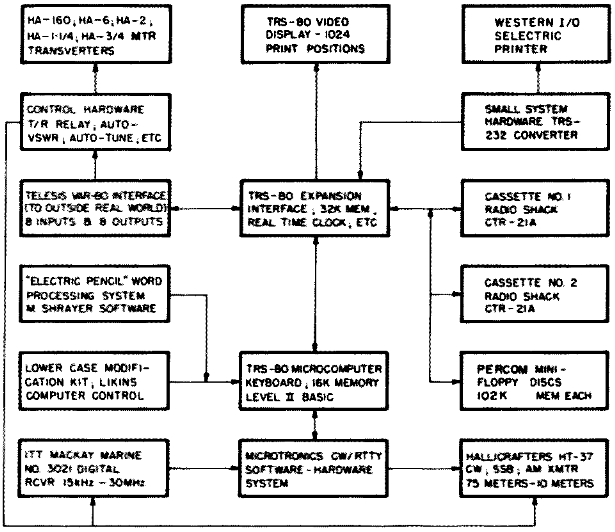

Fig. 1. Block diagram of a TRS-80 microcomputer-controlled ham station.

As icing on the cake for Dr. Ron's system, it also offers a code practice mode that will randomly generate characters or five letter groups at any desired speed, using the TRS-80's random number generator. Radio Clubs take note: no modifications to either the TRS-80, with or without Expansion Interface, or your xmtr/rcvr are required. Ten preprogrammed messages also are provided for the CW operator.

Not to be outdone by HAL devices, Dr. Ron also offers these additional features: PLL adjustable to any receiver passband 800-2300 Hz, 115 V ac pwr supply, LED visual-tuning indicator, side-tone oscillator, TTL and RS232 inputs, all connectors, automatic scrolling (lines of text which move up on the video monitor), double-size characters (32/line) operator-selectable for those without glasses who need them, keyboard buffer that allows you to type up to 255 characters ahead regardless of CW or RTTY speed, and, lastly, if you have the Radio Shack Disk BASIC, an automatic "time-sending" feature.

Selectric Printer Terminals. This probably will be your most difficult (and expensive) decision to make. If cost is not an object, then by all means choose the Selecterm Selectric typewriter/printer. It is a brand new IBM Selectric mechanism, quite properly interfaced with all the solenoids and ASCII interface electronics to work directly with your TRS-80. At approximately $2000 per

copy, it should stand up and salute whenever reveille or taps is played.

After throwing nearly $700 down a bottomless rat hole for a completely "shot" Datel printer, I had the good fortune to find a highly reputable IBM Selectric rebuilding firm through the good offices of *Kilobaud Microcomputing*. I highly recommend the zero-time, overhauled IBM Selectric printing terminal from Western I/O in Scottsdale AZ, for the TRS-80 (see Appendix). This excellent terminal has printed over 3000 pages in the past year.

For those with small budgets and pocketbooks who are willing to gamble $400 to $700 for a used Selectric terminal/printer from any of the many surplus houses, caveat *emptor*! Most of these machines have run 24 hours a day for 7 to 10 years or more, and although advertised as LIKE NEW or OVERHAULED, are mostly junk. Only if the surplus dealer happens to be a relative or close personal friend who is located within an hour's driving time of your QTH is this avenue worth looking into.

Most of these used machines do not speak ASCII, which is the TRS-80's native language. As such, you will have to write a software program to convert your ASCII to EBCDIC, or IBM Selectric correspondence code, or whatever. It is at this stage you will discover that ASCII characters such as up arrow, greater than, and less than have no counterparts on your machine, and that the Selectric code was written by a crazy man. For instance, the combination of events that must transpire to effect a "space" in correspondence code usually can occur only on a Friday the 13th during leap year.

Amateur ingenuity will eventually win, and someday you will bring your Selectric on-line. You can always hide the TTL chips and relays you added inside the TRS-80 Video Display case, and no one will be the wiser. One final bit of advice: never, never purchase any used Selectric terminal without a full and complete maintenance/tech manual with full schematics of the electronics. If you do, it will most likely wind up as an expensive boat anchor instead of your pride and joy printer.

Electric Pencil Word Processing System—Small System Software. This character-oriented word-processing system was written by Michael Shrayer Software and adapted for the TRS-80 by Small System Software. If you are familiar with the IBM Mag Card or IBM MT/ST word-processing systems, you know how a basic word processor works. The Electric Pencil does the same thing, using our TRS-80 computer and Selectric printer, only it does it in about an order of magnitude better and faster.

Here is how it works: Using your cassette recorder, the machine-language software program is automatically loaded into a high-memory location in about one minute. Being a character-oriented word-processing system, this means that text is entered as a series of continuous characters and is manipulated as such. This allows the operator exceptional freedom and ease in the movement and handling of text. Since line endings are never delineated, any number of characters, words, lines or paragraphs may be inserted or deleted anywhere in the text. The entirety of the text shifts and opens up or closes as needed, in full view of the operator. Neither the typing of carriage returns nor word hyphenation is required, since lines of text are formatted automatically.

As text is typed in on the TRS-80 keyboard and the end of the 64 character video display line is reached, a partially completed word is shifted to the beginning of the following line. Whenever text is inserted or deleted, existing text is pushed down or pulled up in a wraparound fashion. Everything appears on the video display screen as it occurs, eliminating any guesswork. Text may be reviewed at will by variable-speed scrolling in both forward and reverse directions. By using the search, or the search and replace function, any series of characters may be located and/or replaced with any other series of characters as desired. When text is printed, this software program automatically justifies the right margain by inserting extra spaces between words on the line, and also automatically inserts carriage returns where applicable. Operator-inserted combinations of line length, page length, line spacing and page spacing allow most any form and layout to be handled. Automatic page numbering and page title printing also is included.

Most of the foregoing paragraph has been pirated from Electric Pencil boilerplate, but, if anything, it is an understatement compared to what this system can do. It is a terribly efficient and addicting system. Once you have actually tried it and used it, you will find that you cannot do without it. Though your author is only a hunt-and-peck typist of the worst variety, it took only between 3 and 4 hours to get the hang of the system, utilizing most of the excellent features it offers. It will work with any TRS-80 printer whether upper case only, or both upper and lower case. All of a sudden your letters will look as if they have been professionally typeset by a commercial printer.

One of the niceties of the Selectric printer is being able to change the printing element, and, thus, type styles, in a few seconds. If you are lucky enough (and wealthy enough) to have a new Selecterm printer with the dual-pitch option (printing either 10 or 12 characters per inch), you may select your printing element from a wide variety of type styles and spacing. For instance, you might use 12-pitch Script for personal letters, 10-pitch Delegate for business letters, and 10-pitch Orator for speeches to be read without your glasses.

TRS-80 Lower Case Modification Kit—Likins Computer Control or Small System Software. Yes, Nancy, there is a Santa Claus. He included lower case capability in the TRS-80, but Radio Shack forgot to hook it up. All TRS-80s have the capability, although some will position lower case characters such as "p" or "y" even with the line rather than in the normal position where the bottom half of such letters is below the line. For printing with your Selectric printer, though, it does not make a big difference, and the printed copy will appear entirely normal.

The Likins kit and Small System kit (to be available soon), are similar in that both add a 2102A memory chip piggyback on another 2101A video memory chip on the TRS-80 main PCB. Your author prefers the Small System hookup since it actuates the lower-case option only when using the Electric Pencil word processing system, and this really is the only time when you want to use it. It can be

installed in about 10 minutes, and involves only soldering the extra 2102A piggyback on a Z-45 chip, cutting one PCB trace and soldering in 5 wires, plus adding a SPDT switch and additional keyboard control key for turning on or off the lowercase function while running the Electric Pencil. Holding "down" the new keyboard control key and pressing BREAK will alternately turn-on and turn-off the lowercase function, much like the shift-lock on a regular typewriter. A good spot to install the additional lowercase control key is just to the right of the BREAK key on the TRS-80 keyboard so it is not actuated inadvertently. Taking only reasonable care, the key may be installed in about 15 minutes using only a hacksaw blade, file, 5-minute epoxy, and 1/8" balsa wood as an insulator/PCB switch mount.

VAR-80 Interface (to outside real world)—Telesis Laboratory. Here is a fascinating little black box that allows the TRS-80 to handle programmed instructions to and from the outside world. Eight outputs are provided, DBO Ø through DBO 7. The first two consist of relays with contacts rated at 3 Amps at 115 V ac. The last six outputs are TTL level, which easily will drive a 7406 or 7407 chip, either of which will handle and drive 6 Radio Shack 275-004 6 V dc relays. If 8 relays are not adequate to handle your ham station requirements, it is a simple matter to, for instance, hang the last four outputs onto a 74154 demultiplexer TTL chip which, through two 7407 buffer chips, will drive 16 relays each. The eight outputs of the VAR-80 are accessed by the TRS-80 using the OUT statement port value. The VAR-80 uses port number zero and decodes the byte value sent to port zero to turn on or off the appropriate relays/TTLs, depending on whether or not any bit in the 8-bit byte of the value number (0 to 255) contains a 1.

A picture is worth a thousand words. Picture if you will, decimal 255 binary (11111111). Since the OUT Ø, 255, from our TRS-80 contains eight each binary 1-bits, all eight outputs of the VAR-80 will be turned "on." If our OUT statement was written OUT Ø, 63, port zero would have the binary number 00111111 addressed to it, and the VAR-80 would turn "on" its first six outputs, leaving its last two outputs "off." Easy isn't it? Counting the 8-bit binary number from right to left tells us the on or off status of each of the VAR-80's eight outputs, depending on whether a one or zero is in any of the 8 possible binary positions.

The VAR-80 also has eight inputs available to the outside world. The first two are opto-isolated, should you be messing around with sensing kilovolt power supplies (yuk), and the last six are TTL. The TRS-80 INP (port) function is used to input data in similar fashion to the OUT statement: A binary one is "on" or "closed," and a binary zero is "off" or "open."

What does all this good stuff do for a ham station? Well, just about anything you want it to do. The only limits are your own imagination and ability to write a simple program in BASIC for your TRS-80 to execute. For real contest nuts, it is now almost feasible for the TRS-80 and its ancillary subsystems described in this article to enter a CW and/or a RTTY contest without your assistance. All the TRS-80 will do (almost!) is ask you to take its log off the Selectric terminal/printer, put the log in the envelope it printed for you, put a stamp on it, and mail it!

As mentioned earlier, the author's TRS-80 Microcomputer-Controlled Ham Station is only one way to go. The choice of subsystems, the choice of software versus hardware, and its implementation, is up to the individual. A very decided trend is worth noting, however. The days of the dedicated computer/processor in the ham shack are indeed numbered, as are the days of the growling-clanking TTY machine. How so, you say? Answer: "The cost-effectiveness of the general purpose microcomputer . . . especially the TRS-80."

Let us close this dissertation with a special "thank you" to Steve Leininger, Ed Juge W5TOO, and the late Mr. Tandy for successfully bringing the TRS-80 "online" at a price many amateurs can afford. Its impact will go far beyond amateur radio and computer hobbyists and even further beyond what our wildest imaginings today can conceive! ■

Appendix

Microtronics Model M-80 5943 Pioneer Road Hughson CA 95326 (209) 634-8888	CW/RTTY Hardware and software for TRS-80 Assembled and tested $129. pp Kit $99. pp
Apparat Incorporated P.O. Box 10324 Denver CO 80210	16K RAM memory for TRS-80 or Expansion Interface $79.
Western I/O, Inc. Attn: S. Mueller, Dir. Mktg. 8337 East San Miguel Scottsdale AZ 85253 (602)-947-0070	Zero-time overhauled IBM Selectric "heavy-duty" printer terminal for TRS-80; $1100 plus $30 cable. This is an IBM #2970 system that would cost $4000 + today.
Small System Software P.O. Box 483 Newbury Park CA 91320	Electric Pencil for TRS-80 $99. TRS232 Interface for TRS-80 $39.
Likins Computer Control 3001 Red Hill Avenue—Bldg. 1 Costa Mesa CA 92626	TRS-80 lowercase modification kit $13. pp
Telesis Laboratory Dept. VAR P.O. Box 1843 Chillicothe OH 45601	VAR-80 Interface for TRS-80 $99.95 pp
Richcraft Engineering, Inc. Attn: TRS-80 Programs Mgr. #1 Wahmeda Industrial Park Chautauqua NY 14722 (716)-753-2654	TRS-80 Morse code transmit-receive program (no ancillary devices required): $15 disk/cassette pp; TRS-80 Disassembled Handbook: $10 pp; TRS-80 All-base conversion program: $10 disk/cassette pp

CW and the TRS-80

—send Morse with a Level I

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About a year ago, I bought a home computer. Because of limited finances (due to the fact that I am not old enough to get a job), I purchased a Level I 4K RAM TRS-80 from Radio Shack. I have become proficient in Level I programming and wish to advance into Level II. But, like a lot of TRS-80 owners, I just don't have the money it takes to upgrade. So, I decided I would see just how much I could get out of my basic 4K Level I machine and share my findings with other computer owners who are in the same predicament.

One of the big breakthroughs actually was discovered by accident. One day I was programming Byge (the name of my computer) and I decided to turn my radio on to get some music. I turned it on, but there was no music. All I heard was noise. Then it occurred to me that Byge was emitting rf noise across the whole AM band. Then I ran a program and the results were revealing. The computer was making all kinds of different tones.

I flipped over to FM and tuned to a spot where these tones were clear and strong. I found that for the TRS-80, the best setting was somewhere around 89 to 90 MHz. For other computers, however, it might be best to tune around until the tones are the clearest possible. Remember, there were no connections needed between the radio and the computer, but the radio had to be in close enough proximity to the computer to receive the rf produced by the computer.

After I discovered the audible capabilities of my computer, I began working on all kinds of new programs. And what was even more stimulating was to run old programs and listen to how each one sounded. One of the programs that I began working on was a program for computer music. By mixing different commands together, I could vary the audible note. I'm sure that any experimentation with your different commands would be well worth the effort.

Months have gone by since I first realized that Byge was capable of "talking back." Now, every time I turn on my computer, I turn on my FM radio. It's just not the same without it.

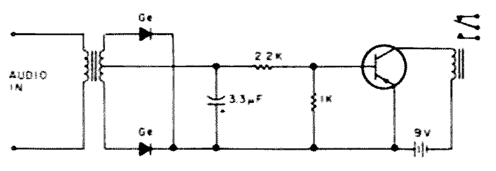

Fig. 1. A schematic of a simple circuit that plugs into the output of the radio. It closes the relay if a signal is present and opens the relay if a signal is not present.

9, 15, 18		2, 5, 6		0, 1, 3		0, 1, 3		0, 0, 1		0, 0, 1	
Wpm	**#**	**Wpm**	**#**	**Wpm**	**#**	**Wpm**	**#**	**Wpm**	**#**	**Wpm**	**#**
1		11	208	21	104	31	54	41	31	51	14
2		12	182	22	99	32	50	42	29	52	12
3	875	13	161	23	91	33	47	43	27	53	11
4	625	14	143	24	85	34	44	44	25	54	10
5	450	15	124	25	79	35	41	45	23	55	9
6	345	16	107	26	74	36	37	46	21	56	8
7	245	17	96	27	69	37	34	47	20	57	7
8	180	18	85	28	64	38	31	48	18	58	6
9	135	19	75	29	60	39	29	49	17	59	5
10	90	20	65	30	57	40	28	50	15	60	4

Table 1. Converting a words-per-minute rate into the speed # required by the computer. At the top of each column is the recommended number of PRINT statements for each gap, pause, and space for that particular range of speeds.

Sending Morse Code

A few weeks ago, some friends who own 32K Level II machines with floppy disks told me that the TRS-80 could now send and receive RTTY and CW. Sure enough, they ordered the hardware and software that was needed and showed me that it was possible. There was only one catch: It required a system equipped with Level II in ROM and 16K in RAM. So that eliminated me, as it might other smaller system operators.

I was determined to show them that what I lacked in memory capabilities I made up for in intelligence.

I began working on a program that would input characters and output Morse code. Using one short loop and one long loop at a steady tone value gave me dits and dahs from my nearby radio. I used PRINT statements for the spaces, pauses, or gaps that are needed between letters and words because they had the least amount of audible tone.

About the Program

The program I have included was written in simple BASIC language. However, abbreviations had to be used in order to have enough memory left to use for array variables. If your system is equipped with more than 4K in RAM, these abbreviations may be spelled out.

Lines 3 through 7 are my two subroutines for dits and dahs. I put them in the beginning of the program because it takes a lot less memory to GOSUB 3 than it would to GOSUB 3000. The program actually begins on line 100. From 100 to 120 the letters from A to Z are assigned a numerical value. Now, since I have used up all my letter variables, I must resort to array variables.

The program now is ready to input characters from the keyboard and display them on the screen. Lines 130, 140, and 150 do just that. Line 130 inputs the character and moves the cursor over two, ready for the next input. It also erases the ? and produces a double-spacing effect. Line 140 calls a SUB at line 200. Line 200 allows backspacing to any place in the text. Line 220 detects a space character (which is a 0) and prints a space on the screen. The rest of the subroutine prints inputs that are greater than 38. These inputs are the four basic punctuation marks. Line 150 increments the array variable and goes to 130 where the next letter is put in.

After the whole message is in memory, the computer must start at the beginning of the text and convert each character into the right sequence of dits and dahs. Line 160 starts the computer at the beginning of the message, then each number from a range of 1 to 42 (since all letters and punctuation are assigned numerical values) goes to the subroutine at 300. Lines 300 through 340 send any number from 1 to 42 to a specified location where a certain sequence of GOSUB produces the code for that number. For example, say an A was typed in. If you recall, each letter was placed at a numerical value. The value of A was 11. So line 310 would send control to line 400. At line 400 we have a GOSUB 3 and a GOSUB 6. GOSUB 3 produces the dit and GOSUB 6 produces the dah. Bingo!

Operational Procedures

When you run this Morse code program, the first thing you must do is tell the computer the speed # at which the code is to be sent. This number must not be mistaken for the wpm number. If you wish to send a certain number of words per minute, Table 1 converts wpm into the speed # required by the computer. This number sets the length of a dit and a dah but does not adjust the length of the spaces between dits and dahs, letters, and words. For good-sounding code, these lengths also must vary with the speed # entered. These lengths are changed by varying the number of PRINT statements at lines 4 and 7 for gaps between dits and dahs, at line 180 for pauses between letters, and at line 670 for spaces between words. At the top of the columns in Table I, the recommended numbers of PRINT statements are listed in order for gaps, pauses, and spaces.

After entering the desired speed and adjusting the number of PRINT statements for gap, pause, and space, you are ready to start entering your message. You must enter one letter at a time, and each letter will be displayed after entering.

To correct a mistake after entering it, just enter minus (−) the number of spaces to the left you wish to backspace. For example, if you type in CQ CQ CQ DR WB7TUG?, all you do is enter −8 and the cursor goes to the R and lets you input the correction and start from there.

Punctuation is limited to four basic marks: the question mark (enter 39), the period (enter 40), the comma (enter 41), and the dash

```
1 G 100
2 G 160
3 F N=16384TO16384+A(2)/3 N N
4 P  P :RET
6 F N=16384TO16384+A(2):N N
7 P :P :RET
100 CLS:A=11 B=12:C=13:D=14 E=15:F=16:G=17:H=18:I=19:J=20:K=21
110 L=22:M=23 N=24 O=25:P=26:Q=28 R=29:S=30:T=31:U=32:V=33
120 W=34:X=35:Y=36 Z=37:A(1)=3:IN "SPEED #";A(2):CLS
130 P ATA(1)*2-4;:P ATA(1)*2-2;:IN A(A(1)):IFA(A(1))=27G 160
140 GOS 200
150 A(1)=A(1)+1:G 130
160 A(1)=3
170 GOS 300
180 P  P :P  P  P
190 A(1)=A(1)+1 G 170
200 IFA(A(1))<0A(1)=A(1)-1+A(A(1)):RET
210 IFA(A(1))=10P ATA(1)*2-1,"0"; :RET
220 IFA(A(1))=0P ATA(1)*2-2," "; A(A(1))=38:RET
230 IFA(A(1))<39RET
240 P ATA(1)*2-1;
250 ONA(A(1))-38G 260,270,280,290
260 P "?"; :RET
270 P "."; RET
280 P ","; :RET
290 P "-"; RET
300 ONA(A(1))G 710,720,730,740,750,760,770,780,790,700
310 ONA(A(1))-10G 400,410,420,430,440,450,460,470
320 ONA(A(1))-18G 480,490,500,510,520,530,540,550
330 ONA(A(1))-26G 660,560,570,580,590,600,610,620
340 ONA(A(1))-34G 630,640,650,670,830,800,810,820
400 GOS 3:GOS 6 RET
410 GOS 6 GOS 3 GOS 3:GOS 3 RET
420 GOS 6:GOS 3 GOS 6:GOS 3:RET
430 GOS 6:GOS 3 GOS 3:RET
440 GOS 3:RET
450 GOS 3:GOS 3 GOS 6:GOS 3:RET
460 GOS 6:GOS 6 GOS 3 RET
470 GOS 3 GOS 3 GOS 3 GOS 3 RET
480 GOS 3 GOS 3 RET
490 GOS 3:GOS 6 GOS 6:GOS 6 RET
500 GOS 6:GOS 3 GOS 6:RET
510 GOS 3 GOS 6 GOS 3  GOS 3 RET
520 GOS 6:GOS 6 RET
530 GOS 6:GOS 3 RET
540 GOS 6:GOS 6 GOS 6:RET
550 GOS 3:GOS 6 GOS 6:GOS 3 RET
560 GOS 6 GOS 6 GOS 3:GOS 6 RET
570 GOS 3:GOS 6 GOS 3:RET
580 GOS 3:GOS 3:GOS 3:RET
590 GOS 6:RET
600 GOS 3:GOS 3:GOS 6:RET
610 GOS 3 GOS 3:GOS 3:GOS 6 RET
620 GOS 3:GOS 6:GOS 6:RET
630 GOS 6 GOS 3 GOS 3:GOS 6 RET
640 GOS 6 GOS 3 GOS 6 GOS 6 RET
650 GOS 6 GOS 6 GOS 3:GOS 3 RET
660 E
670 P  P :P  P  P  P :RET
700 GOS 6:GOS 6 GOS 6:GOS 6 GOS 6 RET
710 GOS 3:GOS 6 GOS 6:GOS 6 GOS 6 RET
720 GOS 3:GOS 3:GOS 6 GOS 6 GOS 6:RET
730 GOS 3:GOS 3 GOS 3:GOS 6 GOS 6 RET
740 GOS 3:GOS 3:GOS 3 GOS 3 GOS 6 RET
750 GOS 3:GOS 3:GOS 3:GOS 3:GOS 3 RET
760 GOS 6:GOS 3:GOS 3:GOS 3:GOS 3:RET
770 GOS 6:GOS 6:GOS 3 GOS 3 GOS 3 RET
780 GOS 6:GOS 6 GOS 6 GOS 3 GOS 3 RET
790 GOS 6:GOS 6 GOS 6 GOS 6 GOS 3 RET
800 GOS 3:GOS 6 GOS 3 GOS 6 GOS 3:GOS 6 RET
810 GOS 6:GOS 6 GOS 3 GOS 3 GOS 6 GOS 6:RET
820 GOS 6 GOS 3 GOS 3 GOS 3 GOS 6 RET
830 GOS 3 GOS 3 GOS 6 GOS 6 GOS 3 GOS 3 RET
```

Listing 1. A simple BASIC program that allows Morse code output by the radio for any text entered by the keyboard. Abbreviations were used to save memory space.

```
130 A(A(1))=R (42) IFA(A(1))=27G 130
140 A(1)=A(1)+1 IFA(1)<I (M /4-1)G 130
150 A(A(1))=27
```

Listing 2. An option for the program in Listing 1 that converts it into a random code-practice sender.

(enter 42). The character for a space is a 0.

After you have completed your text and want the computer to start sending, enter 27. If you want the computer to send the same message over, just enter RUN 2. (Note: With 4K RAM and without an excessive number of PRINT statements at lines 4, 7, 180, and 670, a text may be as long as 11 lines, or even more.)

Option: Making a Random Code-Practice Sender

To use this BASIC program as an aid in learning code, just change lines 130, 140, and 150 as shown in Listing 2. When running this program, there will be a slight delay before the code is sent. Just stand by.

Addition: Adding a Computer-Controlled Relay

You already have computer audio output capability from your FM radio, so now you can harness the logic 0 (no audio tone) and the logic 1 (audio tone) to operate a relay.

Fig. 1 shows a schematic of a simple circuit that takes the raw ac input from the radio and converts it to dc. This dc voltage is then fed into a PNP transistor where it varies the current from the 9-V source to the relay. This activates the relay on a logic 1 and drops it on a logic 0. If the relay does not respond to a logic 1, try adjusting the volume control on the radio. Your computer can now control lights, oscillators, or any other circuit via the relay.

By using this FM radio method of producing audio tones from your computer, you should be able to find a lot of interesting new applications for your small system. The BASIC program I have come up with is just a starting point. The sky is the limit.■

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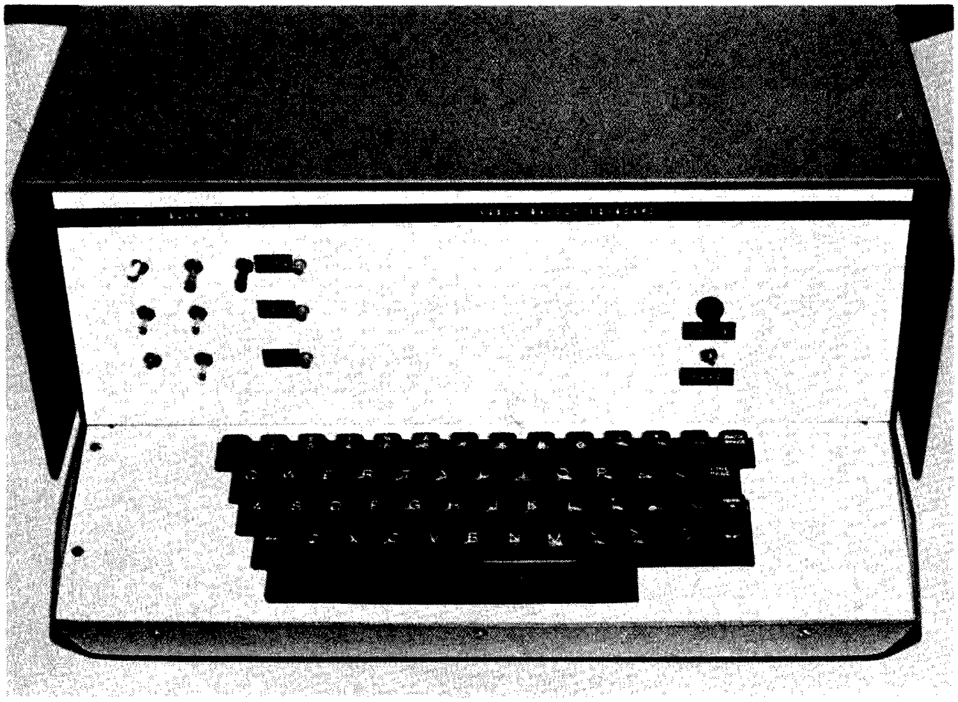
A Solid-State RTTY Keyboard

—with auto-shift

It is generally agreed that state-of-the-art operation on RTTY is the use of an electronic keyboard for transmission and a CRT display for reception. Both of these items are expensive station accessories and, because of their complexity, leave the average homebuilder with the alternatives of laying out the necessary sum to purchase a commercially-made unit or continuing to use the old but reliable mechanical equipment. Clearly, the display unit is a very complicated system, but the keyboard can, if properly designed, be a relatively easy project for the average home shop. The growth of the home computer hobby has produced a wealth of sources for obtaining the keyboards, logic, and other necessary ingredients for constructing a solid-state RTTY keyboard.

A few goals and compromises were made before the design was attempted. The design requirements were: (1) The keyboard must be simple and easy to construct; (2) The keyboard must be inexpensive and constructed from readily-available components; (3) The keyboard must send 60 and 100 wpm, and (4) The keyboard must have full keyswitch interlocking, two-key roll-over, and send the entire Baudot character set.

Only one significant compromise was required. The stop pulse in this keyboard is 44 ms instead of the usual 31 ms. This has the effect of reducing the maximum rate of the keyboard. Very few operators can send at a sustained 60 wpm rate, so the reduction in maximum speed will go unnoticed. However, the keyboard is fully compatible with all printers in spite of the long stop pulse.


Here is a front view of the keyboard.

Several other differences exist between the electronic keyboard and its mechanical counterpart. These are considered differences and not compromises. Most of the departures were required because most of the available keyswitch assemblies were made for transmitting the ASCII code rather than Baudot code. In the Baudot code, numbers and punctuation are in the uppercase. That is, each number or punctuation shares a code and a key with a letter. In order to print a number or punctuation, the figures key must be sent to shift the printer into the figures case. In the ASCII system, the letters do not share keys or codes with numbers or punctuation.

It would be possible to use the ASCII keyboard for transmitting Baudot by simply paralleling the letter-switch connections to the corresponding number or punctuation key. This is not desirable since

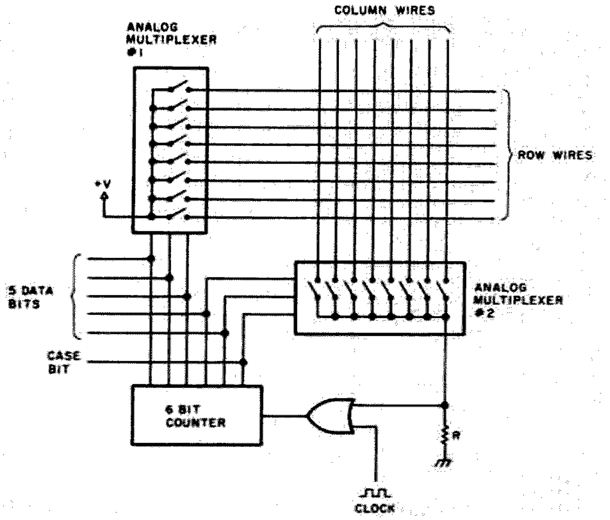
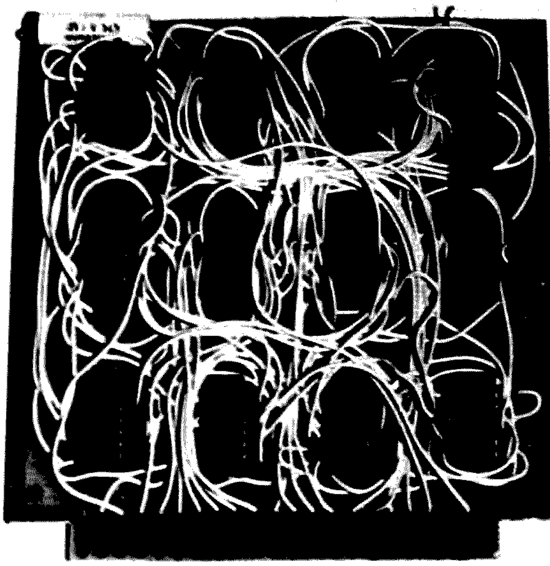


Fig. 1.



The entire keyboard is contained on one 12-chip prototype board, as shown here.

	B0	B1	B2	B3	B4	B5	B6	B7
A0	ltrs*	X	V	M		/	;	.
A1	K	F	C	N	(	$	:	,
A2	Q	Y	P	H	1	6	0	#
A3	U	S	I	space	7	'	8	
A4	figs*	B	G	O		?	&	9
A5	J	D	R	CR			4	
A6	W	Z	L	T	2	"	)	5
A7	A	LF	E	blank*	_		3	

Table 1. Keyswitches connect between row wires and column wires as shown. Those functions shown with an asterisk are not required, but may be wired if keyswitches are available.

the key would appear as a separate code on the keyboard when in actuality it is an uppercase of another key on the keyboard. Pressing either key would send the same letter or number/punctuation unless separated by a figures or letters key. Another problem is that on most ASCII keyboards, neither letters nor figures keys are available.

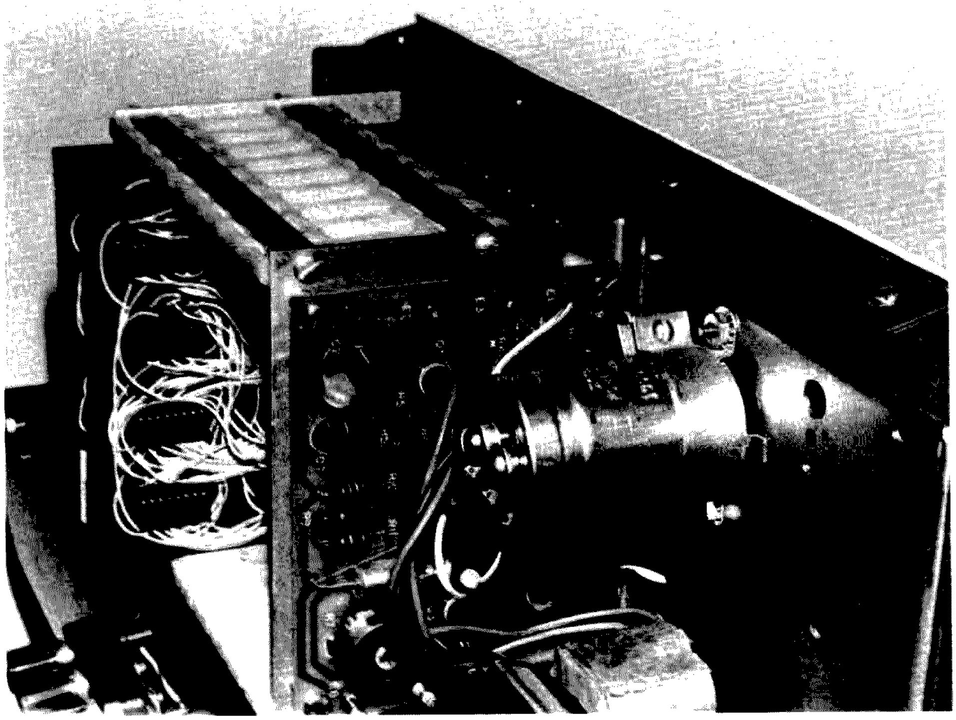
These shortcomings of the ASCII keyboard were overcome by automatically sending the figures or letters code as required. A one-bit memory keeps a running account of whether the keyboard is sending figures or letters. If a key is pressed that differs from the case being sent, the keyboard automatically inserts the proper figures or letters code before sending the different case figure(s) or letter(s). For example, if the keyboard is sending in the letters case and an amateur call is sent which includes a number, such as K2BLA, the operator presses the keys k, 2, b, l, and a. The conventional keyboard requires the following keys; k, figs, 2, letters, b, l, and a. Since with my unit the letters/figures function is completely automatic, no figures or letters keys are required.

On the standard communications keyboard, several keys operate the same on both upper- and lowercase, such as line feed, carriage return, space, and blank. This electronic keyboard treats these as lowercase only. This will affect the speed of the keyboard only in rare cases, such as groups of numbers separated by spaces.

The heart of this circuit is a scanned keyboard. The actual encoding is accomplished by wiring the keyswitches to the appropriate intersection of the scanning matrix (see Table 1). The scanning system allows each switch to be sampled one at a time at some rapid rate, looking for a closed switch.

When a closed switch is found, the scanning process stops until the RTTY character has been sent, after which the scanning continues. If only one switch has been closed, the keyboard will send the Baudot code for the selected key while the scanning remains disabled until the closed switch has been released. If two keys were pressed and held, only the first key down will be sent. If one key is depressed, released before the completion of the first character, and a second key is then depressed, the keyboard will send both characters complete with the proper stop pulses and figures and/or letters characters where necessary. It is because of this two-key roll-over that the electronic keyboard will tolerate a very uneven typing rhythm.

Fig. 1 shows a simplified schematic of the scanned keyboard. The six-bit counter operates at the clock frequency, causing an analog switch in each multiplexer to be closed at any one given time. Sixty-four clock pulses are required to complete a cycle of all possible analog switch states. Keyboard switches are connected between row wires and column wires. If a keyboard switch is closed, a current path will exist from +V, through analog multiplexer 1, the keyswitch, analog multiplexer 2, and the resistor, R. Since the counter will advance through all possible analog switch states, the current path will exist in less than 64 clock pulses after a switch closure, causing +V to be applied to the resistor, R, thus stopping the counter. Each keyboard switch will stop the counter at a different counter state. The keyswitches are connected to the intersection of row and column wires so that the counter will contain the correct Baudot code



Only one of the four plug-in boards visible in this photo is for the keyboard. The others are for accessories mentioned in the text.

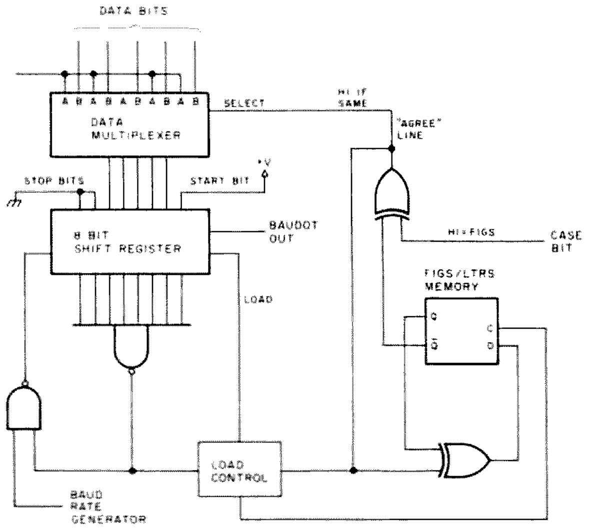


Fig. 2.

plus a sixth bit indicating the case, either figures or letters.

Before any key closure is sent, it must be determined whether it should be preceded by a figures or letters code. A flip-flop (see Fig. 2) serves as a one-bit memory to remember if the keyboard is sending figures or letters. Whenever a keyswitch closure is detected, the status of the case bit, the sixth bit, is compared to the content of the one-bit memory. If they are the same, the "agree" line is high and the 8-bit shift register is loaded with a start bit, the 5 data bits contained in the counter, and two stop bits, in that order, from right to left. This digital word is shifted out as Baudot code.

If the state of the one-bit memory and the case bit disagree, then the shift register is first loaded with 00100 if a figures character is to be sent, or 00000 if a letters character is to be sent. After the figures or letters character has been sent, the shift register is loaded with the data from the scan counter along with the necessary start and stop bits and is shifted out. During this time, the keyboard has been locked out so that any key closures will not disrupt the sending of the data. Also during this time, the state of the one-bit memory has been reversed, indicating that the keyboard is sending the opposite case.

Fig. 3 is the actual schematic of the CMOS Baudot keyboard. U9 and U10 are the analog multiplexers driving the keyboard matrix from the six-bit counter, U11. The 4024 is actually a seven-stage counter, but the last stage is not used. The scan oscillator is U12C and U12D. The frequency of this oscillator is about 32 kHz, allowing for a maximum access time for the keyboard of about 2 milliseconds. The lowest frequency possible for the scan oscillator, consistent with a good keyboard feel, is desirable in order to keep the higher harmonics out of the high-frequency radio spectrum.

The 4035 parallel-in/serial-out shift registers have a synchronous load capability. This allows the registers to be loaded and shifted with the same clock, thus producing an evenly spaced serial output with a minimum of external circuitry. An eight-input NAND gate, U6, determines the state of the shift register and provides a low output when the shift register is empty and ready for a new character.

The keyboard requires an accurate frequency source known as a baud-rate generator. The baud rate of any teleprinter operation is equal to 1/t, where t is the time duration of the data bits. At sixty words per minute, the data bit time is 22 milliseconds, so therefore the baud rate is $1/.022 = 45.45$ Hz. Almost any stable oscillator capable of supplying the baud rate at better than one percent is acceptable. Several single-chip baud-rate generators are available that supply a number of common baud rates from a single crystal. Fig. 4 shows a simple baud-rate generator that supplies 45.5 and 74.2 baud for operation on 60 wpm and 100 wpm.

The electronics for the keyboard was assembled on a 12-IC universal DIP board. The baud-rate generator was constructed on a small portion of another board. The parts placement is not critical for either board. The cabinet is a cut-down IC test set. Almost any type of cabinet will do, but it is desirable to tilt the

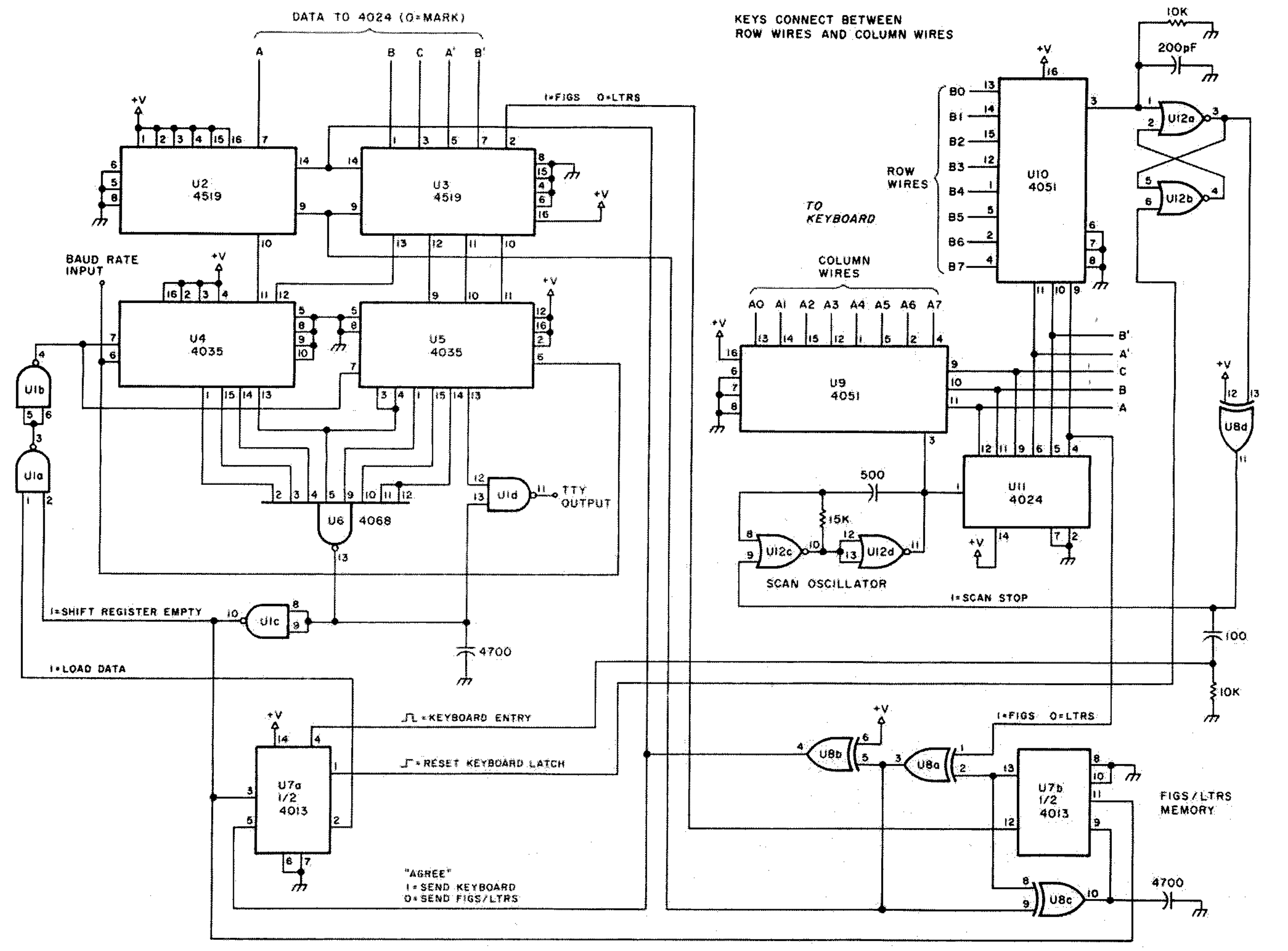


Fig. 3.

keyboard between ten and thirty degrees from the horizontal. A flat chassis or box could be used by attaching oversized feet to the rear. The extra room in my cabinet is used to house a CW ID generator, an audio cassette interface, a signal switcher, and a 1024-character buffer memory. The power supply was made oversized and can accommodate about 10 more boards. The baud-rate generator is shared among all of the systems.

All of the parts required for the keyboard are available by mail order at reasonable prices. Almost any type of keyboard will work since the scanned keyboard circuit is very tolerant of all types of keyswitch arrangements. It would be best to obtain a keyboard with separate unencoded switches. If this is not available, an encoded keyboard may be utilized by removing the encoding electronics. If the electronics are to be removed from an encoded keyboard, be sure that the keyswitches will stand alone, that is, that the printed circuit board is not required for mechanical support. A few very cheap keyboards used this type of construction and are worthless for the Baudot keyboard unless another PC board is constructed. Also, beware of keyboard switches that give only momentary closures. Although these switches will work, the 2-key rollover and the interlocking features of the scanned keyboard will be lost.

The keyboard is a worthwhile addition to any RTTY shack, even when the station may be already equipped with a mechanical keyboard. The light action and the automatic upshift/downshift are such a delight to use that the old cement mixer probably will be relegated to printing only or replaced with a CRT display. ■

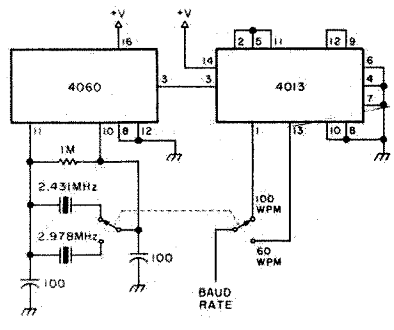


Fig. 4.

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1. William I. Orr W6SAI, *Radio Handbook*, 21st edition, page 14. 15 (general description of RTTY signal generation).
2. Albert D. Helfrick K2BLA, "An Inexpensive Morse Keyboard," *QST*, January, 1978 (describes a Morse code keyboard using a scanned keyboard).
3. ARRL staff, *Specialized Communications Techniques for the Radio Amateur*, page 99 (general description of RTTY communications).
4. Motorola, Inc., *McMOS Handbook*, chapter 6 (general rules for using CMOS circuits).

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SWLing? Try This Souped-Up SSR-1

—digital readout and more for Drake's fine receiver

My first general-coverage receiver had five bands, valves (tubes), was notoriously insensitive on 28 MHz (or 28 Mcs as it was then), and drifted a bit. Still, Radio Australia was received, as were some of the easier Pacific stations. Amateurs were received on the small areas so-marked as was that funny squawk that needed the bfo to resolve it—SSB. Next came the transceiver, and out went the general-coverage receiver as part of the deal.

That was all some years ago, but recently the old hankering for the rest of the shortwaves was felt and the search was on for a modestly-priced, modern general-coverage receiver. At about this time, *73* was reviewing receivers, and I discovered that modern receivers had "synthesized first-mixer injection and used PLLs," and as for the five bands of distant memory, there were now 30, each 1 MHz wide, with no drop-off in sensitivity at the top end.

The receiver finally chosen was the Drake SSR-1[1]. This was my first piece of Drake gear, and I was not disappointed. The receiver did all that the specs said it should, and reacquaintance was made with old and half-forgotten friends on the broadcast bands and with the "woodpecker" on the amateur bands. In all, it was a joy.

Why, then, "muck it about," as the XYL so delicately put it when I had the back off within the first week and appeared to be attacking it wildly with drill and chassis punch? Why indeed? In my defense, I muttered something about "extras" and pointed out that these did not affect the performance of the receiver. Indeed, these mods are offered as extras for the consideration of those who like cream with their peaches (I don't know the equivalent in Americanese!) and to those who can't resist mucking about!

The receiver comes complete with two antenna sockets—neither of which fitted the terminations on my HF antennas. Inspection both inside and out revealed that there was plenty of room to fit a UHF-type socket, and this was done as can be seen in Fig. 2. I decided that I did not require the second antenna socket, two terminal plugs, so the feed from these was removed and the terminals wired to provide a 12-volt supply from the receiver's own.

Further inspection of the

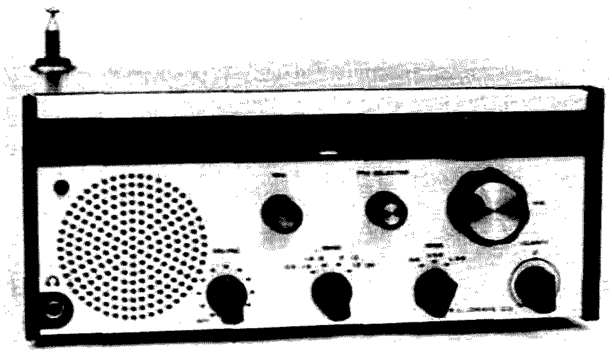

Fig. 1.

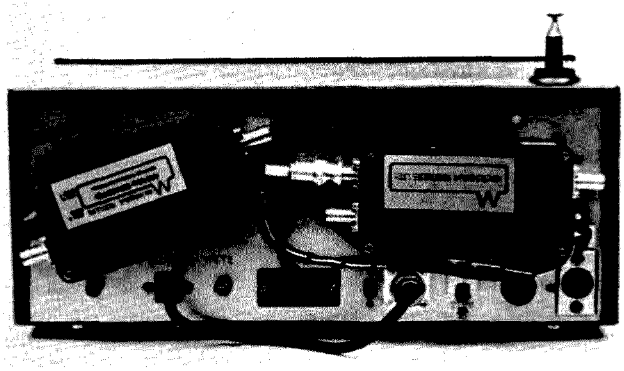

Fig. 2.

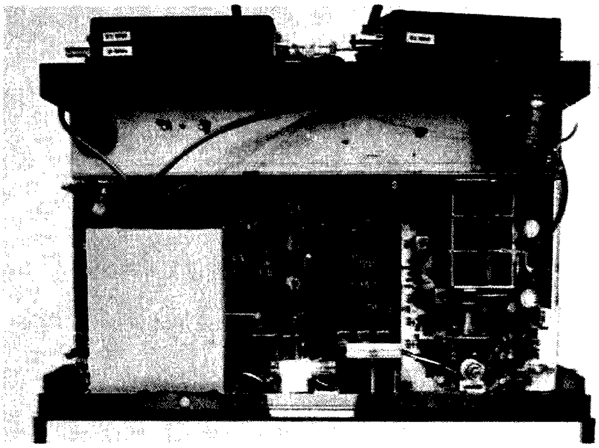

Fig. 3.

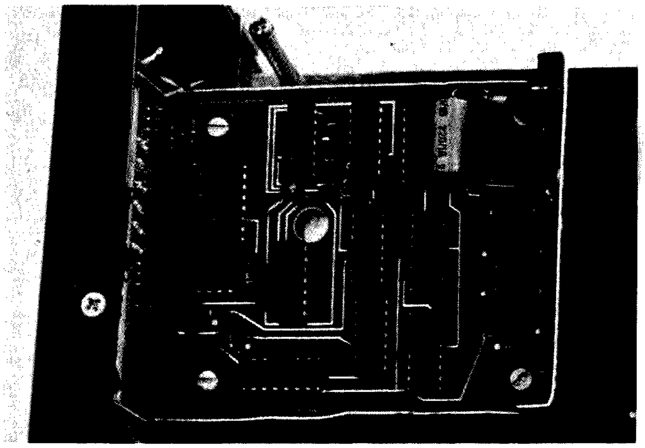

Fig. 4.

back panel showed that there was room to mount a converter for 432 MHz for OSCAR reception. This, together with the same manufacturer's ten-meter preamp, was bolted onto the back and the power supply was taken from the terminals as previously explained.

Encouraged by this instant success, I next looked inside to see how much room there was to spare. Once the battery compartment has been removed, there is quite a lot. Towards the rear is a metal shelf, and the circuit boards are covered by a plastic shield which makes an excellent shelf. See Fig. 3.

A feature of all modern rigs seems to be digital readout. This was one thing that the SSR-1 did not have. At about this time, *73* carried an article about digital readout,[2] and I was just about to order the TTLs and have a go when an ad was discovered in the British amateur radio press (we do have some) which saved me time and frustration, if not cash. The ad offered a CMOS digital readout board designed for the SSR-1 and giving a count of 0-999 on each of the 1-MHz bands.[3] It required 7-9 volts and only two connections to the SSR-1.

With immodest speed the cheque was written, and within two days (Norwich is only 25 miles away) the wired and tested board arrived. Fig. 4 shows that the unit is a small board with three 7-segment LEDs mounted vertically at one end. The keen-eyed will notice that it contains a 12-bit binary counter, 3 presettable up-down counters, and a 4511 display chip. (Incidentally, the board is double-sided.) One coax lead went to the 10-MHz signal line and the other to the front gang of the tuning capacitor.

The unit also required 7-9 volts dc. It was decided to build a small power supply inside the SSR-1 to power this unit. A small 12-volt transformer was fixed under the back shelf (Fig. 5), and the components for the smoothing and stabilization were mounted on a piece of matrix board and fixed to the shelf. The circuit is conventional and uses a 7805 with resistors to raise the supply to 8-9 volts (Fig. 7).

The paperwork supplied with the unit said that its operation might give rise to rf noise, so a small aluminum box was made to house the unit. This box conveniently sits on the plastic cover (Fig. 3).

The next stage was to remove the front panel. Quite an operation, as it was soon discovered that some of the fixing screws are underneath the foam lining and must be probed for. (See Fig. 5.) A hole is then cut to accommodate the LED display in the metalwork above the loudspeaker cut-out (see Fig. 6). When this hole has been cut (or, in my case, hacked), the surrounding area is painted with matte black paint. If at this point the front panel is replaced, it will be seen that

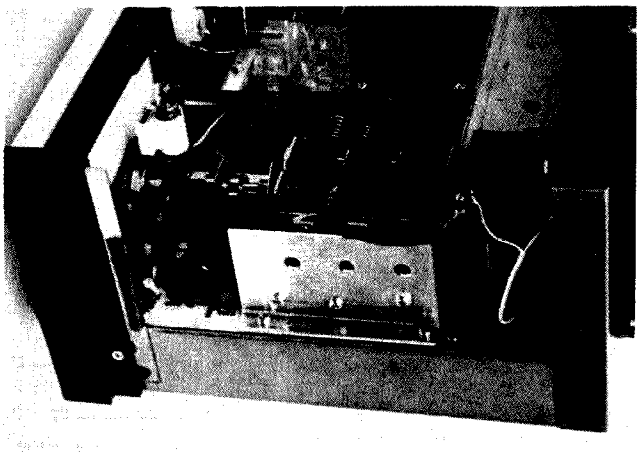

Fig. 5.

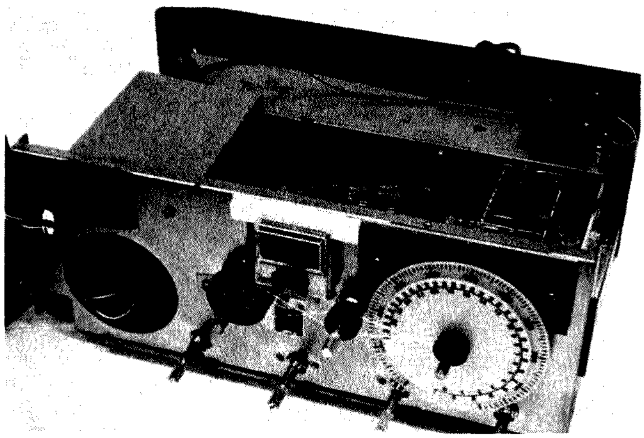

Fig. 6.

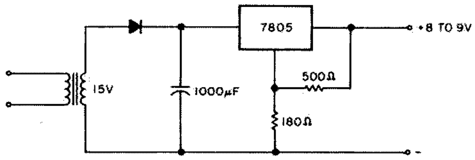

Fig. 7.

the digital display is now completely covered by the plastic strip bearing the legend, "SSR-1." Since this is obviously a handicap to efficient operation, the black paint and white lettering should be removed, using automobile cleaner to remove the paint without scratching the plastic. It is then a simple matter to mask the strip and re-spray the black, leaving an area of clear plastic in front of the display LEDs.

The finished result can be seen in Fig. 1. The display in no way spoils the appearance of the front panel; the clean lines of the original are still there.

Those, to date, are my mods to the SSR-1. There is room inside for more. Perhaps a micro-controlled CW decoder with VDU output via the phone socket. There also is room for an audio filter. The possibilities are endless. See what you can do—and I'd be interested to hear from you.■

References

1. "Review of the SSR-1," *73*, April, 1977.

2. "Build Your Own Digital Dial," W1OOP, *73*, July, 1978.

3. Digital display from B. Brookes Electronics, 69 Leicester Street, Norwich, Norfolk, G.B. Complete unit, but kits and boards may be available.

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Off to MARS with the S1

—mod is also useful for oddball repeater splits

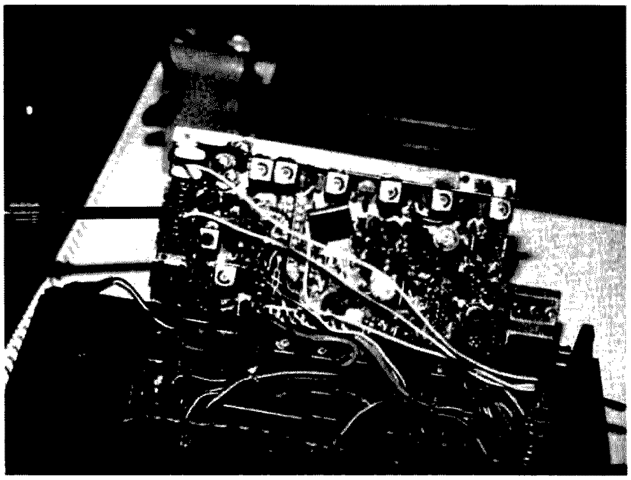
The Tempo S1 represents a great step for portability and flexibility in the two-meter band. For a traveler or someone who lives in an area like Los Angeles, it sure beats buying crystals.

One day, while playing with a Bird Wattmeter, I found out that the little rig put out 2.1 Watts from 140.00 to 149.99. Being active in Air Force MARS and getting tired of carrying a GE Portamobile everywhere, I thought about using the S1 on MARS. As it sat, I could use it simplex, but I also wanted to use the repeater. The S1 is fairly straightforward, so it didn't look too difficult. The rig has ±600 kHz already built in by using 10.1 and 11.3 MHz crystals to provide offset. I called Bonnie at Cal Crystal Labs (1142 N. Gilbert St., Anaheim CA 92801, (714)-991-1580) and ordered a crystal for the MARS split. She didn't know the formula, but said she would do her best to get it. Three weeks later, my crystal arrived and I was ready to dig into my S1. If you could live without your −600 kHz split, it would be a simple matter of putting the crystal in the place of the 10.1 MHz rock. Not wanting to do that, I started looking for ways to have this extra split without losing any of the standard features.

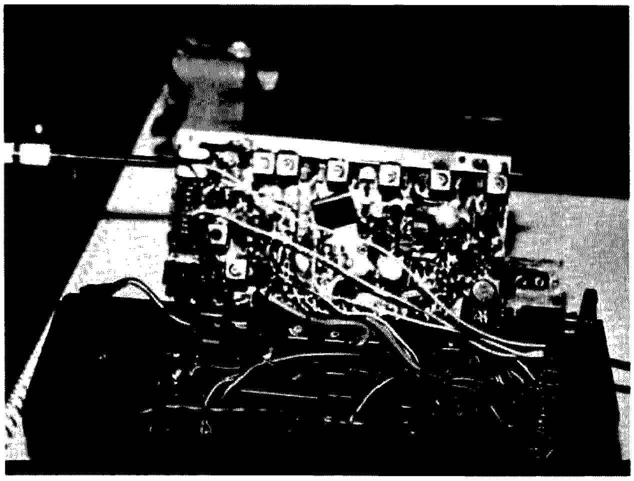
Taking the S1 apart is a simple matter of taking off four screws and pulling the battery plug and board-interconnection plug. Once inside, I saw that Tempo had thoughtfully left plenty of room for their optional PL mods. I also decided that my extra offset switch would fit nicely where the seldom (if ever) used earphone jack is located.

I desoldered the earphone jack and bridged the normally-closed portion of the circuit to keep the speaker operating. I then placed a subminiature on-on switch in the hole left by the ear jack.

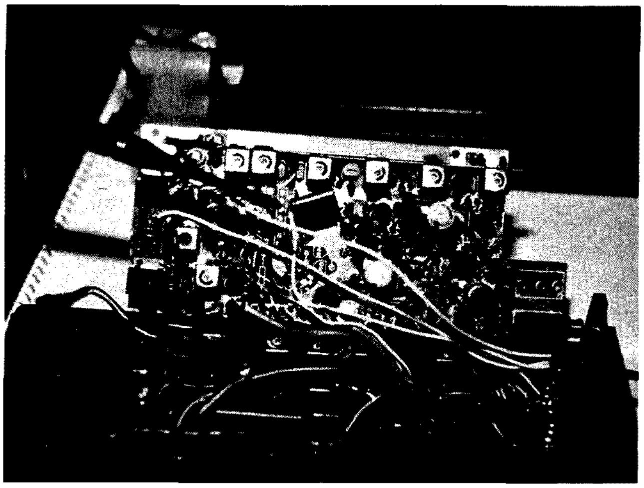
Next, I removed the wire going from the offset switch to crystal E on the transmitter board. I ran a wire from the offset switch to the center pole on my new subminiature switch. I ran



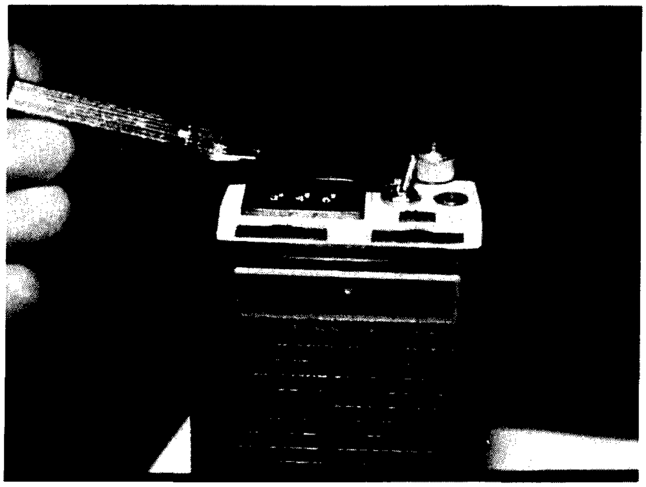
Wire from offset switch.



Wire from crystal E.



New crystal.



Completed product showing new switch.

another wire from the now vacant hole at crystal E to one pole on the new switch.

The final steps depend on how fancy you want to get. I simply ran my third wire from the switch to one side of the new crystal. I then tacked the other crystal lead to ground with solder to give it the proverbial "smoke test." It worked! My frequency counter lit up at 142.152, which was only 3 kHz from the desired 142.155. From that point, I simply started putting capacitors in series to ground with the crystal until the counter read the desired frequency. The first on-the-air test gave full-quieting results with good audio. Good-bye, Porta-mobile!

This mod would work well with oddball split repeaters so that you can have it all. There is actually enough room to put quite a few crystals inside the S1 if you so desire. I also tried the first change with shielded wires, but found them unnecessary. When dialing out of the amateur band, always go out on the high side and come back in on the low side. You will find little resistance and the wear on the BCD switch is minimal. I know that I enjoy my S1 more now that it's "gone to MARS." ■

Reader Service—see page 195

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Field-Strength Fever

—this simple meter eases antenna tuning

For many years I have used two field-strength meters, and they are still in use. I shall give credit to Jo Jennings W6EI (deceased), for he is the person who showed me the simple circuit. This little gadget is non-frequency selective. I have used it from 2 meters through 160 meters. The telescoping antenna may be adjusted to its shortest length when working with 2 meters to keep the needle on scale. I use this field-strength meter to adjust all my 2 meter Js, base-loaded 5/8 wavelengths, beams, etc.

The meter used should be a 100 microamp up to a 500 microamp movement. The diodes may be any germanium type, such as 1N34, etc. Silicon diodes will also work, but are a bit less sensitive. The diode leads may be left their normal length. The sloped meter box is ideal. The box does NOT have to be metal. ■

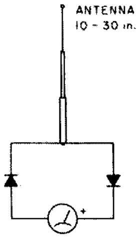

Fig. 1.

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CB to 10
—part XXIV: Penney's SSB rig

Want a 10-meter rig that is cheap, easy to use, and provides up to 1.7-MHz coverage? If so, read on and see how you can change a 40-channel SSB CB into a convenient mobile package for just a few bucks and an hour's time.

The J.C. Penney Model no. 6246 (catalog #981-8378) and the Sears Roadtalker 40 (934.38260700) are 40-channel AM/SSB transceivers using the same phase locked loop (PLL) circuitry. The J.C. Penney model has an excellent instruction manual which contains a good explanation of how PLL circuits work, as well as alignment instructions. By all means, try to obtain this manual if you don't already have it. The methods described for these sets can be applied to other Sears and J.C. Penney sets with similar circuits. You'll have to do some figuring, though, because of some circuit changes and a different schematic numbering system. The following conversion instructions include how to change the 40 AM/USB channels to ten meters, three ways to double the number of channels available, and two ways to change the fine-tuning control to swing the transmit frequency as well as the receive frequency.

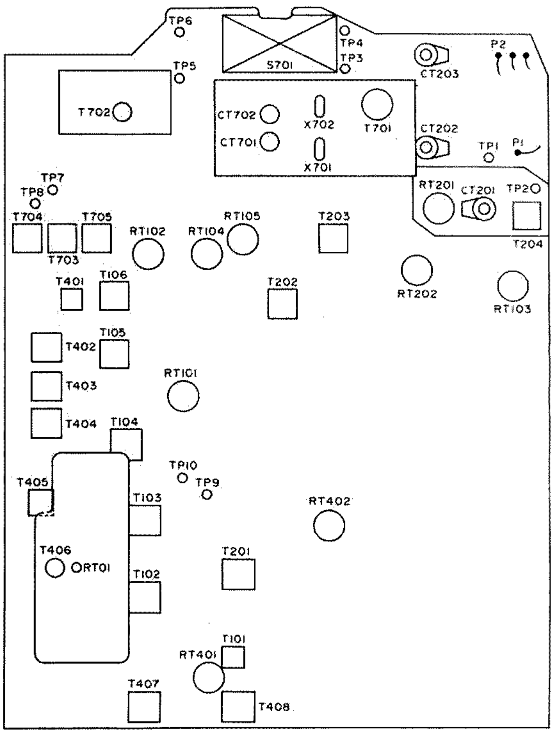

Fig. 1. Component location diagram.

How To Start the Conversion

Frequency Selection

1. Select the starting frequency for the portion of the band you wish to use. My selection was 28.510 MHz because I intended to work sideband and as much DX as possible.

2. Derive the new AM/USB local-oscillator crystal (X701) frequency. To the frequency you have chosen, add 11.275, subtract 1.28, and divide by 3. Example: $(28.510+11.275-1.28)/3=12.835$ MHz.

3. Replace X701. This crystal is located in a metal box behind the channel switch (see Fig. 1). It will be necessary to remove the three screws securing it to the main PCB and then to unsolder the sides of the box from the bottom of the box. This is no problem with the aid of a solder wick. Remove the local oscillator board from the can and replace X701 with the new crystal.

PLL Adjustments

1. Refer to Fig. 1 for component locations. A frequency counter and oscilloscope will make the job easier if problems develop, but if you don't have these instruments, don't worry. With the set tuned to channel 18, adjust T702 to obtain a dc voltage across TP5 and TP6 (ground) of 3.0 ±0.1V and proceed to *Transmitter Alignment* instructions, below.

2. If you want to be more scientific and check things as you go along, or if step one didn't work, get out your frequency counter and proceed with step three.

3. Check the frequency of the new crystal by measuring it between the top of trimmer CT702 and the crystal box. It should be about 12.835 MHz.

4. Check the frequency

from the output of the local-oscillator circuitry by unplugging from the board the white wire leading to the main printed circuit board. This is one of a pair, the other one being white with a stripe. This is the output from the tripler, and the frequency output at this point should be about 38.505 MHz. Plug the white wire back on the board terminal.

5. Connect an oscilloscope to TP3 and TP4 (ground) and adjust T701 for maximum amplitude.

6. Now, with the set tuned to channel 18, adjust T702 for a dc output of 3.0 ±0.1 V across TP5 and TP6 (ground).

7. Measure the frequency across the collector of Q708 and any of the metal shields on the foil side of the board. The frequency should be about 39.995 MHz for channel 18 if you used an X701 frequency of 12.835 MHz (X701 × 3 + 1.49). This completes PLL adjustments and checks.

Transmitter Alignment

1. Alignment of the transmitter section is accomplished by attaching an antenna to the rig (a 104" piece of wire), and, with the help of your HF SSB receiver tuned for about 28.720 MHz, keying the rig (AM, channel 18) and listening for a weak heterodyne whistle. Adjust T703 and T704 for maximum deflection of your HF receiver's S-meter. After this step, place a wattmeter and dummy load on the rig and key the set again. If no output is seen, go back to the wire antenna and adjust T401 and T402 for maximum S-meter reading, again using your HF SSB receiver to detect the peak output position. Once an output is seen on the wattmeter, final adjustment of T401-T408 can be made.

2. Turn RT402 fully counterclockwise. With

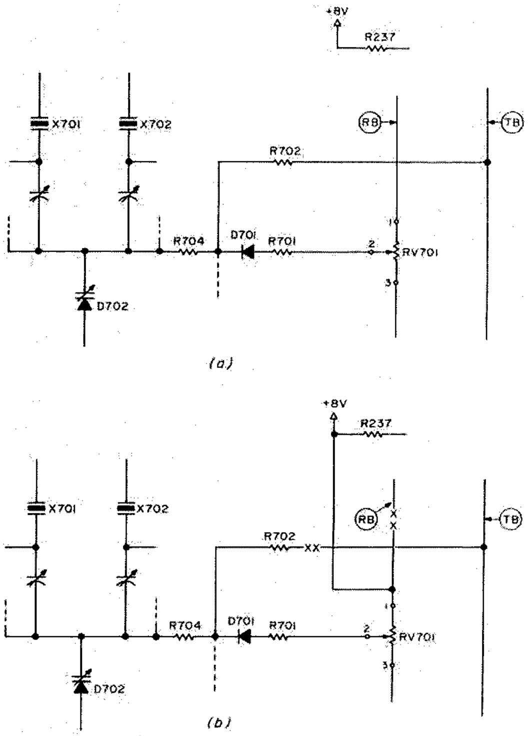

Fig. 2. Mod A—varactor circuit modification: (a) before modification; (b) after modification.

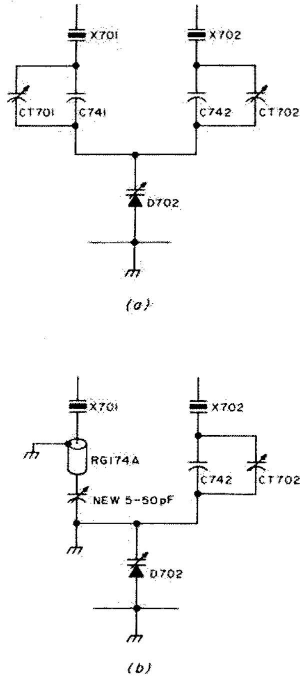

Fig. 3. Mod B—How to obtain a ±5-to-15-kHz swing: (a) before modification; (b) after modification.

the function switch in SSB-USB, hold your mike next to the sidetone of your keyer, use the marker tone from you HF receiver, or, if you're really well equipped, use an audio frequency generator and key the rig. Readjust T703, T704, and T401-T408 for maximum power output.

3. Check the set's output on each channel. On sideband, mine was about 7 Watts. If the output falls off to 0 Watts at either end, readjust T702 very slightly to lock the PLL.

Modifications to the Fine-Tuning Control

This rig has an RIT but is fixed on transmit. The RIT has a range of ±2 kHz. The Mod A changes, below, will enable the transmit frequency to also be shifted ±2 kHz. Mod B will give a swing of ±5 kHz to ±15 kHz.

Mod A—Varactor Circuit

Refer to Fig. 2. This CB rig is designed to provide a ±2-kHz swing on receive by varying the voltage across varactor D702 by means of potentiometer RV701. A +8-V dc potential is applied to RV701 (fine-tuning control) only during receive. During transmit, +8 V dc is applied to the varactor through a fixed resistance, R702. This modification simply supplies +8 V dc continuously to RV701, thus enabling it to function on transmit as well as receive.

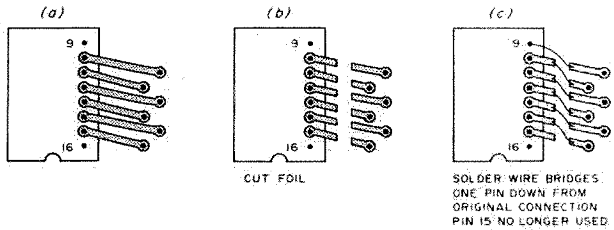

Fig. 4. Modifications to IC701 to obtain 20-kHz channel spacing.

1. Clip the wire originating from the local oscillator board which terminates at C752 and R702. Tape both ends.

2. Clip the wire from terminal 1 of the fine-tuning control near the socket which plugs into the main PCB. Tape the end going to the socket. Solder the other end to the foil side of the PCB to the R237 termination nearest the edge of the PCB. This is a +8-V dc source which is on during both transmit and receive.

Mod B—How to Obtain a ±5-to-15-kHz Swing

Refer to Fig. 3.

1. Remove C741, the 22-pF capacitor in parallel with CT701.

2. Run a 4" length of coax (RG-174/A) from where C741 was connected (center lead to hole nearest crystal) through a hole in the side of the oscillator can. Solder the shield to

the inside of the can.

3. Clip the wire described in Mod A, step 1, and tape both ends.

4. Clip the wire as in Mod A, step 2, except tape *both* ends.

5. Remove the fine-tuning pot from the front panel. *Be careful*—the channel indicator dial is attached to the shaft with a screw. Place tape over the contacts and stick it out of the way inside the set, or clip all wires and use the potentiometer for another project.

6. Install a 5-50-pF (nominal) variable capacitor where the RV701 control was located. Connect the inner coax lead to the insulated section of the capacitor. The shield is *not* connected to the capacitor.

7. Adjust CT701 so that the swing obtained with the panel-mounted capacitor is about ±5 kHz. To obtain a greater degree of swing, remove CT701 from the board. This will yield a swing of about ±8 kHz. The amount of swing obtainable is now controlled by the capacitance of the RG-174/A cable. Removing the shield from the cable from the end nearest the variable capacitor will increase the swing up to a maximum of ±15 kHz.

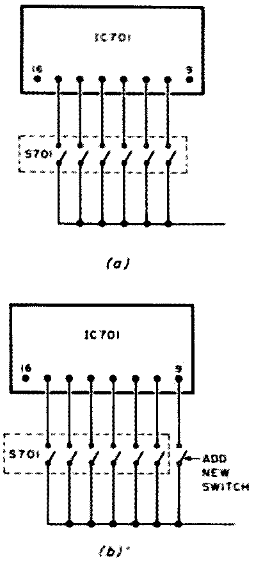

Fig. 5. 640-kHz jump modification: (a) before; (b) after.

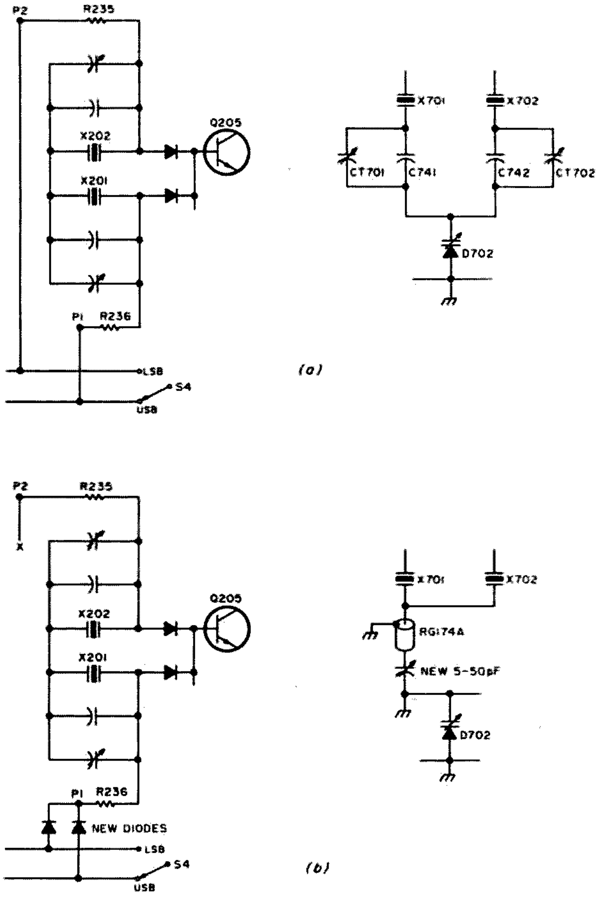

Fig. 6. LSB oscillator crystal modification for 40 more: (a) before; (b) after.

How To Increase the Number of Channels/Bandwidth

Below are three ways to increase the bandwidth of your transceiver. One involves using the LSB section and the other two make use of unused pin 9 of IC701. (Be careful, that's a $40.00 chip.)

Method A

This modification changes the channel spacing from 10 kHz to 20 kHz, thus almost doubling the bandwidth available. My rig covers 28.500 to 29.400 MHz.

1. Cut foil as shown in Fig. 4(a) and (b). This is done easily with a Dremel tool. Sand the varnish from the foil and solder wire bridges, as shown in Fig. 4(c).

2. Perform the Mod B swing, using the instructions to obtain a swing of ±12 kHz. This will provide enough swing to cover the gaps between most of the channels.

Method B

Pin 9 of IC701 can also be used to jump each channel 0.640 MHz up from its original frequency, so that 28.510 MHz becomes 29.150 MHz when this pin is activated. If the rig will tune 28.510-28.950 with pin 9 switched off, it will tune 29.150-29.550 MHz with the pin switched on.

Refer to Fig. 5.

1. Run a wire from unused pin 9 of the programmable divider to a front-panel-mounted switch. (Suggestion: Remove wires from the ANL switch, solder them together, and use the ANL switch.)

2. Run another wire from the switch to the common leg of the channel selector switch. Try the foil side of the board where R722 is attached nearest to the channel switch. With this switch in the on position, each channel will be 640 kHz higher in frequency than it was originally.

Note on the Programmable Frequency Divider: Pins 9-15 on IC701 are the inputs to this device. Energizing pin 15 adds 10 kHz to the base frequency. Pin 14 adds 20 kHz, pin 13—40 kHz, pin 12—80 kHz, pin 11—160 kHz, pin 10—320 kHz, and pin 9—640 kHz. Thus, if channel 1 is 28.505 MHz, energizing pins 15 and 11 will yield a frequency of 28.505 + .010 + .160 = 28.675 MHz. Some hams have replaced the channel switch with seven small switches and "program in" the desired frequency. This IC701 chip is available from New-Tone Electronics International, PO Box 1738, Bloomfield NJ 07003, for under $10. Sylvania's ECG 1255 does not work, and the IC from Sears of J.C. Penney listed for around $40 when I checked.

Method C

Change the LSB local-oscillator crystal for 40 more. Refer to Fig. 6.

1. Select the portion of the band you wish to cover. Using the lowest frequency, calculate the LSB crystal frequency by using the formula in step 2 of the conversion instructions. Example: Additional bandwidth desired, 28.960-29.400 MHz. (28.960 + 11.275 − 1.28)/3 = 12.985 MHz.

2. Install the new crystal in place of X702.

3. Cut the red/black wire attached to P2 near the plug end.

4. Cut the wire to P1 about ¾" from the plug.

5. Remove C742 and CT702, and tie both crystals into the fine-tuning

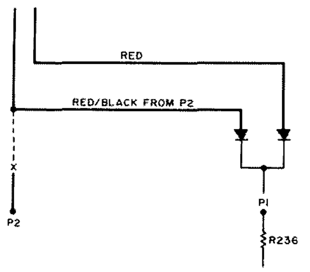

Fig. 7. Adding diodes for conversion of LSB to USB.

capacitor with a short jumper from the crystal side of where CT702 was to the coax going to the air-variable capacitor.

6. Place diodes in series with the wires and reconnect both diodes as shown in Fig. 7.

This modification should give you 1.7 MHz coverage of the band, assuming all the stages are broad enough.

Receiver Alignment

1. Adjust T705, T101, T201, and T102-T106 so that the output is maximum on channel 20 with the set on a convenient AM signal.

2. With the set on channel 20 and a convenient SSB station or signal, adjust T201, T202, and T203 for maximum output.

Conclusion

On-the-air tests from the car have been great. Almost any station heard can be worked if the "biggies" don't pile on. Mobile contacts into Europe are routine from this QTH, and with the rig hooked to the tribander at the house, Asia and Australia are no problem. Signal reports generally run 5 by 5 to 5 by 8, which is solid copy on 10 meters. The receiver is decent and is well balanced with the transmitter's abilities. All in all, the rig is easy to convert and performs very well. ■

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Build an Audio VOM

—and keep your eyes where they belong

There are many cases where one desires simply to check a circuit or device for continuity, contact, or the presence of voltage, without needing any quantitative measurements. Also, there are times when it is not easy to eyeball a meter while making these checks. If you have ever tried tracing down a wire or checking out a switch in your automobile electrical system, you know what I mean.

The simple circuit described here will produce an audio output in proportion to the level of voltage (ac or dc) and will check continuity.

This unit will detect ac or dc voltage to at least 300 volts and down to as low as approximately 6 volts. It will distinguish between ac and dc, with the audio from ac sounding a bit raspy and the dc producing a more pure note. Checking for dc voltage is further simplified by not having to worry about the polarity of the test leads. The sound intensity is proportional to the level of voltage applied.

The lower limit of voltage detection depends on the value of R1, the sensitivity of the device, and your ears. With the circuit shown, I have no problem "hearing" as little as six volts. In the Ohms position, the circuit will detect resistance from a short up to approximately 40k Ohms or more, with a fresh 9-V transistor radio battery. Shorting the test leads together produces the loudest signal in the Ohms mode.

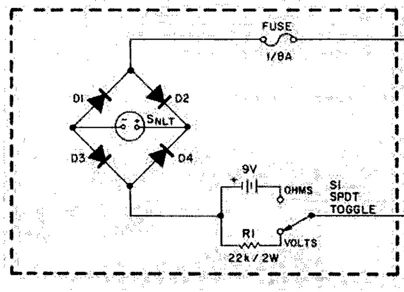

Fig. 1. Simple audio volt-Ohm detector. S_{NLT}—Mallory SC628 Sonalert.® D_1 through D_4—1N5061 or equivalent. (Any general-purpose diode or package bridge rectifier with a piv rating of 500 V or more should work.)

The circuit is quite basic, consisting of a full-wave bridge rectifier with a Mallory Sonalert® transducer connected to the dc terminals, observing polarity, of course. The model SC628 Sonalert has a range of 6-28 V dc using only 3 to 14 mA of current, so the device is fairly sensitive. With the series resistor, R1, or the battery as shown in the circuit, the range of input voltage, or resistance that produces a sound output, will surprise you. Switch S1 selects either an internal 9-V battery for Ohms or series resistor R1 for voltage.

The value of the resistor was determined experimentally to permit a range of voltage to be checked that would most likely be encountered by the average person, and limit the voltage drop across the device to a safe level. At 300 volts, the Sonalert has about 20 volts across it which is still within its range. Finally, a 1/8-Amp fuse is included in series with one of the leads, in case someone goofs and tries to hear voltage with the switch in the Ohms position.

The unit was built to fit into a small plastic instrument case, with the test leads brought out directly to alligator clips for maximum convenience and economy. Just about any small box or enclosure that will hold the parts should work nicely, however.

One word of caution when using this tester—which holds true for any VOM. Always make sure the circuit is de-energized before checking resistance or continuity either by disconnecting all sources of voltage and/or checking for no voltage first. Always return the instrument to the voltage position after using the Ohms position, and you should never have to replace the fuse inside. Also, it is not recommended for voltages in excess of 300.

You will find this little unit as handy as a button on a shirt, for checking for blown fuses, panel lamps, tracing wires, connections, relay coils and contacts, switches and so on. It will check diodes for short or open condition and transformers and coils for continuity; there is a host of other applications too numerous to list here. After using the unit a few times, you will find yourself wondering how you ever got along without it. ■

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Sound-Sensitive CW Sender

—for hands-free Morse

A few years ago I had a slight stroke, and since then have sent the most improbable Morse code ever heard on the bands. It sounds as though I were sending with my left foot. I'm not exactly a serious CW operator, but occasionally I like to keep in practice.

An idea occurred to me which I have never seen in 40 years of perusing ham magazines. How many times have you heard some slaphappy ham *dah-dit-dah-dit-dah-dah-dit-dah*-ing away and copied it with ease? Why not put this to practical use for anyone who can't send with his hands?

I passed this idea along to Ed Jados WA2TYA, who put the wheels in motion, did all the brain work, and a week later had made a rough version of a keyer which would key my rig and follow perfectly my audible *dah-dits*.

The only critical adjustment is the volume control, so that the keyer won't pull in with breathing or extraneous noise, but will prove to key solidly with voice tones. Naturally, talking close to the mike is essential.

Any inexpensive mike is coupled into a 741 IC. The amplified audio is then fed to a bridge rectifier. The resulting dc voltage, which must not be over-filtered so that time lag won't be too long to follow the dots at 20 wpm or so, is then fed to a pair of NPN transistors. Any low-cost transistors such as 2N2222s will work perfectly to pull in a reed relay that will nicely key my Drake TR-4 transceiver.

This first, rough version was completely open and unshielded and would not work with my linear turned on, as it would remain on from rf pick-up as soon as it was once keyed. If you intend to make this keyer, therefore, you had better plan on putting it in a metal box, unless you intend to run very low power.

The only real problem I have is a domestic one with the XYL. She is firmly convinced that I'm a likely candidate for the booby hatch when I'm in the shack sending code.

A week later, in came Ed with the finished product looking like a commercially-manufactured item. It is enclosed in a Radio Shack box 2 x 3¼ x 4 inches deep (5 x 8.1 x 10.5 cm).

The power supply, a simple 12-volt supply, was built in, but just as well could be an external CB power supply or two 6-volt lantern batteries in series. It is not seen in Fig. 2, the schematic of the completed keyer.

With this final product, there is no problem keying a full kilowatt rig as there was with the unshielded version.

We have been hearing a great deal lately about CW for the handicapped. I hope this will be the answer for a good many, as it has been for me. ■

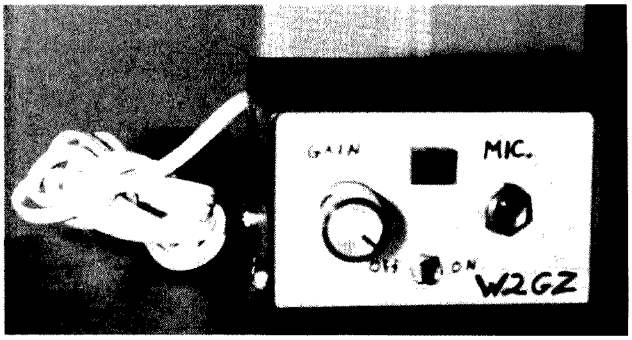


Fig. 1.

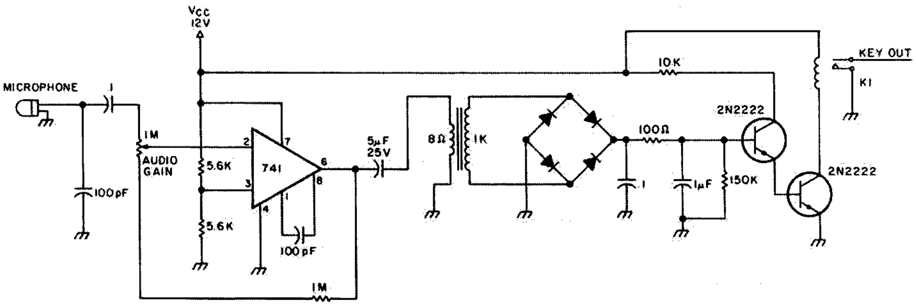


Fig. 2.

Paul B. Littlejohn WA5WPQ
6211 Dunn Avenue
San Jose CA 95123

A Tightwad's FSK Demodulator

—using the 567 PLL

FSK demodulation can be accomplished easily and inexpensively using the 567 tone decoder chip. The applications described in this article were developed for use with a CRT terminal requiring TTL-compatible signals. Only a few external components are required in setting the center lock frequency, bandwidth, and output delay.

The design philosophy of the demodulator establishes a reliable circuit utilizing only the MARK tones. The concept of demodulation provides input conditioning such that all signals except the MARK frequencies are rejected. We can, therefore, assume that the absences of MARK tones constitute SPACE tones. Several advantages in this approach, as compared with circuits demodulating both MARK and SPACE tones, make this circuit appealing to both the beginner and experienced RTTYer.

One advantage is a component (as well as cost) reduction of more than 50 percent. Another is that constraints are reduced since high Q circuits with narrow passbands centered around the MARK frequency are employed. There is no longer a requirement for a wide front-end bandpass filter since the SPACE tones are not decoded. This also permits narrow-shift as well as wide-shift signals to be demodulated without any adjustments. Additionally, the MARK-SPACE summation circuitry has been eliminated. The output of the demodulator can be coupled directly into computers, video boards, or to almost any keyer circuit to drive Teletype® machines.

Functional Description

Refer to Fig. 1 for the basic block diagram. A two-section, two-pole bandpass active filter precedes the tone decoder. This filter conditions the audio input to the decoder, providing 20 dB of gain with a shape factor of 20 dB per decade. With a 100-mV input signal to the filter, the tone decoder would see approximately 1 V, well above the threshold of the tone decoder. The SPACE tone should be at least 6-dB down from the MARK tone providing greater SPACE rejection and improved signal-to-noise ratio. The Q of the filter is 21, establishing an approximate bandwidth of 100 Hertz.

The output of the active filter drives the tone decoder. The decoder is actually a PLL (phase locked loop) which consists of a quadrature phase detector, low-pass filter, and voltage-controlled oscillator. The vco establishes the reference frequency. When the input signal changes phase (frequency) with respect to the vco reference, the phase detector produces an "error" voltage. This error voltage is proportional to the phase difference of the input and reference signals. The error voltage is used to control the vco frequency, thereby preserving the locked condition.

Circuit Description

The FSK demodulator circuit is shown in Fig. 2. U2A, U2B, and associated components comprise the four-pole active filter. Good quality components such as metal film resistors and mica capacitors should be used in the filter circuit to guarantee an adequate shape factor centered around the MARK frequency. The operational amplifier provides maximum amplification around 2.1 kHz providing best signal-to-noise ratio of MARK tones. Audio from the receiver speaker is injected into the filter input through

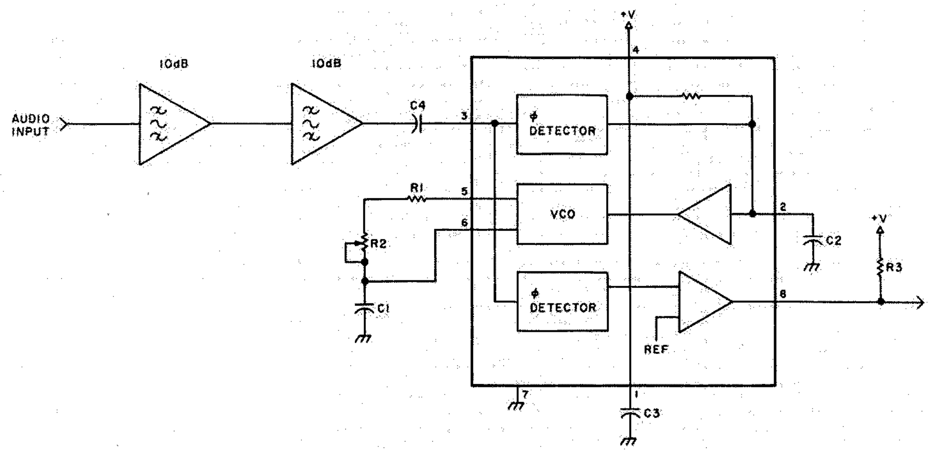


Fig. 1. Block diagram.

R4 and C6, amplified, and capacitively coupled through C4 to pin 3 of the tone decoder. Amplitude distortion due to overdriving the filter is unimportant since the tone decoder is frequency-sensitive only.

The free-running frequency of the vco is established by R1, R2, and C1. R2 should be a multi-turn pot to provide adequate resolution for setting the lock frequency. The bandwidth is set by the lowpass filter capacitor, C2. With the values shown, the passband is approximately 400 Hertz. The output of the tone decoder is open-collector and pulled up to 5 V through R3. When the audio at pin 3 from the filter falls within the passband of the decoder, the output goes low, indicating that a MARK has been decoded.

The speed of operation may be improved by decreasing the value of C3. However, it was found that the output tends to chatter if the value of C3 is lower than 0.8 uF. This is due to high-frequency components causing excessive ringing, thereby driving the output stage through its threshold several times. On the other hand, if C3 is too large in value, the charge time increases making the vco unable to lock fast enough.

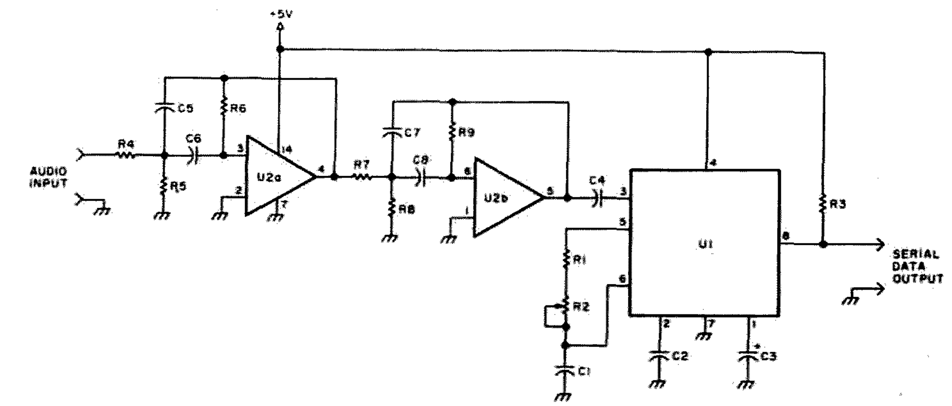


Fig. 2. Schematic diagram.

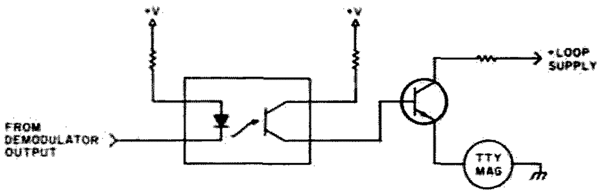


Fig. 3. Typical keyer circuit.

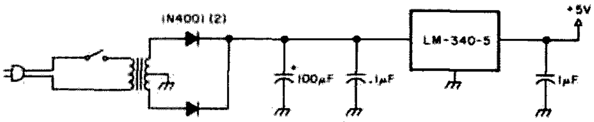


Fig. 4. Regulated power supply.

Alignment Procedure

With the values shown in Fig. 2, the lock frequency should be in the range of 1 kHz to 3 kHz. Probably anywhere in this range should work quite well if used with vfo-operated receivers. However, for best SPACE rejection, and especially if the circuit is to be used without vfo-controlled receivers (2-meter FM), then it becomes necessary to effect alignment as follows:

1) Inject a test-tone of 2125 Hertz at a level of 100 mV p-p to the filter input.

2) Connect oscilloscope at U1 pin 3 and verify the test tone to be approximately 1-V p-p.

3) Connect oscilloscope to U1 pin 8 and verify a TTL low. If the output is not low, adjust R2 until pin 8 goes low.

4) Change the test-tone frequency to 2200 Hertz. Adjust R2 slightly until the output of the 567 changes from one state to another. This establishes the vco unlock frequency.

5) Change the test-tone frequency to 2295 Hertz and verify the output of the 567 to be a TTL high.

Summary

The demodulator circuit in Fig. 2 has been successfully used to decode FSK data on 80, 40, 20, and 2 meters. The active input filter provides substantial interference rejection, improving the signal-to-noise ratio as well as increasing the lock sensitivity by 20 dB. Since only MARK decoding circuitry is utilized, an increase in tracking bandwidths is achieved providing easier tuning with vfo receivers. Moreover, this technique enables narrow-shift and wide-shift demodulation without additional tuning or adjustments.

The output of the demodulator is TTL-compatible and can be directly interfaced to most computer systems through an RS-232 serial I/O port. Interfacing with mechanical teletype machines may be accomplished with an external keyer circuit. A typical keyer circuit using an optical isolator is shown in Fig. 3. When the output of the demodulator goes low indicating a MARK, the input diode becomes forward biased. As this happens, the output transistor in the isolator turns on causing the switch transistor in the teletype loop to turn on. The optical isolator is used to provide ac as well as dc isolation from the loop supply and the demodulate supply. Current spikes induced into the low-voltage supply from the TTY could cause damage to the demodulator.

A suggested power supply is shown in Fig. 4. The IC regulator provides excellent regulation and will source up to 1 A if an adequate heat sink is used. The demodulator requires only a fraction of the regulator's capability, but its low cost and ruggedness make it an attractive device. These regulators may be purchased for under a dollar and will enable additional loads other than the demodulator. ■

Parts List

U1	NE567
U2	LM3900
R1	3.9k, ¼ Watt
R2	5k pot
R3	5k, ¼ Watt
R4, R7	16k, ¼ Watt
R5, R8	178, ¼ Watt
R6, R9	320k, ¼ Watt
C1, C4	.1 uF mica
C2	.047 uF mica
C3	1 uF tantalum
C5-C8	.01 uF mica

Measure Frequency on your DVM

— this 3-chip circuit works to 10 kHz

Howard M. Berlin W3HB
519 Dougfield Road
Newark DE 19713

The type 4151 integrated circuit, manufactured by Raytheon, can be wired as a frequency-to-voltage (F/V) converter enabling a digital voltmeter to measure frequencies from 10 Hz to 10 kHz.

The circuit shown used op amp U1 as a non-inverting comparator[1] which acts as a square wave converter for any periodic input waveform. The comparator's output is limited at 5.1 volts by the zener diode. The 50k Ω pot serves as a dc threshold adjustment to compensate for those inputs that have a periodic waveform superimposed on a dc level.

Maximum Scale Voltage	Maximum Frequency	Resolution
200 mV	200 Hz	± 0.1 Hz
2 V	2 kHz	± 1 Hz
20 V	10 kHz	± 10 Hz

Table 1.

The square wave output then feeds U2, wired as a F/V converter, followed by an op amp integrator, U3.[2] The integrator is used to increase the circuit's response, linearity, and accuracy, while at the same time minimizing the amount of output ripple.

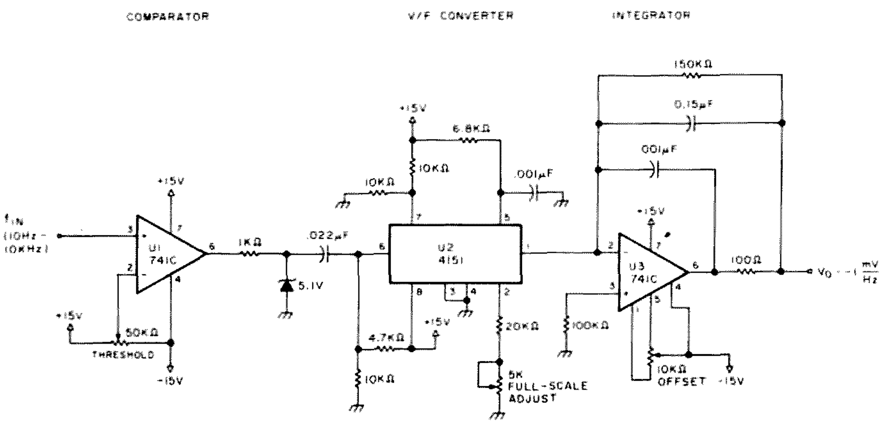


Fig. 1.

The 10k Ω "offset" pot is first adjusted to give a −10-mV output with a 10-Hz input signal. The 5k Ω "full-scale" pot is then adjusted to give a −10.0-V reading with a 10-kHz input. Consequently, the conversion gain for the entire circuit is −1 mV/Hz.

This circuit will work satisfactorily with peak input voltages ranging from 0.3 to 13 volts over the 10-Hz to 10-kHz frequency range. In actual operation, I used a 3½ digit voltmeter connected to the output of the integrator. Consequently, the resolution of the measurement depends on the voltmeter's scale, as shown in Table 1.

When the circuit is properly adjusted, the displayed reading was found to be accurate to within 0.5% at 10 kHz. ■

Footnotes

1. Berlin, Howard M., *The Design of Operational Amplifier Circuits, with Experiments*, E&L Instruments, Inc., 1977.
2. 4151 data sheet, Raytheon Semiconductor Division, 1976.

Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

ROCHESTER MN
APR 12

The Rochester Amateur Radio Club and the Rochester Repeater Society will sponsor the Rochester Area Hamfest on Saturday, April 12, 1980, at St. John's School gymnasium, 490 W. Center St., Rochester MN. Doors will open at 8:30 am. There will be a large indoor flea market for radio and electronic items, prize raffles, refreshments, and plenty of free parking. Talk-in on 146.22/.82 (WRØAFT). For further information, contact RARC, WBØYEE, 2253 Nordic Ct. N.W., Rochester MN 55901.

WELLESLEY MA
APR 12

The Wellesley Amateur Radio Society will hold its annual auction on Saturday, April 12, 1980, beginning at 11:00 am at the Wellesley High School cafeteria on Rice Street, Wellesley MA. Talk-in on .63/.03, .04/.64, and .52. Doors open at 10:00 am. For further information, contact Kevin P. Kelly WA1YHV, 7 Lawnwood Place, Charlestown MA 02129.

ST. CLAIR SHORES MI
APR 13

The South Eastern Michigan Amateur Radio Association will hold its 22nd annual hamfest on April 13, 1980, from 8:00 am to 3:00 pm at South Lake High School, 21900 E. Nine Mile Road (at Mack Ave.), St. Clair Shores, Michigan.

LANGHORNE PA
APR 13

The Penn Wireless Association, Inc., will hold its Tradefest '80 on Sunday, April 13, 1980 at the National Guard Armory, Southampton Rd. and Roosevelt Blvd. (Rte. 1), a half-mile south of Pennsylvania Turnpike Exit 28. Sellers space, 6' x 8', is $5; bring your own tables. There are a limited number of power connections ($3). General admission is $3. There will be prizes, refreshments, a rest area, displays, and surprises. Talk-in on 146.715 and .52. For further information, contact Robert L. Daut, Jr. WB3KRV, PO Box 734, Langhorne PA 19047.

MADISON WI
APR 13

The Madison Area Repeater Association, Inc. (MARA), is pleased to announce its eighth annual Madison Swapfest which will be held on Sunday, April 13, 1980, at the Dane County Exposition Center Forum Building in Madison WI. Doors will be open at 8:00 am for sellers and exhibitors and at 9:00 am for the public. Commercial exhibitors and flea-market vendors will provide a large variety of equipment and components for hams, computer hobbyists, and experimenters. Door prizes will be awarded. An all-you-can-eat pancake breakfast and a barbecue lunch will be available, as well as free movies throughout the day. Admission is $2.50 per person in advance and $3.00 at the door. Children twelve and under are admitted free. Tables are $4.00 each in advance and $5.00 at the door. Be sure to reserve tables early as tables were sold out last year. Talk-in on WR9ABT, 146.16/.76. For reservations, write to MARA, PO Box 3403, Madison WI 53704. For further information, contact Dick Victor WD9GRI, 2314 Rowley Avenue, Madison WI 53705; phone (608)-266-3527 (days) or (608)-238-0153 (evenings and weekends).

AMBOY IL
APR 13

The Rock River Radio Club will hold its 14th annual hamfest on Sunday, April 13, 1980, at the Lee County 4H Center in Amboy IL, one mile east of the junction of routes 52 and 30, south of Dixon IL. There will be free coffee and donuts from 8:00 am to 8:30 am. Camping and tables are available at a nominal charge, as well as breakfasts and dinners. Advance tickets are $1.50; gate tickets are $2.00. Talk-in on 146.52 simplex or 146.37/.97 repeater. For more details, contact Chas. W. Randall W9LDU, 1414 Ann Avenue, Dixon IL 61021.

GRIFFITH IN
APR 19

The Lake County Amateur Radio Club will hold its 27th annual Herbert S. Brier Memorial Banquet on April 19, 1980, starting at 6:00 pm at the Griffith Knights of Columbus Hall, 1400 S. Broad Street, Griffith IN. The evening will feature a famous surprise guest speaker, door prizes, awards, and lots of good food. Tickets are $10 each. There will be no tickets sold at the door. For tickets, contact LCARC, PO Box 1909, Gary IN 46409.

LITTLE ROCK AR
APR 19-20

The Central Arkansas Radio Emergency Net amateur radio club of Little Rock will hold its annual hamfest on Saturday and Sunday, April 19-20, 1980, at the North Little Rock Community Center on Pershing Blvd., Little Rock AR. Activities include a covered flea market, air-conditioned dealer area, forum rooms, a cafeteria, and a Saturday night banquet. Harry Dannals W2HD will be guest speaker. There will be several door prizes along with a main prize. Talk-in on .34/.94. For information, contact Dale Temple W5RXU, 1620 Tarrytown, Little Rock AR 72207, (501)-225-5868.

KANSAS CITY MO
APR 19-20

The PHD Amateur Radio Association, Inc., will hold its eleventh annual Northwest Missouri Hamfest and Missouri State ARRL Convention on Saturday and Sunday, April 19-20, 1980, at the Kansas City Trade Mart, from 10:00 am to 5:30 pm, in Kansas City MO. The 1980 directory of all amateurs in the 20-county metropolitan Kansas City, Missouri/Kansas area will be on sale at the hamfest. For further information, contact L. Charles Miller WAØKUH, 7000 Northeast 120th Street, Kansas City MO 64166, (816)-781-7313, or Thomas L. Bishop KØTLM, 4936 North Kansas, Kansas City MO 64119, (913)-342-4939.

ALL BAND TRAP ANTENNAS!

RALEIGH NC
APR 20

The Raleigh Amateur Radio Society is sponsoring its eighth annual hamfest on Sunday, April 20, 1980, at the Crabtree Valley Mall, US 70 west, Raleigh NC. Activities begin at 9:00 am. General admission is $3.00. There will be many prizes, including a first-prize choice of a TS-120S and power supply or a TS-700SP. Second prize is a tri-band beam; third prize is a heavy-duty CDR rotator. The drawings will be held all day Sunday. A covered flea market will also be featured. There will be a hospitality room on Saturday evening. Talk-in on 146.04/146.64 and 146.28/146.88. For additional information or reservations, write to RARS Hamfest, PO Box 17124, Raleigh NC 27619.

IRVINGTON NJ
APR 20

The Irvington Radio Amateur Club will hold its annual hamfest on Sunday, April 20, 1980, from 9:00 am to 4:00 pm at the P.A.L. Building, 285 Union Avenue, Irvington NJ. Take the Garden State Parkway to exit 143 north or 143B south. Admission is $1.00; tables are $3.00. Refreshments will be available. Talk-in on .34/.94 and .52. For information, call Pete WB2FAS, (201)-763-8220, or write IRAC, PO Box 894, Union NJ 07083.

LINDEN PA
APR 20

The 16th annual Penn Central Hamfest will be held on Sunday, April 20, 1980, at the Woodward Township Fire Hall (Route 220, north of Williamsport PA), Linden PA, from 11:00 am to 5:00 pm. Talk-in on 146.52 and 146.13/.73. For more information, write Kathy Wehr, R.D. #1, Watsontown PA 17777, or phone KA3CXB at (717)-323-7311.

TRENTON NJ
APR 20

The Delaware Valley Radio Association, W2ZQ, assisted by the Lawrenceville Amateur Repeater Group, will hold their annual flea market on Sunday, April 20, 1980, from 8:00 am to 4:00 pm, at the New Jersey National Guard 112th Field Artillery Armory, Eggerts Crossing Road, in Lawrence Township, Trenton, New Jersey. Advance registration is $2.00, or $2.50 at the gate. There will be an adequate indoor and outdoor flea market area. Sellers are asked to provide their own tables. Door prizes, raffles, refreshments, and FCC examinations will be provided. Talk-in on 146.52, 146.07/67, and 147.84/24. For further information and reservations, write DVRA, PO Box 7024, West Trenton NJ 08628.

DAYTON OH
APR 25

The 11th annual FM B*A*S*H will be held on Friday night of the Dayton Hamvention, April 25, 1980, at the convention center, Main and Fifth Streets, Dayton OH. Parking is available in adjacent city garage. Admission is free to all. Sandwiches, snacks, and a COD bar will be available. Live entertainment will be provided. Awards include a new synthesized HT. For further information, contact the Miami Valley FM Association, PO Box 263, Dayton OH 45401.

WORCESTER MA
APR 25

The Central Massachusetts Amateur Radio Association will hold its ham radio auction and flea market on April 25, 1980, at the Main South American Legion Post 341, Main Street at Webster Square, next to Atamian Motors, Worcester MA. The doors open at 6:00 pm, with the auction beginning at 7:30 pm. At the auction, 15% of the profits will go to CMARA. The flea market tables are $5.00 (items $5.00 and less only). Refreshments and door prizes will be available. Talk-in on .37/.97 and .52/.52. For more information, contact Rene Brodeur WA1LEA, (617)-753-7480, or Dave Penttila K1COW, (617)-885-4995.

DAYTON OH
APR 25-27

The Dayton Amateur Radio Association, Inc., will hold its Hamvention on April 25-27, 1980, at the Hara Arena and Exhibition Center, Dayton OH. Admission is $5.00 in advance; $6.00 at the door. Flea-market space is $11.00 in advance; $14.00 at the gate. The Saturday evening banquet will be $12.00 in advance; $14.00 at the door. Senator Barry M. Goldwater K7UGA will be the banquet speaker. For additional information, write Box 44, Dayton OH 45401, or phone (513)-296-1165 5:00-10:00 pm EST. For special motel rates and reservations, write to Hamvention Housing, 1980 Winters Tower, Dayton OH 45423. There will be no reservations accepted by telephone. Make checks payable to: Dayton Hamvention, Box 333, Dayton OH 45405.

AGUADILLA PR
APR 26-27

The Puerto Rico Amateur Radio Club will hold its 1980 convention and hamfest on Saturday and Sunday, April 26-27, 1980, at the Montemar Inn, Aguadilla, Puerto Rico. For additional information and reservations, write to the Radio Club de Puerto Rico, GPO Box 693, San Juan PR 00936.

NEWINGTON CT
APR 27

The Pioneer Valley Repeater Association will hold its third annual flea market on Sunday, April 27, 1980, from 10:00 am to 5:00 pm at Newington High School, Newington CT. General admission is $1.00; table rental is $7.50 each, including admission. Chairs and electricity will be provided. There will be a flea market, planned family activities, dealer displays and sales, door prizes, and free parking. Refreshments will be available. For more details, contact Arnie DePascale K1NFE, Post Office Drawer M, Plainville CT 06062, or Evangelo Demetriou, 38 Volpe Court, New Britain CT 06053.

NEENAH WI
MAY 3

The 3-F Amateur Radio Club will hold its swapfest on Saturday, May 3, 1980, at the Neenah Labor Temple, 157 South Green Bay Road, Neenah WI. Admission is $1.50 in advance for tickets and $1.50 for tables. Admission at the door will be $2.00 for tickets and $2.00 for tables. Facilities include a large parking area, and large indoor and outdoor swap area, with a free auction provided at the conclusion of the day. Food and beverages will be available. For further information, write Mark Michel W9OP, 339 Naymut Street, Menasha WI 54952, or phone (414)-722-4034.

MEADVILLE PA
MAY 3

The sixth annual Northwestern Pennsylvania Hamfest will be held on May 3, 1980, at the Crawford County Fairgrounds, Meadville PA. The gates will open at 8:00 am. Admission is $3.00; children under 12 are free. Indoor table spaces are $5.00 and outside car spaces are $2.00. Bring your own tables. Refreshments will be available. Talk-in on .04/.64, .81/.21, and .63/.03. For information, write CARS, PO Box 653, Meadville PA 16335, Attention: Hamfest Committee.

WARMINSTER PA
MAY 4

The Warminster Amateur Radio Club will hold the sixth annual Ham-Mart on Sunday, May 4, 1980, from 9:00 am to 4:00 pm at the William Tennent Intermediate High School, Route 132 (Street) and Newtown Roads, Warminster PA. There will be door prizes, a flea market, an auction, and a free FM clinic. There will be food, drink, and tables available. Registration is $2.00 per person (children under 14 free), $3.00 per space for sellers, and $5.00 per space for one indoor table. Tickets for the Wilson HT drawing are additional. Talk-in on 146.52 simplex or 146.16/.76 on the PARA repeater. For more information, write WARC, PO Box 113, Warminster PA 18974, or call Pat Cawthorne W3DNI, (215)-672-5289.

FALL RIVER MA
MAY 4

The fourth annual Bristol County Amateur Radio Association flea market and radio auction will be held on Sunday, May 4, 1980, from 9:00 am until 5:00 pm at the Knights of Columbus Hall, Meridian Street, Fall River MA. Talk-in on 146.31/.91. For more information, write to Gerald P. DiChiara AA1Q, 35 Central Avenue, Assonet MA 02702.

STIRLING NJ
MAY 4

The Tri-County Radio Association will hold its annual indoor hamfest/flea market on May 4, 1980, at the Passaic Township Youth Center, Valley Road, Stirling NJ, from 9:00 am to 4:00 pm. Admission is $2.00 and tables are $5.00. Food will be served. There will be many door prizes. Talk-in on 147.855/.255 or 146.52. For information, write TCRA, Box 412, Scotch Plains NJ 07076, or phone Herb Klawunn at (201)-647-3461.

DE KALB IL
MAY 4

The Kishwaukee Radio Club

and the De Kalb County Amateur Repeater Club will hold their annual indoor/outdoor hamfest on Sunday, May 4, 1980, from 8:00 am to 3:00 pm at the Notre Dame School (3 miles south of De Kalb, between Highway 23 and South 1st Street on Gurler Road). Tickets are $1.50 In advance and $2.00 at the door. Indoor tables are available, but if you bring your own, the setup is free. Talk-in on 146.13/.73 and .94 simplex. For further information, send an SASE to Howard WA9TXW, PO Box 349, Sycamore IL 60178.

FRESNO CA
MAY 9-11

The Fresno Amateur Radio Club, Inc., will hold the 38th annual Fresno Hamfest on May 9-11, 1980, at the Hacienda Inn, Clinton and 99, Fresno CA. Full registration is $20.00 in advance; $23.00 at the door. Partial registration is $5.00. The ladies' program is $7.00. Advance registration closes May 2, 1980. There are many activities planned, including a prime rib banquet. Talk-in on 146.34/.94. For more information, write to Fresno Hamfest, PO Box 783, Fresno CA 93712.

SANTA BARBARA CA
MAY 9-11

The 25th annual West Coast VHF Conference will be held on May 9-11, 1980, at the Miramar Hotel, Santa Barbara CA. Highlights will include a hospitality room on Friday evening (May 9), technical sessions on Saturday (May 10), a program featuring key participants in the VHF-UHF propagation breakthroughs of 1979-80, noise-figure measurements on Saturday evening, antenna gain measurements on Sunday morning, plus technical exhibits, door prizes, and a drawing. Pre-registration is $4.00 per person until May 1, 1980, and registration at the door is $6.00. Registration forms, hotel information, and further details may be obtained by writing to Wayne Overbeck N6NB, Conference Coordinator, 5818 Woodlake Avenue, Woodland Hills CA 91367; (213)-347-3456 (home) or (213)-446-4311 (office).

DEERFIELD NH
MAY 10

The Hosstraders Net will hold its 7th annual tailgate swapfest on Saturday, May 10, 1980, at the Deerfield Fairgrounds, Deerfield NH. There will be covered buildings, in case of rain. Admission is $1.00, with no commission or percentage. Commercial dealers are welcome at the same rate. Excess revenues will benefit the Boston Burns Unit of the Shriner's Hospital for Crippled Children. Last year we donated $1,355. Talk-in on .52 and 146.40/147.00. For information or map, send an SASE to Joe Demaso K1RQG, Star Route, Box 56, Bucksport ME 04416, or Norm Blake WA1IVB, PO Box 32, Cornish ME 04020.

GREEN BAY WI
MAY 10

The Green Bay Mike and Key Club will hold its swapfest from 8:30 am to 3:30 pm on May 10, 1980, at the Ashwaubenon Recreation Center. Admission will be $1.50 advanced and $2.00 at the door. Food and beverages will be served. There will be drawings for door prizes. For more information, contact Bob Duescher KA9BXG, 1011 13th Ave., Green Bay WI 54304. Talk-in on .72/.12.

ROCHESTER NY
MAY 16-17

The Rochester Hamfest and New York State ARRL Convention will be held on Friday and Saturday, May 16-17, at the Monroe County Fairgrounds Dome Center, Route 15A, Rochester, New York. Indoor and outdoor flea-market space will be available. Forums, technical programs, and other meetings will be held on Saturday. Equipment displays and flea market will open on Friday afternoon. Hamfest headquarters is the Rochester Marriott Inn at the NY State Thruway. Send a QSL to Rochester Hamfest, Box 1388, Rochester NY 14603, to have your name added to the mailing list, or call us at (716)-424-1100 for specific information.

COEUR D'ALENE ID
MAY 17

The Kootenai Amateur Radio Society will hold its annual Ham Meet on May 17, 1980, at the Northern Idaho Fairgrounds, Government Way, Coeur d'Alene ID. There will be commercial displays, auctions, a swap and shop, contests, and a snack bar. On Friday evening there will be entertainment. Doors will open at 7:00 am and the show will start at 9:00 am. Parking will be available at the fairgrounds. Talk-in on 146.52 simplex and 146.37/.97, club repeater W7LQT/R. For information on free table reservations or tickets, write KARS, Route 1, Box 87, Rathdrum ID 83858.

WABASH IN
MAY 18

The Wabash County Amateur Radio Club will hold its 12th annual hamfest on Sunday, May 18, 1980, from 6:00 am until 3:00 pm at the Wabash County 4-H Fairgrounds, Wabash IN. Admission will be $3.00 at the gate or $2.50 in advance and will include a chance in the major prize drawing. There will be plenty of food, door prizes, and parking. Camping space is available for Saturday night. Talk-in on 147.63/.03 and 146.52 simplex. For tickets or more info, send an SASE to Dave Spangler N9ADO, 45 Grant St., Wabash IN 46992.

EASTON MD
MAY 18

The sixth annual Easton Amateur Radio Society hamfest will be held on May 18, 1980, rain or shine, at the Easton Senior High School cafetorium on Route 50, just south of Easton at mile marker 66, from 10:00 am until 4:00 pm. Donation is $2.00, with an additional $2.00 for tables or tailgaters. Talk-in on .52 simplex and 146.445/147.045 on the repeater in Easton. For more details, write R. C. Thompson KA3BKW, PO Box 1473, Easton MD 21601, or Easton Amateur Radio Society, Inc., Box 781, Easton MD 21601.

YAKIMA WA
MAY 18

The Yakima Amateur Radio Club, W7AQ, will hold its annual hamfest on Sunday, May 18, 1980, in Yakima WA. Breakfast and lunch will be served, starting at 7:00 am. There will be door prizes, a swap shop, and new product dealers will be present. A free parking area for self-contained vehicles at the hamfest site will be available. Talk-in on .34/.94, .25/.85, and .01/.61. For further information, call Walt Hart at 575-4488 or Kenneth Zahn at 452-7982.

ISLIP LI NY
MAY 18

The Long Island Mobile Amateur Radio Club, Inc., will hold the ARRL Hamfair '80 on May 18, 1980, from 9:00 am to 4:00 pm at the Islip Speedway, on Islip Avenue (Rte. 111), one block south of the Southern State Parkway, Exit 43. There will be over 300 exhibitors and no reservations are needed. General admission is $2.00 and exhibitors' admission is $3.00 per space. There will be many door prizes awarded and plenty of parking space. Food and refreshments will be available at the track. The rain date will be June 1, 1980. For additional information, phone Sid Wolin K2LJH (516)-379-2861 nights, or Hank Wener WB2ALW (516)-484-4322 days.

EVANSVILLE IN
MAY 18

The Tri-State Amateur Radio Society will hold its annual hamfest on May 18, 1980, at the Vanderburg County 4-H Center, Evansville IN. Grounds for the hamfest will be open at 8:00 am CST Sunday morning. There will be no admission charge. Tickets will be on sale for door prizes. In addition, there will be many other lesser prizes awarded for hamfest attendance. Exhibit tables inside the hall will be $2.50 each, and a 4-by-8-foot space in a covered area adjacent to the hamfest will be available for $1.00 per space. Food and beverage will be available. Saturday overnight camping space is available for those so equipped. Talk-in will be on the Evansville 147.75/.15 repeater. For further details, contact Dave Bradford N6ACP/9, 313 E. Franklin Street, Evansville IN 47711.

WASHINGTON DC
MAY 24

The Maryland FM Association will hold its third hamfest on Saturday, May 24, 1980, 8:00 am to 4:00 pm at the Greenbelt Armory at the intersection of Greenbelt Road (MD Route 193) and the Baltimore-Washington Parkway, NE of Washington DC, just off I-95/495. Activities include cash prizes, catered food, indoor displays and flea market, and a separate outdoor tailgating area. Donations are $3.00, tailgating is $2.00, and tables are $5.00. Talk-in on 52.525 simplex, 146.161.76, 146.28/.88, and 146.52 simplex, and 449.1/444.1. Tables may be reserved by paying in advance to Fred Siebert K3PNL, 8357 Reservoir Road, Fulton MD 20759. If acknowledgement is desired, please include an SASE.

GORHAM ME
MAY 24

The Portland Amateur Wire-

less Association and the University of Southern Maine Radio Club will hold a flea market on May 24, 1980, from 9:00 am to 5:00 pm on the campus of the University of Maine, Gorham ME. Admission is $1.00 per person. Indoor and outdoor sites will be available. Talk-in on .52, .73, and .06. For further information, contact Jon Taylor N1SD, 44 Mitton Street, Portland ME 04102, or phone (207)-773-2651.

ST. LOUIS MO
MAY 24-25

The ARRL Midwest and Central Divisions will hold their amateur radio and computer hobbyist convention on May 24-25, 1980, at the Cervantes Convention Center, St. Louis, Missouri. Featured will be prominent speakers, information forums, equipment displays and demonstrations, and an indoor flea-market sale. Friday night, May 23rd, will be "Amateur Radio Night" at Busch Memorial Stadium, where the St. Louis Cardinals will play the San Diego Padres. On Saturday night, May 24th, the convention banquet and dance will be held on the riverboat *Admiral*. On Memorial Day, May 26th, there will be an all-day visit to Six Flags Over Mid-America. For more information, write to the Gateway Amateur Radio Association, Inc., Box 68, Marissa IL 62257.

FREMONT OH
MAY 25

The Sandusky Valley Amateur Radio Club will hold its third annual hamfest on Sunday, May 25, 1980, at the Sandusky County Fairgrounds, Fremont OH. Doors open at 7:00 am. Admission is $1.00, and all tables are free. Talk-in on .52/.52 and 146.31/.91. For tickets or additional information, send an SASE to Ron Winke WB8NMK, 1200 Stilwell Avenue, Fremont OH 43420.

HAMBURG PA
MAY 25

The Reading Radio Club will hold its second annual hamfest on Sunday, May 25, 1980, in the Hamburg PA Fieldhouse (take Rte. 22 from east or west, Rte. 61 from north or south). There are indoor as well as outdoor sites. Cash and equipment prizes will be awarded. Talk-in on 146.31/.91 and 146.52. For information, write W3BN, PO Box 124, Reading PA 19603.

ST. PAUL MN
MAY 31

The North Area Repeater Association, Inc., will hold its Amateur Fair on Saturday, May 31, 1980, at the Minnesota State Fairgrounds, St. Paul MN. This is a swapfest and exposition for amateur radio operators and computer enthusiasts. There will be free overnight parking for self-contained campers on May 30th. Exhibits, booths, and prizes will be featured. Admission is $3.00. For information or reservations, write Amateur Fair, PO Box 30054, St. Paul MN 55175.

MANASSAS VA
JUN 1

The Ole Virginia Hams Amateur Radio Club, Inc., will hold its seventh annual Manassas Hamfest on Sunday, June 1, 1980, at the Prince William County Fairgrounds, Route 234, Manassas VA. Booths are available. Admission is $3.00, children under 12 are free, and tailgaters are $2.00. Talk-in on 146.37/146.97 repeater (WB4HHN) and 146.52 simplex. For further information, contact Joseph A. Schlatter K4FPT, Ole Virginia Hams ARC, Inc., PO Box 1255, Manassas VA 22110.

WILMINGTON OH
JUN 1

Clinton County area amateurs will sponsor the first annual Clinton County area Hamfest 1980 on June 1, 1980, 8:00 am to 5:00 pm, at the Clinton County Fairgrounds, Wilmington OH. Admission will be $3.00; 12 and under are free. Fleamarket space is free. There will be door prizes and free parking. Food and drinks will be available. Talk-in on .72/.12. For more info, send an SASE to CCARA c/o Russ Eidemiller WD8NPZ, 310 Bethel Lane, Wilmington OH 45177.

GRANITE CITY IL
JUN 8

The Egyptian Radio Club will hold a hamfest and flea market on June 8, 1980, beginning at 8:00 am at the ERC Clubhouse, Slough Road, Granite City IL. Tickets are $1.50. Refreshments, activities for women and children, and overnight camping are available. Prizes will be awarded. Talk-in on 146.16/.76 and 146.52.

JEFFERSON CITY MO
JUN 8

The Missouri Single Side Band Net Picnic will be held on Sunday, June 8, 1980, at Binder Lake, Jefferson City MO. There will be a covered dish dinner served at noon and drinks will be furnished by the Net. For information, contact Benton C. Smith KØPCK, net manager, Prairie Home MO 65068.

BARRIE ONT CAN
JUN 13-15

The Lake Simcoe Hamfest will be held on June 13-15, 1980, at Molson's Park, Barrie, Ontario, Canada. Doors will open at 12:00 noon on Friday, June 13. Registration at the gate is $5.00 and pre-registration is $4.00, with children under the age of 18 admitted free. Talk-in on VE3LSR 146.85, 146.52 simplex, and 3780 kHz. For information, reservations, or tickets, write to Lake Simcoe Hamfest, PO Box 2283, Orillia ONT, Canada L3V 6S1.

OXFORD ME
JUN 28

The Yankee Radio Club, Inc., of Maine, will hold its Yankee Hamfest '80 on Saturday, June 28, 1980, at the Oxford County Fairgrounds in Oxford ME. Featured will be computer displays, talks on selected subjects, a ladies program, a youth program, swap tables, door prizes, and a buffet dinner in the evening. Registration will be $8.00, complete with a dinner and door prize chances; $7.00 for early registrations. For admission only, at the gate, the cost is $2.50. Camper hookups will be available for Friday and Saturday nights at $2.00 per night. Talk-in will be on 146.28/.88 and on 146.52. For information and registration, send an SASE to Lynda Mount, 198 Cony Extension, Augusta ME 04330.

BURLINGTON ONT CAN
JUL 5

The Burlington Amateur Radio Club will hold its 6th annual Ontario Hamfest 1980 on Saturday, July 5, 1980, at the Milton Fairgrounds, just south of the intersection of Highways 401 and 25 (Exit 39). General admission is $3.00; children and ladies are free. Pre-registration before June 15, 1980, is $2.00. Gates will open Friday, July 4, 1980, at 12:00 noon and Saturday, July 5, 1980, at 7:00 am. The flea market opens at 8:00 am and tables are free. There will be camping available and food and prizes. Talk-in on 147.81/.21 VE3RSB. For information, write BARC, Box 836, Burlington ONT CAN L7R 3Y7.

WAUKESHA WI
JUL 19

The Kettle Moraine Radio Amateur Club (KMRA) will hold its annual hamfest on Saturday, July 19, 1980, beginning at 7:00 am, at the Badger Raceway, Waukesha WI. The Badger Raceway is located west of Dousman on U.S. 18, 3½ miles from the intersection of I-94 and State Highway 67. There will be overnight camping on the grounds on Friday. Tickets are $1.50 in advance and $2.00 at the door. Talk-in on 146.52, 52.525, and 28.650 MHz. For additional information and advance tickets, write KMRA Hamfest, 108 Shepard Ct., Mukwonago WI 53149.

WEST FRIENDSHIP MD
JUL 27

The Baltimore Radio Amateur Television Society will hold its annual BRATS Maryland Hamfest on Sunday, July 27, 1980, at the Howard County Fairgrounds, just off I-70 and Route 32 at Route 144, West Friendship MD. Beginning at 8:00 am, activities will be held rain or shine. Talk-in on .63/.03, .16/.76, and .52 simplex. For information or table reservations, write BRATS, Box 5915, Baltimore MD 21208.

GEORGETOWN IL
AUG 30-31

The Illiana Repeater System, Inc., amateur radio club will hold its 11th annual Danville, Illinois, Hamfest, Saturday and Sunday, August 30-31, 1980, at the Georgetown, Illinois, Fairgrounds. Advance gate donations are $1.50 per adult; $2.00 at the gate, with children 14 years and younger free. Activities will include two days of flea markets, commercial exhibitors, RTTY setups, an Antique Wireless Association display, a home-brew builders contest, a USAF MARS station, and other interests. Meals and refreshments will be served both days and overnight camping facilities are available. For more information or advance tickets, send an SASE to Illiana Repeater System, Inc., PO Box G, Catlin IL 61817.

Microcomputer Interfacing

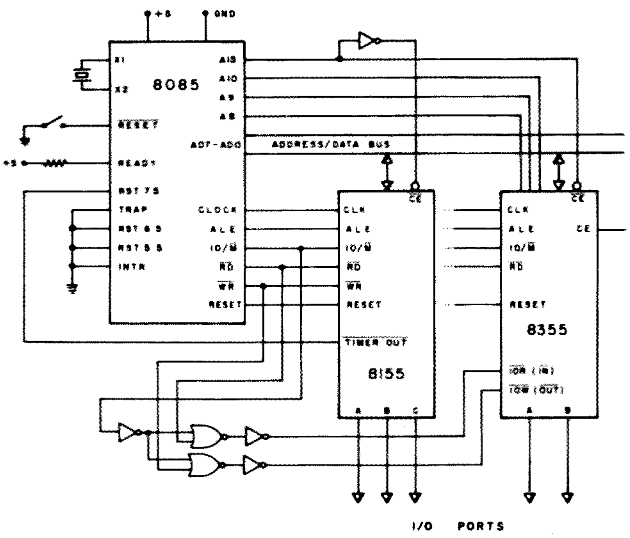


Fig. 4. Pin configuration for the 8085 central processor unit or microprocessor chip.

Bit	Function	
D0	Defines Port A	Logic 1 = Input, Logic 0 = Output
D1	Defines port B	
D2	Defines port C	Four modes possible
D3	Defines Port C	
D4	Port A Interrupt Enable	
D5	Port B Interrupt Enable	
D6	Timer Control	
D7	Timer Control	

Timer Control Bits		Function
D7	D6	
0	0	No effect upon the counter
0	1	Stop counting
1	0	Stop after this count has been completed
1	1	Load counter and start counting. If the counter is running, load and restart after the current count has finished.

Table 2. Control bit designations and their functions. These bits are used to program the 8155's control register to control the various 8155 I/O ports, interrupts, and timer.

Function	Address
Command/Status Register	XXXXX000
Port A	XXXXX001
Port B	XXXXX010
Port C	XXXXX011
Counter bits D7–D0	XXXXX100
Counter bits D13–D8 and Counter	XXXXX101

Table 3.

from page 27

pin 5) so that it could be sensed by the RIM instruction, or it could be connected to one of the 8085's interrupt pins, RST 7.5, for example, so that the end of the timer's period could be detected through an interrupt action. The timer's output is fairly flexible, being programmed to operate in one of four ways shown in Table 1.

These control bits, M2 and M1, are the most significant bits in the 16-bit count value that is programmed into the counter. Since the counter is only 14 bits long, the control bits are not included in the count itself, but are used by the counter's control logic to determine the state of the counter's output when the count has been finally decremented to zero. Whenever a new 14-bit count value is reprogrammed into the counter, these two control bits also must be included in the new 16-bit word.

The 8155 read/write memory chip also has an internal control register that is loaded with an eight-bit byte that is used to determine the operation of the I/O ports and 14-bit counter. The various control register bits and their functions are shown in Table 2.

There are six device addresses that are associated with the 8155 in an 8085-based system. These addresses control the I/O ports, the timer, and the control register. The control register's address may be used in a read operation to read various conditions or various status bits. We shall not discuss this further. The individual addresses and their functions are shown in Table 3.

In our 8085-based system, these devices have addresses 200 through 205. Remember that the 8155's chip enable input, $\overline{CE}$, must be at a logic zero for the memory or I/O devices to operate properly. The final, minimum system that we have configured is shown in Fig. 3. Two additional integrated circuits, an SN7404 hex inverter and an SN7402 quad NOR, are needed to provide gating and inverting functions. (See Fig. 4 for 8085 pin configuration.) Note the use of address bit A15 to select between the 8155 and 8355 chips. We have chosen the 8355 as the read-only memory chip in this system. In our next column, we will explore the use of this system and the development of some software examples that may be used in small control systems.

Ham Help

Recently I got a Mite UGL-41 teleprinter, which works from 110-volt, 400-Hz mains. I'm looking for someone who is experienced in such power supplies, has a supply for sale, or maybe has a surplus unit. We have 220-volt, 50-Hz mains here, but this is not the real problem. I am also looking for a manual and a spare parts source for my Mite. Thank you.

Detlev-R. Fliegner DL7VS
Glockenblumenweg 28 a
1000 Berlin 47 West Germany

Our Apple computer net meets every Sunday night 0100Z on 14.329 MHz ±QRM. If you have a problem in programming, this may be the place to find answers, or give help to someone else. SWLs may mail questions to me for airing on the net.

James E. Hassler WB7TRQ
129 Park Ave.
Orchard Valley
Cheyenne WY 82001

I would like hams who live within 100 miles of the San Andreas Fault on the west coast of North America and who would like to participate in an earthquake prediction project to please send an SASE to me. This is a bona fide project to cooperate with the U.S. Geological Survey to supply data on band conditions to a scientist who is studying the electromagnetic field of the San Andreas Fault.

Lawrence I. Cotariu KA6GVI
8041 N. Hamlin Avenue
Skokie IL 60076

I need an operation or service manual for a Clegg FM-27B. I will copy and return or pay for copies. Thanks.

Jung Y. Lem KB6BO
5222 Coringa Drive
Los Angeles CA 90042

OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. if OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
24596	1	0001:32	69.8
24609	2	0055:48	83.4
24622	3	0150:04	97.0
24634	4	0049:23	81.9
24647	5	0143:39	95.5
24659	6	0042:59	80.3
24672	7	0137:15	93.9
24684	8	0036:34	78.8
24697	9	0130:50	92.3
24709	10	0030:09	77.2
24722	11	0124:25	90.8
24734	12	0023:44	75.6
24747	13	0118:00	89.2
24759	14	0017:20	74.1
24772	15	0111:35	87.7
24784	16	0010:55	72.5
24797	17	0105:11	86.1
24809	18	0004:30	71.0
24822	19	0058:46	84.5
24835	20	0153:02	98.1
24847	21	0052:21	83.0
24860	22	0146:37	96.6
24872	23	0045:56	81.4
24885	24	0140:12	95.0
24897	25	0039:32	79.9
24910	26	0133:48	93.5
24922	27	0033:07	78.3
24935	28	0127:23	91.9
24947	29	0026:42	76.7
24960	30	0120:58	90.3

OSCAR 8 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
10565	1	0116:13	69.5
10579	2	0121:11	70.8
10593	3	0126:08	72.1
10607	4	0131:05	73.3
10621	5	0136:03	74.6
10635	6	0141:00	75.8
10648	7	0002:45	51.3
10662	8	0007:42	52.6
10676	9	0012:39	53.8
10690	10	0017:36	55.1
10704	11	0022:33	56.3
10718	12	0027:30	57.6
10732	13	0032:28	58.9
10746	14	0037:25	60.1
10760	15	0042:22	61.4
10774	16	0047:19	62.6
10788	17	0052:15	63.9
10802	18	0057:12	65.2
10816	19	0102:09	66.4
10830	20	0107:06	67.7
10844	21	0112:03	68.9
10858	22	0117:00	70.2
10872	23	0121:56	71.5
10886	24	0126:53	72.7
10900	25	0131:50	74.0
10914	26	0136:47	75.2
10928	27	0141:43	76.5
10941	28	0003:27	51.9
10955	29	0008:24	53.2
10969	30	0013:20	54.5

OSCAR 7 ORBITAL INFORMATION FOR MAY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
24972	1	0020:17	75.2
24985	2	0114:33	88.8
24997	3	0013:52	73.6
25010	4	0108:08	87.2
25022	5	0007:28	72.1
25035	6	0101:44	85.7
25047	7	0001:03	70.5
25060	8	0055:19	84.1
25073	9	0149:35	97.7
25085	10	0048:54	82.5
25098	11	0143:10	96.1
25110	12	0042:29	81.0
25123	13	0136:45	94.6
25135	14	0036:04	79.4
25148	15	0130:20	93.0
25160	16	0029:39	77.9
25173	17	0123:55	91.4
25185	18	0023:14	76.3
25198	19	0117:30	89.9
25210	20	0016:50	74.7
25223	21	0111:05	88.3
25235	22	0010:25	73.2
25248	23	0104:41	86.8
25260	24	0004:00	71.6
25273	25	0058:16	85.2
25286	26	0152:31	98.8
25298	27	0051:51	83.6
25311	28	0146:07	97.2
25323	29	0045:26	82.1
25336	30	0139:42	95.7
25348	31	0039:01	80.5

OSCAR 8 ORBITAL INFORMATION FOR MAY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
10983	1	0018:17	55.7
10997	2	0023:13	57.0
11011	3	0028:10	58.2
11025	4	0033:06	59.5
11039	5	0038:03	60.7
11053	6	0042:59	62.0
11067	7	0047:55	63.3
11081	8	0052:52	64.5
11095	9	0057:48	65.8
11109	10	0102:44	67.0
11123	11	0107:40	68.3
11137	12	0112:37	69.5
11151	13	0117:33	70.8
11165	14	0122:29	72.1
11179	15	0127:25	73.3
11193	16	0132:21	74.6
11207	17	0137:17	75.8
11221	18	0142:13	77.1
11234	19	0003:56	52.5
11248	20	0008:52	53.8
11262	21	0013:48	55.0
11276	22	0018:44	56.3
11290	23	0023:40	57.5
11304	24	0028:36	58.8
11318	25	0033:32	60.1
11332	26	0038:27	61.3
11346	27	0043:23	62.6
11360	28	0048:19	63.8
11374	29	0053:15	65.1
11388	30	0058:10	66.3
11402	31	0103:06	67.6

Ham Help

I am looking for a bimetallic thermostatic heater, 60° to 70° centigrade, for a crystal oven, or a successful electronic temperature control for same, working off of 5 to 12 volts.

I am also looking for a schematic and/or alignment data for a Wells Gardner Co. receiver, model CWQ 46229. Any help will be appreciated.

Rex D. Faulkner
3416 Brinkley Road, Apt. 102
Temple Hills MD 20031

For informational purposes, I'm interested in locating amateurs who have operated in former European colonies or territories.

Gary Mitchell WA1GXE
Box 1003
Fairfield CT 06430

I am interested in obtaining information regarding any modifications to the Heathkit HW-101 transceiver or the Heathkit Mono-Bander transceivers, HW-12, HW-22, or HW-32.

Doug Limbaugh WA9GPH/8
2030 Riverside Court
Lansing MI 48906

I need a repair/service manual and pattern pictures for a Central Electronics, Inc., R.F. Distortion Indicator, model DI-1, serial #2056, manufactured by P&H Electronics of Lafayette, Indiana. I will pay reasonable copying charges if a manual is not available.

James F. Hartley W1DIS
US Route #302, Box 11
Raymond ME 04071

In May, I'm being transferred to Ft. Polk, Louisiana, and need some information on clubs and activities in the Ft. Polk area. Can anyone help?

SSG Gene Slaten
3 BDE LDRSP SCH
APO NY 09074

I need a schematic for a Hy-Gain model 628G hand-held VHF-UHF monitor-scanner. It is a discontinued model and any help will be appreciated.

John Ward WB9EDI
2811 Schumacher Drive
Mishawaka IN 46544

Corrections

In "The Dollar-Saver DVM" (*73*, January, 1980, p. 83), we incorrectly listed Beckman Instruments, Inc., of Fullerton, California, as the source of the parts kit for the DVM in the article.

Payment for the parts kit should be directed to the author, not Beckman Instruments, Inc. Additionally, all checks received by Beckman Instruments for the parts kit will be returned to the senders.

We regret this unfortunate error and offer our apologies to all who have been inconvenienced by it.

Gene Smarte WB6TOV
News Editor

There are several errors in my article, "An LED Display for the HW-2036" (October, 1979), and I hope that this will help solve the problems encountered by those readers who attempted to construct the display.

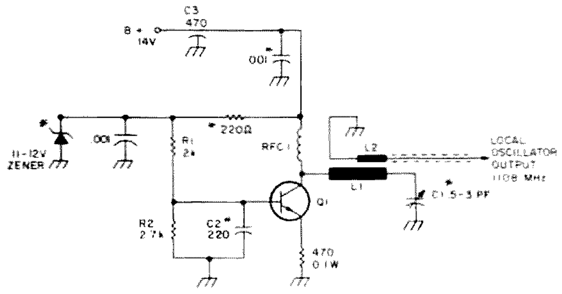
First, Fig. 9 (p. 40), top view, is correct. However, the PC layout in the bottom view is not. PC layouts for both sides of the 2036-DB board are shown here.

Next, the 2036-MB PC board layouts (Fig. 10, p. 40) are also in error. The 2036-MB component side PC layout and the corrected parts location are shown here. Note that, as mentioned in the original article, the 1-MHz crystal and neighboring 0.01-μF capacitors are not mounted on the component side.

The designations for the pinouts of the chips shown in Fig. 8 (p. 39) were omitted. The chip on the left is a Fairchild 9368; the one on the right is an SN74LS48.

And, finally, Radio Shack has changed the part number of the 24-conductor mike cable to W-1870. It can be ordered by phoning Radio Shack Customer Service in Ft. Worth at (817)-531-0274.

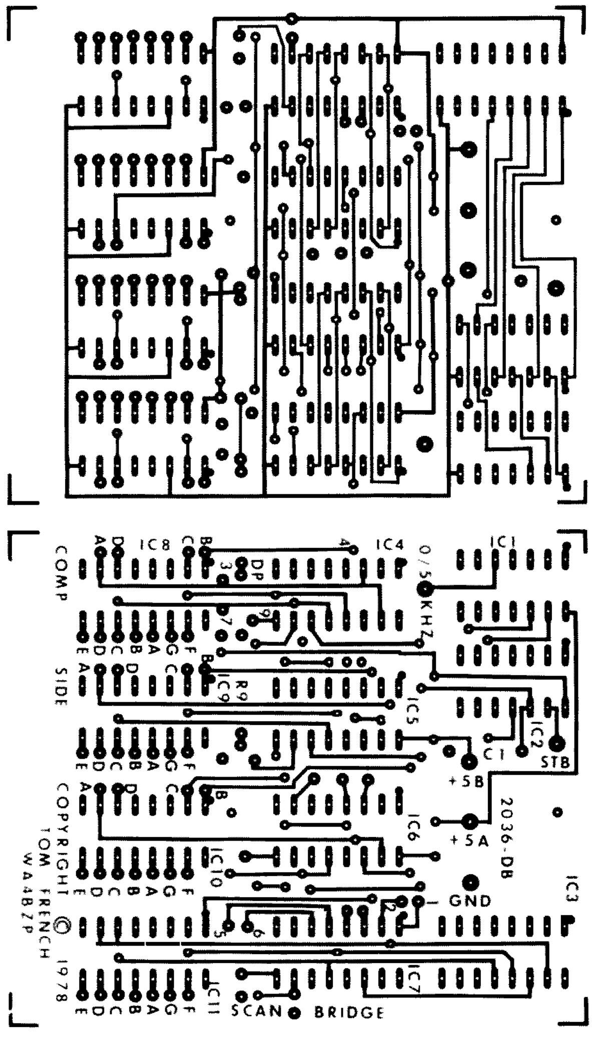
Tom French WA4BZP
1161 Lane Park Road
Tavares FL 32778



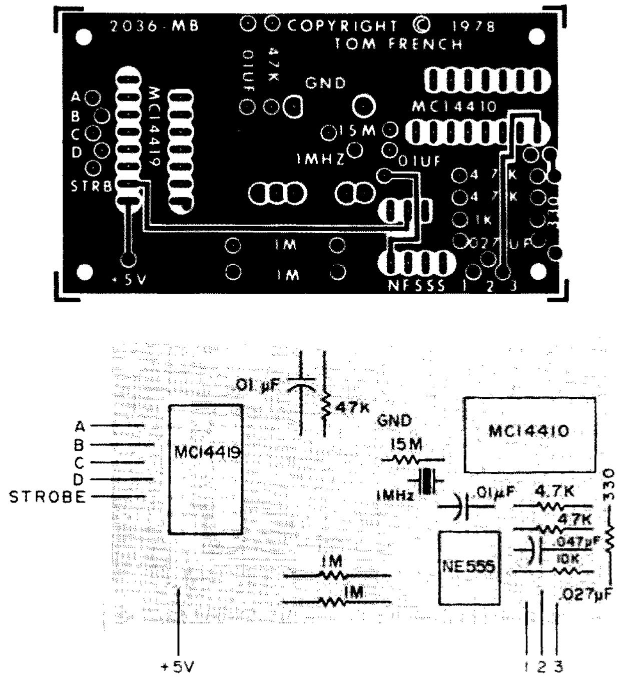
*Revised local oscillator circuit, Fig. 5 (b), of "You Can Watch Those Secret TV Channels." *indicates new or changed part.*

Here are some updates to the microwave TV downconverter circuit that was originally described in the August, 1979, *73 Magazine* article entitled, "You Can Watch Those Secret TV Channels."

- The value of the capacitor between S1 and J3 in the power supply is 0.001 μF.
- The local oscillator circuit has been changed to improve performance and increase the electrical tuning range. This increase in electrical tuning is especially nice during extreme outside temperature changes. The improved oscillator circuit is shown in the accompanying schematic diagram. The original PC board may be modified with careful use of a sharp knife to incorporate the changes. Be sure that the two 0.001-μF disc capacitors are located as close to the B+ end of R1 and RFC1 as possible.
- If the above LO change is made, then smoother electrical tuning will result by lowering the maximum power supply voltage to about 15.5 volts. This can be done by replacing the 910Ω resistor, R1, with 1500Ω.
- It was found that when in direct sunlight the temperature



Revised Fig. 9, "An LED Display for the HW-2036."



Revised Fig. 10, "An LED Display for the HW-2036."

in the downconverter box can get excessively high. Painting the box white and, if possible, positioning it to be shaded by the antenna will keep its temperature at a more reasonable level.

• Use *very small* drops of epoxy to attach the mixer lines to the base board.

• The length of the piece of small coaxial cable between the LO and the mixer line should not exceed 5 cm (2 in.).

• Even after careful assembly and tune-up of the converter, a few of them seemed to lack sensitivity. The cause of this has been found to be a bad impedance match between the antenna and the mixer. A significant improvement can sometimes be made by replacing the 5-pF antenna coupling capacitor (C1) with a "gimmick" capacitor made from a piece of bare solid hook-up wire, about 22 AWG or so.

Make the "gimmick" by forming a loop about 1/8" in diameter on one end of the wire and filling it with solder to give it a little extra surface area. Attach the other end to the antenna connector, suspending the looped end over the diode end of L2 where the 5-pF capacitor was previously attached. Space it above about 1/32" at first, then carefully adjust the spacing with an insulated stick for best signal.

Parts and PC boards for this project can be obtained from the authors. Send an SASE to me for a list.

Jim Barber KØJB
22518 97th Avenue N
Rogers MN 55374

Ham Help

The Atlanta Radio Club is offering two cash scholarships of $500 each this year. Applicants must be licensed amateurs and must be high-school graduates entering an accredited college or university as freshmen in the fall of 1980. All applications must be completed and postmarked not later than midnight, May 15, 1980. Write to the Atlanta Radio Club Scholarships, PO Box 77171, Atlanta GA 30357, for application forms and additional information.

Phil Latta W4GTS
Secretary, Atlanta Radio Club
Scholarship Committee
259 Weatherstone Parkway NE
Marietta GA 30067

I need schematics or technical info on the following: Triplett model 3433 AM/FM signal generator, Deltron model C5-10.5C B power supply (s.n. 34983), and Navy surplus receiver, AN/URR 35B. I'm interested in conversion of the latter to two meters. Thank you.

George H. Potts
113 7th Avenue
Roebling NJ 08554

I have 3 UHF oscillators which I would be happy to donate to an individual or club.

The units are about 4" high and 3" in diameter and look like gold-plated (gad!) brass—complete with lighthouse-type tubes and marked "freq 1.71-1.73 GC." These were manufactured by Trak in 1963.

All these tubes have filament continuity, but there is no guarantee that they will oscillate. The units have grid- and plate-tuning slugs. Any takers?

David D. Blackmer WA6UNK
Route 3, Evergreen
Nipomo CA 93444

I have acquired a Bell System Star Set, model KS-20778, series B headphone and mike. It is designed for use with telephone operations. I would like to be able to use the set with an SB-104A from Heath. Any schematics, modifications, advice, etc., would be greatly appreciated.

Michael D'Antignac
908 Alpha Street
Inglewood CA 90302

I need help in obtaining repair/service information or at least a complete schematic for a Telequipment Servicescope oscilloscope, type S-32. I will be happy to pay for the manual or for copies or will borrow and return the manual after copying it myself. Any help will be sincerely appreciated.

John R. Parke WA2JYA
125 Hempstead Road
Trenton NJ 08610

I wish to purchase, in any condition, a Heathkit Ham-Scan Panoramic Adapter, model HO-13.

Kenneth Hunt WB7OVU
6519 Valhalla Ave.
Klamath Falls OR 97601

I have need for schematic diagrams and any other available information for a Link model 150T1 FM transmitter and a model 150FR1 FM receiver. I would be happy to compensate for copying costs, etc., or be willing to buy the service manuals involved.

Jerry Van W9VOW
1150 Kellogg St.
Green Bay WI 54303

I would like to buy or borrow a manual and schematic for a McMurdo Silver signal generator, model 906, which covers 90 kHz to 170 MHz.

H. W. Brown K1TO
1015 Concord Circle
Haddonfield NJ 08033

I need a front glass, scaled for a Hallicrafters SX-111 receiver. Thank you.

Kirt Damon KA5GSI
6027 Chef Menteur Hwy
Suite 202A
New Orleans LA 70126

I have just been put in charge of my club's hamfest for this fall and would like any newsletters or other information from readers which can help me make it a good one. In fact, I would appreciate a copy of any club newsletter that might have meeting ideas, etc., which I can pass along. Thanks.

Matt Beha, Jr. KA4DYM/8
3752 Lane Court
St. Joseph MI 49085

I need help in converting a Royce model 639 SSB CB radio to 10 meters. The SSB generator uses two crystals, LSB—9.7875 and USB—9.7825. The PLL circuit uses three crystals, LSB—10.2385, USB—10.2415, and AM—10.240. The unit also uses a 27-MHz ceramic filter before the driver and final in the transmitter.

I would appreciate any information from anyone who has converted the 639 or a unit that uses a similar circuit. Thank you.

Jon W. Krannawitter WBØRNN
514 W 21st
Hays KS 67601

I'm Looking for *Radio Boys with the Flood Fighters* and *Radio Boys in Gold Valley*, by Chapman, to complete a series.

R. Randall K6ARE
1263 Lakehurst Road
Livermore CA 94550

I need schematics, alignment instructions, voltage readings, etc., for an HRO 5TA1 (pre-WWII) and an 1155-series receiver (WWII R.A.F.). The HRO and 1155 have external power packs and the 1155B has a built-in power pack.

I will shortly be a licensed ZE and will certainly appreciate any help. Thank you very much.

Brian W. Legg
9 Wingate Road, Highlands
Salisbury, Zimbabwe Rhodesia

I need a schematic diagram for a Gonset Communicator II 2-meter AM transceiver. I will repay any reasonable photocopying charges or copy and return. I need only the schematic, not the operation manual.

Tim McDonough WD9EDT
1800 Pickett Street
Springfield IL 62703

I need a schematic and manual for an Eico scope, Model 435. I will copy and return and pay all postage.

Jim Spivey KB4DQ
Rt. 1, Box 23-B
Cusseta GA 31805

I am in need of diagrams, schematics, alignment instructions, and info on any mods to the Hammarlund HQ-140-X. I will copy and return.

John A. Poplawski WB2GFR
9 East 15th Street
Bayonne NJ 07002

I have acquired a National NC-88 receiver in poor working condition. If anyone can supply a schematic diagram, I will gladly pay for copying and mailing costs.

I would also like any references to any articles that would be useful for repairing old receivers. Thank you.

Marc S. Webb WB1FPB
566 Washington St., #17
Weymouth MA 02188

RTTY Loop

from page 12

cution, rather than setting the program counter. The beginning of the program would then be:

```
0100            ORG $0100
0100 4F         START CLR A
0101 B7 801D    STA A PIACA
... etc.
```

The transfer address would be $0100, and the program would be reassembled, taking three fewer bytes. Of course, you could leave it alone, execute from $0103, and fill the first three bytes with NOPs. Do hope this helps things along.

Also from out west, Clay Abrams K6AEP passes along the information that he has a TV camera hooked up to a Micro-Works DS-68 Digitizer and can send pictures either on SSTV or RTTY. Some of the software he has written for this system has appeared in the pages of *73*, and it looks like he has a fine setup. Both he and I wonder if anyone else has tried this combination. Anyone?

While I'm on the topic of computers and RTTY, one more letter came in. Felton Mitchell WA4OSR of Mobile, Alabama, addresses himself to the problem of the "software UART" discussed in the above RTTY programs. Mitch points out that a 555 timer set to interrupt the processor can provide for the timing external to a delay loop, this freeing the processor to do other tasks. This removes many of the objections voiced to the program. I agree, Mitch, that using an interrupt, such as the IRQ vector in the 6800, would be a simple way to provide for outputting the Baudot bits. However, my intention with the program was to show how to send and receive RTTY with a minimum of external devices. An interrupt timer must first be built and then calibrated to provide exactly the right interval, and if you want to change speed, a hardware change is needed. With timing loops, changing constants is easy, quick, and painless. If you had a software-controlled interrupt timer, things would be different, but, again, we would be getting into additional hardware, which is one area I attempted to avoid.

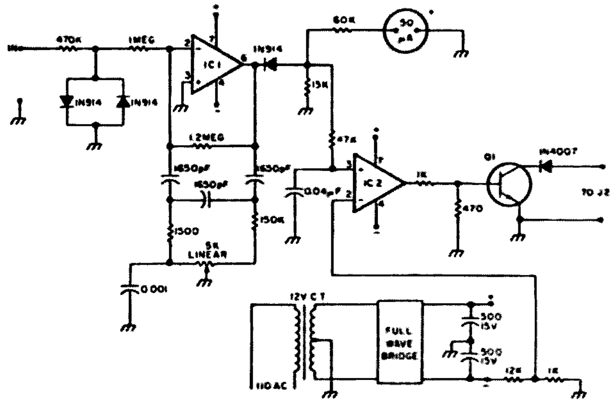


Fig. 4. IC1, IC2—741 op amps; Q1—MJE-340.

And now . . . April update. Still no word on Teleprinter Art, Ltd. Neither has a response to my nor anyone else's letter been received. I am forwarding material to the proper authorities and ask anyone who has had dealings with the firm in the past to please send me details, good or bad, for inclusion. I will let you all know what gives, as soon as I find out.

Next month holds some more on demodulators you can build, as well as a look at some more mail. Following that, I hope to provide some insight as to commercial equipment offered for use on ham RTTY: demodulators, video terminals, and more. Stay with us, and see it all here in RTTY Loop!

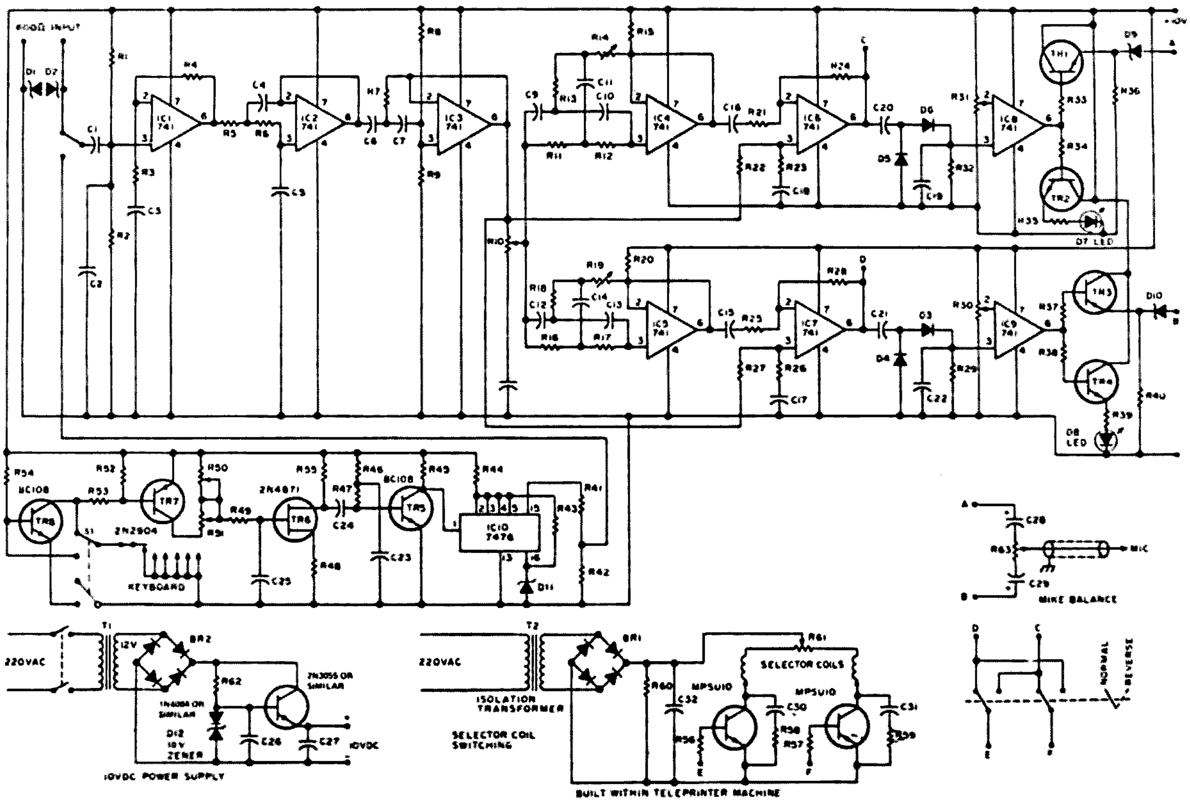


Fig. 3.

LETTERS

from page 20

cy? A lot of people just do not obey the rules. Whatever happened to using minimum power necessary? When did they come out with the rule allowing someone to *own* a frequency? Our HF bands are sounding more like 11 meters every day.

I do not claim to know it all, but I do *try* to obey the rules. I ran a Ten-Tec Argonaut for six months and worked the world on two Watts. So do not cry to me about your busted kW! I am a bit of a pessimist. I predict that in ten years our HF bands will be a lost cause. They will undoubtedly be just like 11 meters.

My personal cure for HF was VHF and UHF. There you can tinker and converse without being jammed. Our 450-MHz band does not yet have a lot of readily available equipment. Thus, most of the people there are tinkerers and experimenters. Most of these people respect their privilege of being able to operate at all.

So someday when you turn on your rig, you will hear garbage on our HF bands that surpasses even CB. I have already given up on HF and sold all my HF gear. So everybody have fun on 20-meter CB.

Michael Crumpton
Orlando FL

WHAT A LETDOWN

Today, after reading your January editorial, I feel like a teenage boy who idealized the athletic man across the street and just found out that he was as queer as a three-dollar bill. Boy! What a letdown!

I don't know of any ham who wants the code requirements dropped. It appears to me that only *certain* people would stand to gain financially from canceling the code requirements.

If there is a great number of people who find the code requirements too difficult, we could go to the present CB licensing procedures. I am sure that this system would satisfy those people who want to make money at our expense.

By the way, Wayne, I bring people into amateur radio the *right* way. I teach Novice classes through the Adult Education System in our community.

David W. Wilcox WA1YOC
Caribou ME

NEW RFI PROBLEM

May I provide a word of warning to any ham using a 1978 LeBaron with a "lean burn" engine who contemplates using more than 30 Watts output? The original computer is *not* shielded and high rf can really send it into a tailspin. My problem included 18 months of rough engine performance and mileage variation from 25 mpg to 10 mpg on an intermittent basis! Three new computers, 5 sets of plugs, 3 new PCV valves, a carb boilout, and at least a dozen engine scopes offered no help! Finally, a hot-line call from Florida to Chrysler Engineering revealed that they had indeed had problems with police, vets, and other users of high-output 2-way radios (no tech bulletins had been issued, nor was Sales warned of problems to prospective users). The cure—simply wrap the computer case in aluminum foil—not very professional, but it seems to work!

Anyone having problems is advised to insist on a call to Detroit—the field service people have *not* been advised!

Lowell C. Stanley WA9OLL
Lantana FL

BUY AMERICAN

Thank you for printing the Joe Feagans W9HCI letter in the December issue. He saved me the time and effort of expressing the same sentiments myself.

Yes, you do have the best amateur radio magazine going. I agree with about 90% of your editorials, but the rest has become pure drivel.

The honorable mention you have given lately to the CB HFers is unbecoming of an otherwise excellent publication. Within their own 10½-meter subculture, they obviously can no longer differentiate between right and wrong. Future hams? Where would they operate then in crowded band conditions? Would MARS frequencies become funny channels?

Unlike most hams who think this type of problem will go away by remaining ignorant about it, the Novices on 10 CW do an admirable job on any idiot who ventures above 28.000 MHz into their, that is to say our, frequency spectrum.

Further, you have implied that most Yaesu and Kenwood equipment is CB-bound. I tend to agree. Albeit even a Collins KWM-2 can be modified for 10½ meters, it does not appear that Rockwell has actively gone after that market. This then becomes a personal matter of ethics for all hams when they decide who to patronize when buying amateur gear. I would like to see more business given to our people at Atlas, Drake, etc.

Lowell Loughary K7LFT
Portland OR

TELENETICS/TELARIS

Just a quick note about the fine article on the 7516 chip written by Bill Hosking W7JSW in the October, 1979, issue of *73*.

Your readers will have a hard time locating the manufacturer of these devices, as they changed names as well as addresses.

They are now: Telaris Telecommunications, Inc., 2772 Main St., Irvine CA 92714.

Thanks to the efforts of a couple of the users of our repeater, WB6FUB/RPT, we managed to find them again.

Mike DeHart WB6KRU
Walnut CA

FEEDING FRENZY

While listening to the recent Kingman Reef DXpedition, I was extremely disturbed by the actions of our fellow hams in the United States. The only proper analogy I can give this fiasco is a "feeding frenzy."

I realize that in a pileup, especially of a rare country, there will be a bit of anxiety involved, but *this* was ridiculous. I hope this never happens again.

In conclusion, I don't wish to repeat any of the unidentified comments or imply degrees of intelligence of the hams who made the comments, but I cannot resist the temptation to interject on one of the most used phrases. This was in reference to CBers. Now, being an upgrade from eleven meters, I can truthfully say that CBers have much more self-control than that referred to. My regards to W2FIJ and those who were trying their best at 2200Z on January 9, 1980, 28.594 ±.

Sorry, gentlemen, I did turn the dial.

F. C. LaMont, Jr. KA6AAE
Modesto CA

GREAT DISSERVICE

I read with interest your views expressed in the January, 1980, issue of *73 Magazine*. I have been quite impressed with your publication and opinions for some time now, but, by the same token, I also support the ARRL. I believe they have a valid function in our hobby. I enjoy reading all available ham publications because I feel it is necessary to hear more than one viewpoint on an issue.

I must say that I'm inclined to agree with you on your statements concerning lack of participation by younger amateur prospects. However, I don't feel eliminating the code requirement is going to help anybody. Speaking for myself and other hams (at least in the Toledo area), it would be a great disservice to the good of the hobby to do away with code. I, for one, am proud to have achieved the code knowledge I have (and, incidentally, Wayne, I used your *73* code cassettes to do it).

As a matter of fact, I am now using your 21 wpm cassette as well as your old enemy, the ARRL W1AW code practice. Not only am I studying your Extra Class book, but I am also using the ARRL manual plus several other sources. Sorry, Wayne, but there is no such thing as a complete study guide. This is partially the fault of the FCC itself, and I don't blame your organization or the ARRL. You do have fine publications, so please, keep up the good work.

Steve Lewis KA8CXT
Russford OH

Contests

from page 14

tion during July in Denver and in the MARAC newsletter.

ARRL EME CONTEST I
Starts: 0001 GMT April 19
Ends: 2359 GMT April 20

Briefly, the rules are as follows: All amateurs worldwide are invited to participate. The object is to conduct two-way communication via the Earth-moon-Earth path on any authorized amateur frequency above 50 MHz. Stations must exchange callsigns and a signal report and acknowledge all information. Contacts may be made on CW or SSB. Only one contact per station on each band regardless of mode. Each station can have only one signal per band on the air at all times. Fixed or portable operation is permitted, but portable stations outside their licensed call areas must sign portable and identify the operating call area. Each station can use only one callsign during the entire contest. Entry classes include single- and multi-operator. Score 100 points per EME contact. The multiplier is the total number of DXCC countries and US and Canadian call areas. Contacts with KH6, KL7, and so on carry multiplier credit as DXCC countries but not as call areas. Entries must be postmarked not later than June 2. For complete rules and additional information, see the February issue of *QST*.

HELVETIA CONTEST
Starts: 1500 GMT April 26
Ends: 1500 GMT April 27

Use all bands, 1.8 to 28 MHz, on CW or phone. Each station can be worked once per band regardless of mode.

EXCHANGE:

RS(T) plus three-figure serial number starting at 001. Swiss stations will also give their canton.

SCORING:

Each contact with an HB station counts 3 points. The multiplier is the sum of Swiss cantons worked on each band, 26 maximum per band. Final score is sum of QSO points multiplied by the sum of cantons worked on each band.

ENTRIES & AWARDS:

Certificates will be given to the highest scorer in each country. USA and Canadian call areas are considered as separate countries. Logs must be postmarked not later than 30 days after the contest and sent to: TM USKA K. Bindschedler

Results

YL ANNIVERSARY PARTY, 1979
COMBINED SCORES CW & SSB

Station	*CW*	*SSB*	*Total*
N1YL	1,728.0	12,006.0	13,734.0
WD5FQX	297.5	10,296.0	10,593.5
WB4PRM	2,200.0	5,812.5	8,012.5
KI4W	552.5	5,757.5	6,310.0
WA2NFY	567.0	4,263.0	4,830.0

WINNERS
Corcoran Award (plaque)—N1YL
Hagar Award (cup)—VK3KS

YLAP SSB CONTEST		YLAP CW CONTEST	
DX		DX	
DJ1TE	10,780.0	VK3KS	637.5
DL1MS	9,690.0	LZ1QG	506.25
G4GAJ	6,944.0	DF2SL	228.0
DK5TT	4,407.0	YC1BZ	212.5
DK9ZL	4,112.5	DK5TT	152.0
G4EZI	3,636.0	JA1AEO	32.0
North America		*North America*	
N1YL	12,006.0	WB4PRM	2200.0
WA1KKP	10,647.0	N1YL	1728.0
WD5FQX	10,296.0	K1QFD	1674.0
WB2OHD	9,821.0	W8YL	1248.75
K6KCI	8,387.0	N9AIB/4	968.75
KA5AZT	6,875.0	W3CDQ	621.0
WB9ZBE	6,519.0	WA2NFY	567.0
K6DLL	6,490.0	KI4W	552.5
W2GLB/5	6,270.0	W2HFR	546.0
W8DUV	6,042.0	WDØELR	525.0

Results

1979 CAN-AM CONTEST
TROPHY WINNERS
Canadian Champion Combined—VE5DX
American Champion Combined—K6LL/7
Canadian Phone Trophy—VE7BGK
American Phone Trophy—AG7M
Canadian CW Trophy—VE7CC
American CW Trophy—N4ZZ
Multi-Operator Champion—VE4VV
Club Competition—Ontario Contest Club

SINGLE-OPERATOR

Canadians		*Americans*	
	Phone		
VE5DX	952,271	K6LL/7	870,177
VE7BGK	872,894	AG7M	550,368
CZ6OU	506,106	WB4OSN	385,530
VE3BVD	435,860	N4TO	249,291
VE3DLR	214,985	AG9S	194,850
VE3KZ	112,922	NØAQK	144,275
VE7VX	95,694	WA6TOE	139,018
VE3DUS	73,140	NØJW	127,310
VE1CCC	58,520	KB5FU	126,799
VE3DAP	52,576	WAØLKL	108,675
	CW		
VE5DX	598,000	K6LL/7	371,424
VE7CC	560,637	N4ZZ	324,213
VE3BVD	411,382	N7ZZ	313,110
VE3KZ	379,638	AA6DX	280,692
VE1AIH	233,920	KØJW	275,500
VE3DAP	178,924	N4TO	265,000
VE3DZV	166,553	AG7M	250,101
VE1BGD	129,168	WB4OSN	243,945
VE1ANU	117,180	WAØLKL	241,428
VE8TM	105,164	N4OW	220,968
	Combined		
VE5DX	1,550,271	K6LL/7	1,241,601
VE7BGK	872,894	AG7M	800,469
VE3BVD	847,242	WB4OSN	629,475
VE7CC	560,637	N4TO	514,291
CZ6OU	506,106	WA8LKL	350,103
VE3KZ	492,560	N4ZZ	324,213
VE1AIH	233,920	N7ZZ	313,110
VE3DAP	231,500	NØAQK	307,084
VE3DLR	214,985	AA6DX	280,692
VE3DZV	166,553	KØJW	275,500

MULTI-OPERATOR

Phone		*CW*	
VE4VV	562,122	VE4VV	561,144
VE2FU	526,962	VE2FU	427,630
VE1AWN	434,076	VE1DXA	312,660
AA6DX	403,970	VE1AWN	302,220
VE1DXA	398,497	N4UF	231,168
N4UF	377,460	VE3UDO	185,283

CLUB COMPETITION
Ontario Contest Club—1,662,754
South Florida DX Assn.—1,620,716
Halifax ARC—1,062,257

HB9MX, Strahleggweg 28, 8400 Winterthur, Switzerland.

Canton abbreviations are: ZH, BE, LU, UR, SZ, OW, NW, GL, ZG, FR, SO, BS, BL, SH, AR, AI, SG, GR, AG, TG, TI, VD, VS, NE, GE, and JU.

H26 AWARD

For contacts made after January 1, 1979.

Send a list and QSL for each of the 26 cantons worked on CW and/or phone, RTTY, and SSTV to: Walter Blattner, Postbox 450, 6601 Locarno, Switzerland.

USS NORTH CAROLINA MEMORIAL STATION

The Azalea Coast Amateur Radio Club (WD4ORA) will be operating from the battleship *USS North Carolina* Memorial, Wilmington, North Carolina, on April 12 and 13 from 0930 to 1700 EST. Operating frequencies will be 25 kHz up from the lower edge of the General phone bands.

QSL to ACARC, PO Box 4044, Wilmington, North Carolina 28403. SASE, please.

Looking *West*

from page 10

remains the same: the special allure of the rails. Now, after many years, I think I understand the meaning of the song.

TRAINS AND HAMCONS DEPARTMENT

On the return leg of our journey, the three of us spent quite a bit of time discussing rail travel and how it might be applicable to amateur radio in light of the ever increasing cost of fuel and other alternate methods of transportation. It's no secret that many amateur radio conventions, even the biggies, are suffering from the fuel crunch. As with everything else, amateurs seem to think twice before taking the family mobile for a few-hundred-mile ride these days. As we talked, an idea popped into our collective heads which I might share with you. The train car we were in holds 88 people. According to AMTRAK, they have cars that hold more but most are 88-seaters. Let's hypothesize that a fairly good convention is being planned for, say, the San Francisco area. In the old days, when gasoline was 20¢ or even 30¢ a gallon, it was nothing for southern Californians to make a long weekend trip north to such an event. Today, most of us cannot afford such a trip.

What if alternate transportation were available at a reasonable price. How about a package which included transportation, hotel rooms and convention entry fee? Here might be a chance for an enterprising convention planner to make some friends and, possibly, some extra bucks. Suppose that our hypothetical San Francisco convention rented three coach cars, a club/dining car, and a baggage car from AMTRAK. The baggage car and one coach would originate in San Diego and would be tagged onto the regular San Diego-to-Los Angeles run. Meanwhile, in Los Angeles, the club/dining car and two other coaches are loaded with the LA contingent. When the San Diego train arrives, the two cars carrying the convention-goers are added to the cars from Los Angeles and all are hooked to the regular train headed to San Francisco. When the train arrives, the planner has buses ready to wisk the new arrivals to their respective reserved hotel rooms, and when they check into the hotel, they are handed their convention ID. On the return leg, the process is simply reversed.

As an added attraction, the sponsor might get a well-known manufacturer to host the club car, set up an operational display of his equipment and let those on board operate "train mobile," and let the manufacturer pick up the entire tab for that car. Obviously, the car would probably be limited to VHF operation, but there is nothing to keep whoever is sponsoring the club car from showing his entire line of equipment. Remember, I operated using only a rubber ducky and made a myriad of contacts. Possibly it could be arranged to install a ¼-wave mag mount atop the car for even a better signal. Anyhow, if this type of package could be put together, it might well make for a rather enjoyable trip and, moreover, ensure good attendance at the particular convention. I have run my hypothetical San Francisco convention and its associated transportation, lodging and admittance package past numerous local amateurs and most agree that it sounds like fun. So, you who are planning a show in the near future might take this idea under advisement. AMTRAK does rent out cars for those who want them, and the prices I have been quoted for certain runs seem very realistic. Think about it. It might be a way to save a faltering show or add a new dimension to one doing well already.

THE CES DEPARTMENT

As many of you already know, I have been and still am deeply involved in consumer electronics. I have been since I fixed my first TV set at age five. We had a 10" RCA 630 in those days, and annually it required a 6AC7 sync amplifier. Well, television and all other aspects of consumer electronics have come a long way since that RCA 630. Today, I proudly claim ownership of a complete Sony home video entertainment center including a videotape recorder and will shortly be adding a portable Beta VCR and camera to expand on what I already have. No, I am not trying to brag. It's just that I have become as addicted to video as I have to amateur radio. Both hobbies have the ability to complement one another as was described in past columns. Anyhow, ever since it was decided to hold the winter CES in Las Vegas, I have become an annual attendee.

The train arrived on time, and we took a cab to the Landmark Hotel, where we had reservations. We had chosen the Landmark for a number of reasons, but the most important was that it was only across the street from the Las Vegas Convention Center, where the major part of CES takes place. In regard to the Landmark, I would like to express our collective sincere gratitude to the people who run it—especially to Mr. Bill Snyder for making our stay a most enjoyable one. I'd recommend that hotel anytime, especially if you are attending CES without access to an automobile. For a real treat, the next time you go to Las Vegas, have dinner in their skytop restaurant. It has a most breathtaking view of the city, especially at night. Also, the prime rib is terrific!

Enough about the frills; on to the 1980 winter CES. Though I have no official figures as to attendance, it seemed a little less crowded this year. I judge this mainly by the much smaller crowds at the food lines and smaller groups around each booth. Also, the overall atmosphere seemed far more businesslike than in years past; however, this is only a personal observation. For the second year in a row, home video and video-related products were in the forefront, followed closely by home audio, telephone equipment, and auto sound (auto radios, tape players, etc.), with personal radio communications taking a back seat to just about everything else. To my eye, it appears that CB has lost a lot of ground and, most unfortunately, has taken amateur radio along with it.

Last year, I estimated that amateur radio and amateur-related products accounted for around 1% of what was shown. This year I would say that it was down to about .1%—maybe less—not that CB fared all that much better. It appears that CB radio manufacturers are wising up and concentrating on making a smaller number of superior-quality radios rather than hordes of poor ones. Many of the new CB sets are very advanced and feature such niceties as microprocessor control, digital readouts, better quality receive and transmit audio, and, in general, a better, more professional look about them. Low-end merchandise was scant when compared to mid-market and top-end radios, with a definite emphasis on SSB. As the year progresses, you will see what I mean as these new models start appearing in local stores.

On the amateur radio scene, there were a few companies such as Antenna Specialists, Avanti, Midland, Fijitsu-Ten, Pathcom, and others who either showed amateur radio products or at least had information to hand out regarding them, but the numbers that we had last year were definitely down this year. In no way do I blame the manufacturers for this. Actually, if there is a "blame" at all, it must be laid at the feet of the overall economy of the nation

right now. Some of the smaller companies probably couldn't afford it this year, I suspect.

There were no amateur radio magazines with booths this year. During 1979, Cowan Publishing divested itself of *CQ*, and though they were in attendance, they were showing only their CB and industry-related periodicals. *CB Magazine* also had a booth, manned by the magazine's new editor, Gordon West WB6NOA. Under Gordon's guiding hand, *CB Magazine* is slowly but surely becoming a cut above anything else in its field. In the past few months, it has taken up the cause of amateur radio with regular features and an ongoing amateur radio training program as an integral part. I feel it's becoming somewhat of a "transition magazine," a publication aimed at the CBer who wants more than just ratchet-jawing on channel 19. Gordon, along with Leo Sands, is doing some truly amazing things with *CB Magazine*. They're going in directions that no CB magazine has ever gone before and are seemingly meeting with a positive response. I personally wish them well in their new direction. They were the closest thing to an amateur radio oriented publication to be seen at CES.

Another publication which drew a lot of interest was *Omni* magazine. *Omni* had two attractions named "Omni" and "Huggy." Both were robots who roamed the convention floor, stopping now and then to chat with passersby. Needless to say, they drew crowds. By the way, if you are at all interested in sci-fi, science fantasy, and the like, then *Omni* is definitely a magazine you have to see at least once. I've been hooked on it since issue one. It's one of the most beautifully appointed magazines ever produced, in my humble opinion.

While people may be buying smaller, more economical to operate automobiles these days, auto sound is doing well. If people are economizing on the size of their new auto purchase, they seem to be making up for it with luxury interior sound systems. There are now high-end systems available which give close to 200 Watts rms per channel of audio with quality that rivals high-priced home stereo systems. Most of the better-quality auto sound systems now feature approximately 20 Watts per channel, digital AM-FM tuning, and built-in cassette record/play features. Again, much of the equipment shown at CES will be available quite soon.

Home video, which includes recorders, videodisc, projection television, and home microprocessors, also has come a long way this year. Many new companies are entering the market and the competition is making for some fascinating items. Almost everyone now has a full line of home video recorder/players. Last year VHS had at least a 6-to-1 margin over Beta, but that lead seems to be dwindling a bit with the introduction of the new 5-hour Beta format and extended length L-840 tape. Theoretically, the L-840 tape is not supposed to be used on anything but Beta III machines, but somebody seems to have forgotten to tell my Sony SL-7200 this fact. At least in my particular machine, I have had no problem using either it or the L-750 cartridges, but you are on your own in this one. I have spoken to others who have had problems doing what I do, and have paid a lot of bucks in repair costs. So, beware of the consequences if you try either L-750- or L-840-length tape in an older Beta I machine.

Sony now has a battery-powered portable Beta-format recorder which looks very much like a pint-sized version of their portable ¾" U-Matic EJ unit. The playback quality was excellent and this will probably be the unit I will procure later this year. They also have a neat little roll-around cabinet that houses the recorder, a switcher/character effects generator, and accessories for the system. It is literally a compact roll-around mini home-production facility. Add a camera, and you are ready to go make some rather professional-looking home movies . . . er . . . tapes. Speaking of color cameras, Sharp had a real knockout with its XC-32OU. Now, this is not a cheapie camera by any standards. It was meant for industrial and EJ use, and was only recently made available in Sharp's consumer line because the company saw a growing trend by home video enthusiasts towards higher quality reproduction. The XC-32OU is a 3-tube camera, which means that it has separate red, green, and blue pickup tubes. In this camera, the tubes and optics for them are mounted in a pre-aligned sealed unit, thus affording minimal registration readjustment over prolonged time periods. It boasts a horizontal resolution of 500 lines at center and a vertical resolution of 400 lines at center, in addition to a 46-dB S/N ratio at standard 2,500 lux, F4, 3,200 K illumination. The camera weighs only 9.9 pounds, though it is bigger than most home cameras, measuring 5.2" wide by 14.76" long by 7" high. The best part is the price. The Sharp rep at the booth told me that a complete package, which included AC adapter, an F2, 8X lens, 1.5" electronic viewfinder, pistol grip, and shoulder pad, could be purchased for under $5000. Other accessories including a 4" electronic viewfinder and a shotgun-type mike are also available. Needless to say, I was very impressed by the XC-32OU. It's definitely a cut above the average single-tube camera at a price that's only a little more than the cost of a top-line single-tube unit.

Computers and microprocessors abounded this year. It's no secret that everyone, including the "Big 3" department store chains, is getting into the home-computer business, but they are not alone. This year you will be seeing many traditional home entertainment companies offering their version of the home computer as another add-on to the TV set. Many of these are both utility- and entertainment-oriented, with the ability to do the "books," keep track of the bills, and also play a myriad of games. By the end of 1980, I suspect that the term "mini-floppy" will be a part of everyone's vocabulary. Both Apple and Ohio Scientific pulled large crowds, though the smaller companies did equally well.

So, there you have CES '80 Las Vegas. It was a good show. A bit more businesslike than in years past, but, nonetheless, a worthwhile show to attend. There were no earth-shattering developments this year, but rather a continuation of the refinement of existing product lines with a definite emphasis on high-end merchandise in all aspects of consumer electronics—a definite indication that today's consumer wants better quality for his dollar.

DATELINE: IRAN

Alan Kaul W6RCL is a field producer for the NBC Network News. He was among the 100 US journalists sent to cover the Iranian situation, and was among those that Iran expelled when it ordered all US journalists out in January. Upon his return to Los Angeles, Alan filed the following report for the Westlink News about amateur radio in third-world nations in general and Iran in particular. It was first played the week of January 20th, and I am reprinting it here for those of you who do not hear the Westlink News on your local repeater.

"It's difficult to say what's happening to amateur radio in third-world countries such as Iran. Under the Shah, American hams were encouraged to bring in equipment and apply for licenses, but native Iranians with ham tickets probably numbered fewer than a dozen. Also under the Shah, Iranian citizens who wanted to own shortwave receivers could, provided that these radios were not equipped with beat frequency oscillators. A young man I met who owns such a radio said that the secret police there didn't realize what he had, because when he bought his radio, he wisely purchased a shortwave set which had a built-in cassette player and a not-so-noticeable bfo.

"When you drive through Tehran these days, you see a city of more than three million people, but you don't see a single amateur-only antenna. There are no quads and no beams; nothing to advertise that a ham lives here or there. Yet, I was told that there are six licensed amateurs in the country and that their equipment is either home-built or purchased from Americans who made hasty departures during the revolution a year ago. One ham I met, who was licensed in another third-world country, told me that he has tried unsuccessfully for 4 years to obtain an Iranian license. He's just about given up hope. There's no such thing as reciprocal licensing these days.

"Unlike Islamic Jordan, where amateur radio is encouraged and even propagated by government-sponsored radio clubs, there is nothing comparable in Iran. Officially, the government seems to be moving toward the dark ages. That's because the government's official position is

that modernization is bad. So, don't look for things to get any better, don't look for reciprocal licensing, and don't look for permission for a DXpedition."

220 ON THE MOVE DEPARTMENT

While two meters continues to stagnate in southern California, plagued by ever-increasing episodes of malicious interference and seemingly endless rounds of on-the-air profanity sessions, things on the 220-MHz band are moving quite smoothly. Unlike two meters, where repeater owner-operators are an unseen commodity, the opposite holds true on the 220-MHz band. Repeater owners are usually active users on their systems and available for consultation by user groups. In my five years on that band, I have yet to hear a single profane word uttered or witness a massive attack against the established norm by outsiders who want things their way. Simply, the inhabitants of 220 won't tolerate the false "liberation" that these windbags who now plague two extoll. But 220 has something going for it that two meters hasn't: intercommunication between all aspects of the spectrum's usership. This intercommunication comes in the form of an organization known as the 220 MHz Spectrum Management Association of Southern California.

Unlike its two-meter counterpart, which has only a handful of repeater owners and a small number of users as members these days, the 220 SMA continues to grow and widen its scope. From the outset, the 220 SMA was a "spectrum users" organization, and this led to a rather tightly knit operation. While FM and repeater people make up the majority in numbers, they do not dominate the organization. In fact, 220 SMA was structured in a way that permits no one person or special interest group to dominate either that organization or the band. By and large, they are a highly technical organization which places politics in a secondary position, and technical advancement, rather than political prowess, has been the key to successful development of the 220 band for all modes and all users.

At a recent meeting, the 220 SMA came forth with a proposal to establish two national weak signal CW/SSB calling frequencies. They are 220.01 MHz and 222.0 MHz. The reason for two channels is simply that amateurs on the east coast prefer 220.01 for such operations, while out west, 222 has taken root as the home for such operations. By establishing both, the needs of all amateurs can be met, while, at the same time, both coasts and everyone in between will know where to look for such activities.

Another 220 SMA recommendation is the establishment of 223.74 MHz as a national ASCII and packet radio calling channel to give amateurs who are oriented toward such communication a reserved spot in which to operate and locate one another. While it may be a year before the first ASCII stations are in operation, nonetheless, the 220 SMA feels that now is the time to plan for the future and avoid a crisis situation later on. By far, the 220 SMA is the leader in the development of the 220-MHz spectrum. They fought hard to protect it against Class E CB, fought for its survival at WARC, and are now working toward its overall technological development under the guiding hand of its current chairman, Ray Von Neumann K6PUW. So, while two meters wallows in the mire of its own decay, searching for a solution to problems it brought to itself by the uncaring aloofness of those who own and operate repeaters, by those who shun any organized attempt to change things by again becoming active in their spectrum management organization and taking an active part in the efforts to rid both two meters and the amateur service of those who willfully violate the terms of their licenses, the 220 band moves ahead quietly and on sound footing, picking up the pieces and continuing where two meters left off. The technology of tomorrow is on 220.

LINEAR TRANSLATION DEPARTMENT

Northern California now has an operational two-meter inband linear translator. The following report from Neil Lewis WB6VIV tells the story:

"On Sunday, January 6, 1980, narrowband communicators activated a 2-meter SSB-CW linear translator. The SSB-CW translator, with a 600-kHz offset, is being operated at an interim site in the hills of Oakland, California, approximately 800 feet above sea level. Signal quality reports from amateurs throughout the San Francisco Bay area were excellent. The 100-milliwatt translator was also worked by stations in the San Joaquin-Sacramento Valley and Sierra Nevada Mountains. The translator was even worked by a station over 100 miles away. This demonstrates the efficiency of narrowband communications. The system is working great, far better than our wildest dreams. Sunday was a very exciting day for all of the NBC members who worked so hard on this project. WB6JNN deserves much of the credit for designing and building the 2-meter linear translator circuitry."

DX

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N9MM, W0SR, and VE3QA. Board liaison is W4UG and HQ liaison is W3AZD.

Speaking of the ARRL Board of Directors, they met in Hartford CT on January 17 and 18, 1980, and several topics of interest to the world of DX came up. Referring to the official meeting minutes, here are the items directly affecting us DXers:

9. Noel Eaton, who led the IARU WARC team, has been elected to a newly created office—International Affairs Vice President. Noel is VE3CJ.

11. Membership Affairs Committee Chairman Wicker reported "thumbs down" to the July, 1979, "100 IARU Countries Award" proposal.

20. Contest Advisory Committee Board Liaison Olson "commented orally on changes in the 1980 DX Test rules which he felt were not made in compliance with Standing Order 65 and which accordingly *should be reexamined after the 1980 Test*" (emphasis added).

21. DX Advisory Committee Board Liaison Milius gave the DXAC report.

33. W0BWJ was elected First Vice President and W4RA was elected Vice President. Both are DXers.

40. President W2HD is to appoint a committee to study possible uses and subdivision of the new 10-MHz amateur band and report at the July, 1980, Board meeting.

44. On Director W3KT's motion, the Board unanimously directed the general manager "to announce in the next possible issue of *QST* that the rules for the ARRL DX Contest will be reexamined for possible restoration in whole or in part to their previous status and that *comment is solicited* prior to June 15, 1980" (emphasis added).

45. The Membership Affairs Committee will study and report on "consideration be given to the publication of a bi-weekly DX publication by the ARRL."

55. The Membership Affairs Committee will study the incoming QSL Bureau organization; its objective is to increase efficiency and decrease workload.

61. The Plans and Programs Committee is to study petitioning the FCC to change the 20-meter phone allocations as follows: 14150-14350 Extra Class; 14175-14350 Advanced; 14200-14350 General.

65. President W2HD is to appoint a special committee to formulate guidelines for combatting the increasing malicious interference on the amateur bands.

78. QSL Bureau managers are authorized $4000 total for travel to hamfests, etc.

87. Dave Bell W6AQ, who is chairman of the committee organizing this year's Fresno Convention in April, for his work in making amateur radio films for the public, was awarded the title "The Cecil B. DeMille of the airwaves."

89. President W2HD was directed to "seek the elimination of the existing restrictions on operations in the 1.8-2.0 MHz band at the earliest possible date" (in light of the fact that LORAN-A in Region 2 will be gone no later than Dec. 31, 1982).

Between December, 1978, and May, 1979, and again from August to December, 1979, JA7JT operated from Ogasawara Island as JA7JT/JD1; he made 9435 contacts. In be-

Call	Via	Call	Via
AP2AD	K1KNQ	T3LA	W7OK
AP5HO	N0RR	UK1PGO	UA1OSM
AH8A	WD5EKM	VK0KH	VK5WV
A4XGY	K2RV	VP1KT	WB4INC
A4XID	G8HOR	VP2AG	WB2TSL
A7XA	DJ9ZB	VP2ML	K1RH
CN8AK	WA3HUP	VP2VDU	WD8BVG
CT2CB	KB5GL	VP2VEJ	WB3KGY
CX5RV	G5RV	VP8AI	WD4AHZ
C5ACG	K4YT	VP8QG	WA4JQS
VE2WI/C6A	VE2UN	VP8WA	WA4JQS
DU6RH	W7HPI	VQ9DM	K1BZ
WB5LBJ/DU2	W7HPI	VQ9KK	WA3HUP
W7LPF/DU2	N2CW	VQ9TC	W3HNK
OK3TAB/D2A	OK3ALE	VR6TC	W6HS
D68AP	WB2OHD	VU2CK	K3GL
EA8OR	DJ6JI	VU2KMK	N7UT
FB8XV	F5VU	VU2RX	W2LOG
FB8ZO	F6EYB	VU2UH	SP9AJT
FG0FJD	W2GHK	VU2XX	VE3HDC
FG7AS	W7RUK	XT2AU	WA1ZEZ
FK8CR	W7OK	XT3AA	ON5GN
FM7WE	K4FJ	YB9X	JA1UT
FY7YE	W5JLU	YK1AN	DJ9ZB
HC5EE	K8LJG	ZB2BL	W9JVF
HC8GI	W3HNK	ZB2EO	K3MNW
HH2VP	N4XR	ZD7HH	W4FRU
HI7XWL	W2GHK	ZF1MA	VE3GCO
HK0BKX	WB4QFH	ZF1MT	K9XJ
HL9UX	WA4RVO	ZK2VE	W7PHO
HP2XRX	WB2DCP	ZS2MI	WA2IZN
HS1ABD	K3EST	3D6BP	W1OX
HS5AID	AG6D	3D6BW	G4AVA
HZ1AB	K8PYD	4S7DA	W3HNK
JT1AN	W7PHO	4S7DJ	W4BAA
J3AAG	K1EM	4U1UN	W2MZV
J3ABX	DF3GX	4Z4US	WA2KGY
J6LCT	WA1ZXF	5B4IJ	OE8HFL
J6LIM	VE2EWS	5H3FW	DF4TA
KC4AAC	K7ODK	5L1A	WA4DPF
KC4USR	K9VFY	5L2AV	N6FL
KC6MJ	W7PHO	5N0DOG	W4FRU
KG6SL	WA6AHF	5T5AY	W4LZZ
KH2AD	W6TPC	5Z4AA	OE6MBG
W6ENK/KH4	WB9MFC	5Z4YV	JA2AJA
K6LPL/KH5	K6LPL	5Z4YW	VE3ACY
WA2FIJ/KH5K	WA2FIJ	6W8AR	WB4LFM
W8NMK/KH0	K4AVU	6W8DY	VE4SK
KP2A	WB2VFT	7Z2AP	I8YCP
KV4AA	K6PBT	WA4LRB/8R1	N4BPP
KX6PP	WD4NVH	K9EF/8R1	K1RH
OY5NS	W3HNK	9G1AP	I0LCJ
OY9J	K2IJL	9H1ED	WA1YYX
PZ2AC	WB4RRK	9H4L	W3HNK
P29DI	W4KXF	9H79EU	9H1EU
VE3BVD/ST2	VE3FRA	9H79GL	W3HNK
S2BTF	W5RU	9J2TJ	N8JW
TA2KS	G3SCP	9N1MM	N7EB
TF3YH	WA8AEE	9Q5GB	W7KTI
TG9ML	K5BDX	9V1TK	JA6RIL
TR8DX	F6ESH	9V1TX	N5FN
TZ4AQS	ON6BC	9X5LG	DL8AO

QSL Managers—Lists of QSLing information are available everywhere, and we do mean everywhere. We have tried to make this list useful in a special way by listing stations actively worked on the bands during the month of January. This should become a regular part of this DX *column in* 73. *You will note some listings which are the same as they have been for years. The idea is to provide you with useful information for your recent DXing.*

tween, a stint from Minami Torishima yielded 3570 QSOs, broken down as follows: 628 in North America, 30 in South America, 49 in Oceania, 444 in Europe, 14 in Africa, and 2,405 in Japan (many there on 6 meters).

Many strange callsigns began filtering out of the U.S.S.R. around the first of the year, beginning with the letter R or with the letter U followed by a numeral. Some of the special calls are in preparation for the Olympic Games to be held in Moscow this summer, while some are for centennials of various cities in the Soviet Union. The only way to figure out where the station is located is to ask (just like in the U.S. after the FCC finished eliminating all geographic significance of callsigns).

Those on the Newington staff responsible for the changes in the ARRL International DX Competition (just run in February and March) came under fire at the January Board of Directors meeting. *QST* was ordered to run a prominent announcement of solicitation of comments concerning the changes so an evaluation can be made before the 1981 affair. The new rules for this year's Contest appeared on page 94 of the December, 1979, *QST*. They bear reading carefully with consideration being given to whether the DX contesters of the world want another contest which is essentially a carbon copy of the *CQ* Worldwide DX Contest, which has run in October and November for 30 years.

Oh, yes, during the *CQ* CW Contest last November, PJ2CC set a new world record in the multi-transmitter class, with 11,786 contacts, 154 zones, and 522 countries. Operators were K4BAI, W1BIH, W1GNC, K3EST, WB4SGV, K3KU, K4VX, and YU3EY/KA3EHD. QSLs to K4BAI.

New operators from Equatorial Guinea are Alberto 3C1AB and friends 3C1s NE, NM, and JP, all operating from the same station.

All the information for this column was from *The DX Bulletin* out of Vernon CT. Please send input for this column c/o *73* . . . especially photos and guest editorials. Thanks, and good DXing!

Awards

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made available to all US and foreign amateurs for two-way communication in the separate award areas. All modes of communications are accepted with the exception of those contacts via repeater.

All awards have a fee of $1.00 each or 6 IRCs. GCR apply. Apply by sending your list of contacts to: Certificate World, Rt. 2, Box 72, Fulton, Mississippi 38843.

THE OLD SOUTH AWARD

This certificate depicts a scroll listing the ten states of the Old South. It is awarded for contact from each of the states of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

OLD MAN RIVER AWARD

A certificate picturing the mighty Mississippi River and the ten states bordering the river can be yours for contacting the states of Arkansas, Illinois, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Tennessee, and Wisconsin.

MISSISSIPPI STATE AWARD

If you thought your first Mississippi QSO was hard to get, try making a total of ten to earn this award. A state outline and statistics add up to an interesting award for your hard work.

CAPITOLS OF THE UNITED STATES

This one will not come easy. You must have two-way communication with all 50 US state capitols plus Washington DC. Fifty-one QSOs will earn you an award listing some facts about the US Capitol and proof of a lot of hard work and fun.

There's a good chance you may have already qualified for some of these awards. If not, good luck on earning them. Let Certificate World hear from you and be sure to tell our friend Stu WB5ULD that you read about it in *73 Magazine*'s Awards column.

SMIRK AWARDS

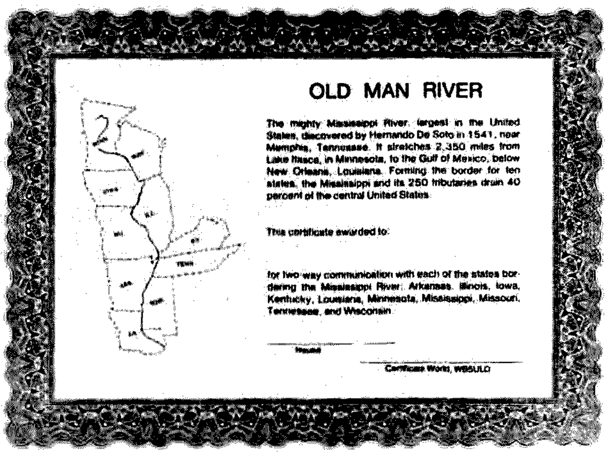
Ray Clark K5ZMS, representing the Six-Meter International Radio Klub (SMIRK) has forwarded some very impressive achievement awards for fellow six-meter enthusiasts to pursue.

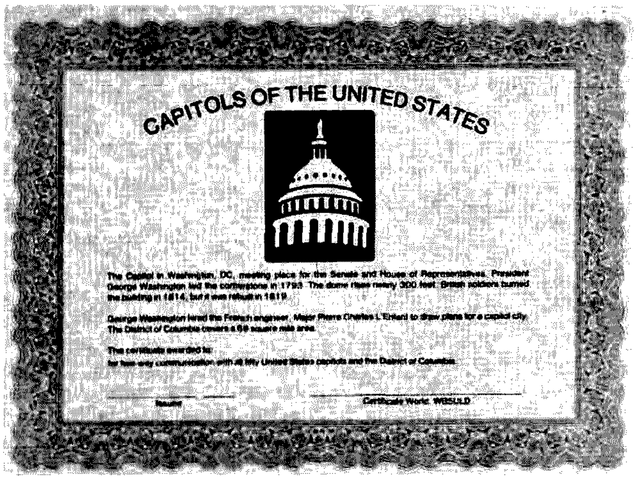
To become a member of SMIRK, applicants must make 2-way contact by any normal emission with other members of SMIRK. US stations must fog 6 contacts, while stations outside the US must log at least 3 member stations. All contacts must be made after October 14, 1973. Once this is accomplished, forward your claim along with $4.00 for a lifetime membership certificate.

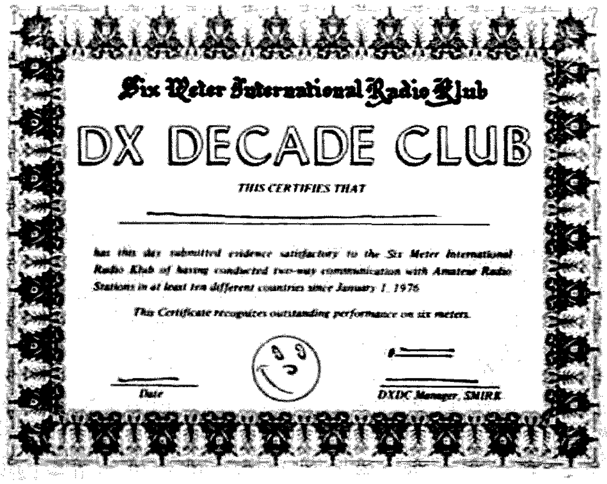
Once a member, you then become eligible to apply for the other awards sponsored by this six-meter group. Separate awards are given for making contacts with 100, 250, 500, and 1000 SMIRK members utilizing the same guidelines as already mentioned. Cost is free to members of SMIRK.

And for those who want the ultimate challenge on 6 meters, SMIRK offers the DX Decade Award for having contacted ten DX countries on six meters. Endorsements are given for 15, 20, 25, etc., in increments of 5 DX country contacts.

To apply for the DX Decade Award, list all logbook information and enclose $3.00 for ten countries and $1.00 for each 5-country endorsement seal being applied for. For all correspondence with the SMIRK group, write: WA1KYH, SMIRK Award Manager, 18 Laurel Drive, Medfield MA 02052 USA.







New Products

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ment and retains up-scale accuracy. The accuracy of the model 4381 is ±5% of nominal full scale and the vswr is a low 1.05 max to 1 GHz in 50-Ohm systems. *Bird Electronic Corporation, 30303 Aurora Road, Cleveland (Solon) OH 44139.* Reader Service number 477.

THE BULLET ELECTRONICS SE-01 SOUND EFFECTS GENERATOR

As a boy, the ability to make the sound of a six-shooter or of a machine gun was a prerequisite for growing up on the west side of town! Today's children, however, do not need to strain their vocal chords; instead, they can use the Bullet Electronics SE-01 Sound Effects Generator.

The SE-01 is a complete sound effects kit which is built around the Texas Instruments SN76477 integrated circuit. The SN76477 is a complex sound generator which employs analog and digital circuitry in one 28-pin dual inline package. The chip includes a noise generator, a voltage-controlled oscillator (vco), and a super-low-frequency oscillator (SLF) which, when coupled with a noise filter, a mixer, attack/decay circuitry, and associated control circuitry, can produce a wide variety of entertaining sounds. So versatile is this chip, in fact, that it finds major applications in such equipment as arcade and home video games, as well as in a number of home and industrial timers, alarms, indicators, and controls.

While the SN76477 is readily available (e.g., from Radio Shack), only Bullet Electronics appears to offer a complete kit of parts with which to exercise this chip. Thus, I didn't waste a minute in securing the SE-01 kit!

The kit comes complete with a compact printer circuit (PC) board and all of the parts necessary (except for the battery and a speaker) to utilize the functions in the SN76477. Included in the kit are numerous switches and potentiometers which allow the user to program various sounds. The kit also comes with a complete set of instructions on how to build the kit as well as with documentation on tests to be performed to ensure that the kit has been properly assembled.

The components are of high quality, though the markings on a few of the capacitors were somewhat inadequate. Nevertheless, the kit went together quickly (even given the fact that my 9- and 11-year-old daughters did most of the soldering). Best of all, the kit worked from the first time it was turned on.

Our first attempts to program sounds such as white noise and a siren were highly successful and only served to whet our appetites! Thus, it was not long before the room was filled with the sounds of birds, running water, a rapid-fire ray gun, a horse galloping, and a two-tone warble. Other sounds followed and included a steam train (with whistle) and a female scream (the girls' favorite!).

But the fun did not stop there. By experimenting with the controls, we discovered that we could make the sound of a person walking or running through a grassy field. And delight of delights, the burning of a little midnight oil produced the sounds of a two-engine airplane (one could hear the engines beating against one another), a machine gun, and the screaming dive of an airplane out of control.

Because of the chip's unique capabilities, a cult of sound-effect addicts has developed among the users of the SN76477. This group is best represented, perhaps, by the SE-01 Users Group. Using Bullet Electronics as a clearinghouse, the users group will share information on the kit and the sounds it can produce through a set of published notes. Information on the Users Group is included with the SE-01 kit.

The kit, including a 5% shipping charge, sells for $17.80, and it makes a fine little project for those cool spring nights... that is, of course, if you can get the kit away from your children! The SE-01 Sound Effects Generator is available in kit form from *Bullet Electronics, PO Box 401244-A, Garland TX 75040.* Reader Service number 12.

Theodore J. Cohen N4XX
Alexandria VA

Review

1980 RADIO AMATEUR'S HANDBOOK
American Radio Relay League, 1979

By now most amateurs have probably recovered from the shock they suffered when the new, large size, revised 1979 ARRL *Radio Amateur's Handbook* appeared. The 1980 version of the *Handbook* does not outwardly appear much different than the 1979 edition, but as the new look continues into a second year, more refinement and a few changes in content can be found. The price of the 1980 *Handbook*, like just about everything else, didn't stand still. Ten dollars is the list price for the fifty-seventh edition, up 25¢ from 1979.

Inflation may not be entirely to blame for the price increase, since this year's *Handbook* is slightly longer and has what is advertised as better paper. Among the other improvements a sharp reader might notice is improved layout and graphics. Highly detailed diagrams have been enlarged while less important sketches have been shrunk. The fuzzy photos that plagued last year's edition are gone, and the only smeared artwork is a printed circuit template in the chapter on VHF and UHF receiving.

As the "standard manual of amateur radio communications," the new edition is expected to contain information about the components and circuitry used in state-of-the-art gear. Discussion of digital logic is still limited to a few pages and there is no mention of the microprocessor and its role in amateur radio. Several construction projects make use of digital logic, but the League has not recognized it as an important part of the current technology. Most of the new gear is digitally oriented, yet the ARRL has made little effort to universally educate its members to this trend. In other areas, the *Handbook* does try to stress recent innovations. The 1980 edition has a section on the use of VMOS field-effect transistors and a discussion of high-performance receiver design. Technically-minded hams may also find the design tables for Chebyshev filters useful.

Many hams were dismayed by the deletion of all the material on "specialized communications techniques" from last year's ARRL guide. The editors apparently decided that such modes as RTTY, slow scan, and fast scan amateur television are indeed legitimate amateur pastimes and they once again have a special place in the *Handbook*. The discussion of satellite techniques has been greatly expanded and improved, perhaps in expectation of interest in the AMSAT phase III program. ATV has been allotted several additional paragraphs with schematics and block diagrams, but the SSTV and RTTY sections no longer have descriptions of home-brew gear.

Several chapters have been heavily edited and projects that were favorites in the past have been replaced by ones seen recently in *QST*. These changes are especially noticed in the sections on antennas and mobile/portable operation. The tube and semiconductor tables that were conspicuously absent in last year's *Handbook* have been reinstated. Special emphasis is given to rf and low-noise transistors, and, for the first time, a package overview diagram is included.

Providing a book that covers all aspects of amateur radio is not a simple task. The diverse nature of the hobby combined with the inevitability of rapid technological change makes the *Handbook* susceptible to criticism from all sides. The 1980 *Radio Amateur's Handbook* shows that the shortcomings of previous editions can be remedied and that a practical, up-to-date, comprehensive manual can still be published.

Tim Daniel N8RK
Terre Haute IN

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

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ing equipment to work on the new modes. I don't have any delusions that we will be plunging into the new modes in strength this year . . . I think it will take several years, as it did when I promoted FM and repeaters. But I do think that the new modes have as much possibility for popularity as FM and that they will bring a new bunch ot fun to amateur radio.

In all, the Ham Industry Conference was a fine opportunity for manufacturers, dealers, and the media to get together and talk at length, getting to understand each other's problems, getting ideas, mulling over the things which have not worked, and agreeing to work together toward a better amateur radio in the future.

SCHEDULED TALKS

The first talk I have scheduled for 1980 is at the Baltimore Hamboree and Computerfest at the Maryland State Fairgrounds at Timonium on March 30th. The only other talk so far scheduled for 1980 is at the Tri-City Hamfest in Pasco, Washington, in June.

That's right . . . nothing planned for Dayton, Atlanta, St. Louis, and points north and south for this year. It's not a question of not being asked in most cases; it's a matter of the time involved. Despite claims to the contrary from Connecticut, I *am* human and find that there are only so many things which I can do in a given amount of time.

If I were to plan to get to more hamfests and conventions, this would take away from the time which I perhaps could better spend on working towards the development of the new ham communications modes . . . working with the FCC toward better regulations . . . working towards developing amateur radio in some more developing nations. The demands of my three monthly computer magazines and the very rapidly growing software publishing business, which is worldwide in scope, are formidable.

After thinking quite a bit about the new ham bands which have generated so much enthusiasm, I suspect that they will be of minor importance because of their narrow width and thus their inability to support much ham activity. There are several other developments which seem to have vastly more to offer the 99% of us who won't be able to get a word in edgewise on the new bands and I'll be working toward developing these ideas.

To those amateurs who feel that because we came out of WARC okay, the end justifies the means, I'll have some words at my talks. I feel that we have been granted a blessed reprieve and that we should not squander it on the usual backbiting, which seems to be in vogue right now. We should use the time we've won to make sure that amateur radio has an established place in the spectrum for all time. It's time we started working seriously toward getting back, if possible, satellite allocations so amateur radio can successfully cope with the communications needs of the '80s and '90s. In just one generation, it will be the year 2000, and how much planning has been made for amateur radio at that time?

I'm working with my community toward developing the town and services that we want Peterborough to have in the year 2000. This means planning for growth in housing, business, roads, water, sewers, and all of the regular community services such as snow clearance, police, hospitals, fire, etc. It is an exciting project and it has many parallels with the need for planning for amateur radio growth, new modes, technological advances, and (perhaps most important) ways to get the FCC to provide us with rules which are needed and in a timely manner.

In the computer field, I've given talks for several years on the economic opportunities this exploding industry is providing. This has not abated and the opportunities are even better than before . . . which I probably will be talking about at both Maryland and Washington . . . if you're interested. The real growth in the microcomputer industry is just now getting started and the opportunities to make really big money are just sitting there, waiting for entrepreneurs to grab 'em.

At my June talk, I'll be revealing, for the first time in public, some of my plans for developing a completely new mode of ham communications. This will be a mode which I think will be as popular as FM and repeaters are today and which will generate an enormous amount of ham building and experimentation. At first we will be adding accessories to accomplish my new mode . . . but it won't be long before commercial rigs will be available with the new mode built in. This has to remain a trade secret at present, but I can give you a small hint . . . it has a lot to do with microprocessors . . . and it is going to be a lot of fun. I think it will do a lot to help generate interest in amateur radio just by virtue of the improvement it will bring to ham communications. Those few who have been privy to my ideas seem to be most enthusiastic and the general feeling is that this could well revolutionize much of amateur radio communications.

Since I have agreed to give the manufacturers who have signed a contract to keep my secrets a lead of at least six months for the design of the new equipment, I won't be able to discuss these ideas until June, at the earliest.

Dayton. At the present time it is not definite whether I will even be going out to the Dayton Hamvention this year. I skipped it in 1978, but did have a booth to sell *73* subscriptions. In 1979, I had planned on not even having a booth, but they called and had me on the program to talk about microcomputers, so we did have a booth. We have no plans for a booth this year, but I might fly out for a day just to see the manufacturers and talk with them briefly.

I gather that the slowdown in ham sales has thrown a blanket on the Hamvention and that many of the firms will be waiting for better times. Some of the dealers, heretofore at Dayton in force, will be running smaller booths with fewer salespersons, more to show the flag than anything. There may be some good bargains on esoteric equipment as dealers strain to get rid of inventory which does not move fast. With the cost of money depreciating ham gear at about 2.5% per month, dealers can no longer afford to carry items which do not sell quickly. I suspect many of them will be bringing the slow-moving stuff to Dayton with prices which should clear this stuff out.

WARC CREDITS

The initial barrage of self-congratulation is remarkably reminiscent of the orgy we experienced over the 220-MHz situation. Oddly enough, in reading reports on WARC in non-amateur journals, though I have read some very in-depth reports on what happened and "why the sky didn't fall," those most deserving credit have yet to even get a mention in the ham publications.

The key to the surprising turn away from politics at Geneva seems to involve not amateurs or their representatives, who merely benefitted from the situation, but one Frank Urbany of the National Telecommunications and Information Administration (one of the 65-member U.S. delegation) and Algeria's chief of delegation, Noureddine Bouhired. By coming to an agreement to clear out reserved, but unused, frequencies registered with the International Frequency Registration Board (IFRB), the Third World nations

were able to see substantial cooperation on the part of the developed nations in making frequencies available for them . . . and it broke the political stalemate which was about to stall the whole conference.

Algeria had been the spokesman for the Third World in pushing the concept of a 70-30 split of frequencies, with the large share going to the developing nations. The compromise on the IFRB changes got the conference off the developing political battle and on to technical matters, where agreement was much easier to attain. The published reports on WARC give credit to Urbany and Bouhired for preventing politics from getting into almost every later decision.

I hope the amateurs who had a wonderful trip to Geneva and who came back with 50 kHz of new ham bands which we may see in a couple of years or so and other frequencies which are due much, much later will now turn their efforts to helping amateur radio achieve Third World growth and thus make future conferences hinge less on strokes of good luck and more on long-range planning.

MAY IN L.A.

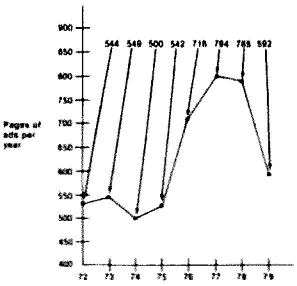
Since the National Computer Conference (NCC) will be in Anaheim again this year, I'll be in the L.A. area around May 20-25th. If there are any clubs which would like to cook up a special meeting for an evening of creative thinking about amateur radio, get in touch and let's see what we can organize.

This is also an invitation for my old friends in the area to plan to come out to a dutch dinner with Sherry and me on Wednesday the 21st, 8 pm, at the Red Onion in Palos Verdes. This is a ham-run restaurant with one of the best Mexican cuisines I've found. It is an old favorite with Sherry, who lived in Palos Verdes a few years back. In order to make sure that we have table room, please drop me a note or give me a call and let me know that you are going to be there.

WHAT HAPPENED AT HR?

Much as I deplore the politics of *Ham Radio* magazine, I do hate to see them going into what appears to be a terminal nose dive. The hobby needs a publication which concentrates on abstruse design articles and *HR* has certainly filled this need for our elite.

Perhaps I am overstating the seriousness of the problem. A look at a chart of the number of pages of advertising per year for the last eight years may put this into perspective.



Oddly enough, in 1972, *HR* had more pages of ads than *QST*, but by 1979, *QST* was running almost 700 more pages of advertising than *HR*. In fact, with the exception of *HR* and its sister magazine, *Ham Radio Horizons*, most ham magazines did very well in 1979, showing good growth. What went wrong?

It looks to me as if there were a number of contributing factors. The part *HR* played in shooting down the Amateur Radio Manufacturer's Association (ARMA) soured many advertisers. This was a serious blunder. The article on how to screw ham dealers was another massive blow to advertiser confidence in the publisher. Only a handful of advertisers are still supporting the magazine.

A couple years ago, *HR* published far more construction articles, but today the magazine looks more like an engineering journal and is over the head of most hams. I like construction articles to explain the considerations which went into the design, but I balk at extensive calculus and math proofs. Did you see the matrices equations in the recent *HR* article on designing a yagi antenna?

Dealers, who are a potent advertising force, also have been very upset over the aggressiveness of the *HR* bookstore, which they feel is taking money away from them. The massive *HR* booths at hamfests selling books in competition with the dealers aggravated this situation. I think *HR* finally saw the light on that and may have stopped this scam.

When you get the dealers mad at you, they also put pressures on the manufacturers to cut advertising, so they get you twice.

Another factor which has hurt *HR* has been their limited support of repeaters. During the 1970s, the use of repeaters grew from the preserve of a few hundred pioneer hams to the most popular amateur activity in the world. While *73* was publishing hundreds of articles on the subject, *HR* was largely ignoring this revolution, with the result that most VHF amateurs turned to *73* for information. This meant that advertisers of VHF products got relatively little results from *HR* ads, particularly as compared to the same ad in *73*. About the only major VHF manufacturer presently still advertising in *HR* is one who has never tried *73*, or any other ham magazines, as far as I recall.

The torpedoing of both the manufacturers and dealers has cut advertising, which has in turn reduced the articles, and this has reduced ham interest. This is a downward spiral which is difficult to stop. Where they used to run around 80 pages of articles, now it is half that! With immediate changes in management and perhaps a new editor, things might turn around. It will be a long hard climb back up. The magazine has to be more responsive to the readers . . . and to the industry, upon which it depends for life.

DOGGIE-DOO

The other day, an article came in on the modification of a war surplus transmitter for the amateur two-meter band. I might not have paid much attention to the article if there hadn't been a photo with it of the unmodified rig . . . in the shape of . . . er . . . dog . . . er . . . well, you know.

It seems that Meshna has rounded up a bunch of little transmitters which were made for use in Viet Nam. These are in the shape of . . . er . . . animal droppings. Other similar rigs are shaped like mud or little wads of clay. When you break 'em open, you find a miniature transmitter on about 150 MHz, a stack of those little batteries we use in watches, a foil antenna, and a movement sensor. The idea was to strew these turdlets along the Ho Chi Minh Trail. They would then start transmitting when anything shook the ground, letting us know by remote receiver when any cars or trucks or even troops were moving along the trail.

The batteries are long dead, but they can be replaced and these little rigs can be used for experimenting or even for doing what they were intended to do . . . put around the house to let you know when you have unwanted visitors.

I got right on the phone and made sure that John Meshna had plenty of the rigs. Then I drove down and picked up a couple to use for further pictures and some playing around. They are certainly realistic! I keep one on my desk, on a piece of Kleenex, and you should see people shy away from it. The jokes started right away, too . . . perhaps encouraged by a bunch of QSL cards we received lately. Someone around Japan has been signing SH1T, giving the location as Crap Island and the operator's name as O. M. Turd, and telling the stations which are worked to QSL via W2NSD. We've gotten quite a few cards and were about to print up some responding cards when the new rigs arrived. If we can get an exact mailing address for the DX station, we'll send some appropriate rigs.

It is kind of a shame that some joker is taking advantage of the naivete of the Russian amateurs by pulling this dirty trick on 'em. In all innocence, they have been sending us the QSLs for working this "DXpedition."

You may be sure that we'll be wide open for further modifications of the camouflaged transmitters. They're available for $4 each from Meshna. I can think of some interesting awards for the better conversions. Let's see what you can do . . . do-do.

Having haunted electronic surplus stores for years, a visit to Meshna's was almost traumatic. I got that old feeling which resulted in me buying ten of everything I wanted, just in case. This filled up a whole barn and brought on two major auctions of all this debris. I bought parts and surplus stuff for thirty years before finally reforming. Still, I can feel the subconscious pressures to buy a dozen of this and a box of that. The Meshna store is so packed with fantastic goodies that I managed to escape only by massive use of my resolve to not fill up the car . . . and an alarmed tugging at my

sleeve by Sherry worried by the look in my eyes and the compulsive reaching for my wallet.

Just a few weeks ago, I was in New York and stopped off to say hello to my old friend Sy Denby at Metro Electronics. Sy remembers me well over 30 years ago when I used to haunt his surplus store on Cortlandt Street and buy prop pitch motors, BC-654s, and items like that. I was in there every Saturday for years. I'm sure I toted home several tons of surplus from Sy's place. In those days, I was building ham gear day and night, converting surplus, and having a ball.

My cellar ham shack eventually got so full of ham gear and parts that I had to operate my rigs by remote control from the living room . . . there just wasn't room to get into the shack any more. Yes, the visit to Meshna brought back memories. Thirty years ago, I had the time to sit down, break open one of the surplus delights, and bring it into a ham band. Today, I can just dream of that as I work on the pile of mail from readers, think up plans for dealing with the FCC, solve problems for four magazines, and try to keep up with the literature in two different fields.

FCC DEBACLE

In late January, the FCC finally adopted rules permitting the use of ASCII on the ham bands. That's the good part . . . the bad news is the restrictions.

One of these days, some outfit is going to take the FCC to task for consistent violation of the FCC rules. This rule is just another example of how the Commission violates its own rules whenever it pleases, with amateurs having no voice in the matter. What rule? As I have pointed out many times before, and have even testified before the FCC, this new rule is in direct violation of Part 97.1c.

The basis and purpose of amateur radio regulations state that the Commission has the responsibility to provide us with rules which will "provide for skills in both the communication and technical phases of the art." This means that the FCC is supposed to encourage amateur inventing, experimenting, and pioneering . . . and this new rule change certainly does not do that by even the wildest use of the imagination.

This new rule finally allows amateurs to use techniques and standards which are years old. Amateurs have not been permitted, even when requesting special temporary authority, to keep up with the commercial developments. And here we are again, just as we were when the Commission finally broke down and permitted radioteletype communications some thirty years ago, with restrictive rules which prohibit amateur experimenting and pioneering. One of the basic reasons for allowing amateur radio has been as a means to experiment and devise new modes of communications . . . new techniques. Yet these are exactly the things which the FCC prohibits.

I think that the FCC should be sued and thus forced to abide by their own regulations. Sure, they have phoney excuses for hobbling amateurs and prohibiting us from doing what the rules say we should be doing. In the name of monitoring our transmissions, the Commission has virtually brought amateur experimentation to a halt for over thirty years. I think we should sue and ask for extensive punitive damages . . . in the name of the United States . . . and in the name of every licensed amateur.

Just look at the benefits the amateur development of single sideband has brought to our country and the world! And this happened in spite of the Commission, not because of any help from it. Many amateurs have wanted to develop other novel systems of communications, but have been prohibited from even experimenting with them by the Commission. Is $10,000 per licensed amateur too little to ask for the incalculable damages we have suffered? That would come to some $3 billion and that figure just might be enough to get the attention of Congress and bring about some desperately needed changes.

When CBers caused a lot of TVI as a result of the FCC rules on linear amplifiers, who got it in the neck? CBers? You bet not . . . it was the hams. Now that CB has died down and the amplifier people have gone out of business, we are still stuck with the stupid rules which keep us from having a decent signal on ten meters.

About ten years ago, amateurs started putting on pressure to get permission to use ASCII on the ham bands. There were no good reasons for delaying this for all these years . . . just the usual glacial movement of stuff through our government agency and a complete lack of any lobby effort on the part of amateur radio to speed up the process.

So here we are with a 300 baud speed limit, and we have just barely managed to get permission for that. This in a day when 300 baud is like driving a car at 10 miles per hour. The fact is that 300 baud is even considered as ridiculously slow for telephone communications. 1200 baud phone data exchange is coming about rapidly, and radio communications should enable us to work on data links of 9600 baud and above. We are being restrained to the antiquated bandwidth limits of old AM phone signals, and I see no good reason why we should have to live by bandwidth standards which are over fifty years old in a time when new techniques might make vast changes in radio communications if they were permitted to happen.

What would happen if we took off the bandwidth limitations on the ham bands? We could insist only that all signals stay within the ham bands. Bandwidth is a function of rate of exchange of information, so what we would be doing is trading off bandwidth for time. Do we care if a signal is broad if it is only on a short time? Or are we still geared to the old concepts of stations going on the air and transmitting continuously until it is time for the other station to transmit? I think we should be able to experiment with new modes of communications . . . that we should be able to use RTTY, SSTV, FAX, and SSB on the same frequencies.

How can we come up with packet transmissions, time-slice transmissions, and other ideas which might or might not work if we can't try them out? The FCC used to be able to get off the hook on restrictive regulations by pointing out that, well, if any ham really wanted to try out new ideas, he could get an STA . . . a special temporary authority . . . and go ahead. But the FCC has routinely been denying these for the last few years, so that avenue of developing new ideas is closed to us.

Until the time that we get some clout in Washington, we are going to be so emasculated by the FCC that amateur radio will be able to provide only a fraction of the inventing that it used to be able to provide. We need a lobby in Washington which can put pressures on the Commission to get them to stop spiking the guns of amateur radio . . . pressures to let us be free.

Back in 1974, when amateurs really got fed up with the insane repeater regulations which tied us up in red tape, slowed down new repeater licenses to a point where it took months to process them, and brought the development of new repeater ideas completely to a halt, we protested with a formal hearing before the FCC Commissioners. I organized a committee representing repeater groups from all over the country which went to Washington (no help from the ARRL) and testified. The result was the biggest change in amateur regulations in the history of the Commission. Well, the Commission got a good start on the deregulation of ham radio, but they eventually stopped and a regulation era has come back again.

If we need to have another hearing, okay, we can arrange it. But I think it is time for amateurs to let the Commission know that the new ASCII rules are asinine and that we want to be free of restrictions and over-regulation. We want the Commission to get on with deregulation and to stop hemming us in with rules forcing us to use communications standards which are a generation old. We want to be able to be in the vanguard of development, not the clean-up squad.

The new ASCII regulations stink.

There is no valid reason why every FCC monitoring station has to be able to copy every amateur transmission 100%. As long as we sign our calls in a way they can copy, they should butt out of our communications. They can get their jollies on the 99.9% of ham communications which will be using time-honored standards. But if we want to try out ASCII at 3247 baud, then we should be able to. If we want to send some other digital code, leave us alone.

That's what I think . . . now the pages are open for any coherent arguments, pro or con.

CIVIL DEFENSE

The recent events in Afghan-

istan and Iran have moved the country substantially in the direction of again taking on the responsibility for opposing Russia and its expansionism. This was one of the ideas we had in mind when we bogged down in Viet Nam.

If we are going to put up some resistance to the Russian takeover of the world's main supply of oil, we have to be prepared in many ways. Oh, we can go about it in the same way we did in Viet Nam, turning to our military and asking them what we should do. If we do this, as we did in Viet Nam, we have to be prepared for their standard answer: Fight. Perhaps one of the greater problems facing our country is the lack of any high-level group dedicated to outthinking our enemies.

We have our military, dedicated to fighting enemies. We seem to have a State Department, dedicated to placating our enemies. And then we have the politicians, vacillating between the two extremes, going first one way and then the other, confusing everyone, including themselves.

Back just before the war in Viet Nam, I made a visit to the country and many of the neighboring countries. As a result, I came up with a plan for avoiding the conflict and still winning the war. I wrote this up in *73* and have had many letters of agreement on the plan, but there was no way to ever get the idea where it would do any real good. Letters to Congress didn't get beyond administrative assistants.

The basic concept was to use the time-honored system of bribing. We were spending about a half million dollars each to kill the Viet Cong. For a tiny fraction of that expense, we could have set up a toll booth on the Ho Chi Minh Trail and issued a parcel of farm land, a house, some furniture, food chits for a year, and the opportunity to get a job in a nearby factory.

The factories would make the prefab homes, the furniture, goods for export . . . and, most important, small cars for local sale and television sets. TV tamed the wars on New Caledonia. The natives had to go to work to earn money to buy TV sets and this stopped the wars. Then, the products advertised on TV meant more work, so it was an endless cycle . . . no more wars between tribes.

If low-cost cars, perhaps not much more than go-karts, were made available, most people would work their asses off to get one, and again the people would be started towards working instead of fighting. The investment to get all this started would have been miniscule as compared to the cost of fighting . . . not to mention the loss of American lives involved.

We have a different situation in the Middle East these days, but that doesn't mean that we can't come up with some ways of outsmarting the enemy instead of trying to outfight 'em. For instance, suppose we sat down with the chaps in Pakistan and, instead of offering to ship billions of dollars in arms with no strings attached, we offered to help them only if they would set up a buffer zone between Afghanistan and Pakistan . . . perhaps five miles wide. This zone would be deeded to the U.S. for 99 years and we would guarantee free travel across it. But this would be American land and would set up a situation wherein Russia would have to go through our land in order to attack Pakistan. This would also give us an area from which to monitor radio communications within Russia and Afghanistan . . . and room for airports and military bases.

If that worked, we might suggest the same for the borders of Saudi Arabia and other worried oil states. Thus, for any aggressor to get at a country, they would have to cross U.S. soil and get us directly and immediately involved.

I can just see future surplus camel-dung radios.

One of the ways Russia has really taken advantage of us has been via the past SALT agreements. This was one reason why I was pleased to see interest in a new SALT agreement fading. It seems to me that Russia fights for every concession they can wangle on these treaties and then goes ahead and ignores them completely, laughing at us for taking them seriously.

According to the earlier SALT agreement, neither the U.S. nor Russia would attempt to protect the populations of their cities against nuclear attack. We went right ahead and essentially dismantled our civil defense system. Russia went ahead and built the most comprehensive system of civil defense of their populations in history. Their people can be holed up safely in a matter of minutes and their estimates are that much of the population of Russia cannot be touched by atomic warfare.

Their industry is underground or else so spread out through Siberia that it would be impractical to try to knock off much of it. Ours is gathered in a few easily-removed areas . . . like around Route 128 in Boston, in Silicon Valley, etc.

Okay, supposing that some of the above is true . . . what can *we* do about it? Well, the one big thing that radio amateurs can do is to get set up for any possible emergency. We need to get cracking on some sort of civil defense communications network and we certainly don't want to wait for word from Washington before we get going on this. This is a matter, as I see it, for our radio clubs to tackle.

In time of emergency, we will need massive communications capability. We'll have to be able to provide local, medium range, and even long-range communications. We'll need emergency repeaters and cross-band operation to the low bands. We'll also need to be able to intercommunicate with all of the other users of two-way radio such as taxis, doctors, trucks, police, fire, road crews, CB, etc.

There are a few clubs which have set up vans with emergency communications equipment along these lines. I'd like to see every major club work in this direction, setting up mobile emergency communications centers. It takes a lot of work, some expense, and dedication, but the results are worth it. Not only is the resulting communications center a good advertisement for the club and for amateur radio, but it is also good public relations in many more ways. A well-advertised emergency unit can help local amateurs get cooperation from the citizens, from the local government and police.

In addition to a mobile communications center, clubs also want to build up their ability to cope with emergencies. This means having an up-to-date inventory of the ham gear which is available for use in emergencies . . . where it is and how to get it. This gear has to be used every now and then, for nothing ever works right the first time out. How many HTs do the members of your club have? How many are synthesized and how many are on fixed channels? Does anyone in your club have a portable emergency repeater? What about power sources?

73 Magazine will look most favorably on articles on emergency preparation for clubs . . . on pictures of mobile communications centers . . . on photos of club projects. Let's get club work started on this and help each other with letters and articles on how you're doing.

I have some later plans for a VHF linkup which might enable repeater groups to interconnect with any other repeater group on a 24-hour-per-day basis. We'll see how plans for this come along. It would make a superb emergency communications system if it can be attained.

1940

One of the very few benefits of getting old is the ability to remember "the way it was" many years ago. Unfortunately, there is very little call for this talent. On the off chance that there are a few relative newcomers to amateur radio who have sucked in on the romanticized recollections of old-timers, let me regress for you and give you an idea of what hamming was like forty years ago.

With the start of the war in Europe on September 3, 1939, most of the DX disappeared from 20m. Ten meters was a relatively new band, with hams just discovering techniques for building equipment to use this band. I remember hearing GM6RG pouring through on ten with solid signals every day for hours back before the war started.

And what ham band was the most used . . . by far? You'll miss that guess probably . . . it was forty meters, and no phone allowed. Everyone was crystal controlled, and, with crystals costing around $50 each in terms of today's dollar, few hams had more than one crystal. This meant that when you went on the air, you checked out the band very carefully to try to find a frequency which didn't have too many active stations on it . . . particularly the powerhouse stations.

Once you bought your crystal, you were stuck with it. The receivers were, by today's standards, broad as a barn door, so

any strong signals within a few kilocycles would wipe you out. Fortunately, few stations had high power, with 50 Watts being considered a good average. The magazines of the times, *Radio* and *QST*, published articles on building one-tube transmitters. I remember the QSL-40 rig with a single 6L6G, crystal controlled, 40 Watts... on a chassis the size of a QSL card.

Hams were very proud in those days to get as much power as possible out of receiving-type tubes. Of course, you didn't dare hold the key down for long if you didn't want to melt the plate of your final... but the glass tubes made it so you could see what was going on and take your finger off the key before the plate got quite white hot.

With crystal control, the system was to call a CQ and then tune the band, usually starting from one end or the other. The higher-powered stations tended to be close to the band edges. There was nothing surprising about hearing someone calling you 200 kc away from your frequency. We get so used to using vfos that we forget what it is like not to have one. Forty years ago, there was no real thought of being any particular place in the band... you just had a frequency and you tuned the band without regard to where your frequency was.

What about phone? The most popular phone band, by a very wide margin, was 160m. In those days, we only had two classes of license, effectively. These were Class A and Class B. Only a small percentage of the hams had the Class A ticket, and they were privileged to operate on 20- and 75-meter phone. This was not as big a plus as you might imagine. Those bands were each 100 kc wide and held about nine big signals since AM was the phone mode at that time. On 75m, most of the band was occupied by a handful of nets and they did not welcome newcomers.

A kilowatt phone rig was a very big deal then. I don't think you could build one for much less than $25,000 in today's dollars, so they were for the wealthy... and these hams lorded it over their less fortunate brethren. It was an attempt by a few surviving members of this group which pulled off the so-called "Incentive Licensing" proposal in the early 1960s. This was an attempt to get all the "kids" off the phone bands.

One-sixty was the big phone band, with more phone activity than all other ham phone bands combined. It was packed from 1800-2050 kc, almost entirely with low-powered rigs. The big deal then was the 6L6 oscillator modulated by a 6L6... a two-tube transmitter, running around 10 Watts or so, and a ball to use.

Those amateurs today who are having problems with mental cases jamming repeaters or making them difficult to use should know that we had their grandfathers doing essentially the same thing forty years ago. These jerks would get on 160m and play phonograph records by the hour... bringing about an FCC rule against broadcasting music or any one-way communications. Attempts to reason with these guys got nowhere, despite some antenna-cutting and black eyes.

There was a lot of pressure for more phone frequencies at that time. The League was flatly opposed to phone operation and would have none of it. This brought about the formation of the National Amateur Radio Council (NARC); it quickly grew into a very big national organization and soundly defeated the ARRL over the matter, getting the FCC to okay a phone band for 40 meters. Once the phone bands had been expanded, the NARC need died down, as did NARC.

A tiny group of experimenters was playing around with 2½- and 5-meter rigs, but they were in the strict minority. I built a little 1G4/1H5 transceiver for 2½ meters in a box about the size of a Gonset Communicator and had a ball with it at that time. I was also quite active on 40m and 160m phone. If you'll check your old QSTs, you'll find that I won the Sweepstakes phone contest for 1941 for Eastern New York!

Just before the war, there were about 50,000 licensed amateurs in the U.S. There were few enough so I was able to take a map of Brooklyn and make a mark for every ham in the *Callbook*... and then set out to visit all of them. This was around 1938-39 and I made the visits on bicycle or skates. I think Ed Pillar W2KPQ has forgotten my visit in 1938 to his station.... down near Coney Island Avenue. Ed is still very active... with ATV repeaters these days.

When the war came along, we were put off the air immediately. I was on 160 that fateful Sunday and got the news of Pearl Harbor on that band. A couple of hours later, W1AW was broadcasting word to get off the air, and within a couple of days the last hams were off the air... for almost five years.

Some 40,000 of our 50,000 licensed hams joined the armed forces. Without this body of technicians, the military would have been in very deep trouble. Our hams were first put into blitz training schools as teachers to qualify radio operators and radio technicians. Virtually every teacher I ran into during my time in the Navy was a ham ... as were many of the radiomen and technicians.

Much has been made of the amount of ham building in the pre-war period. I would like to put that into perspective. In the 1920s, hams built their equipment... they had to since little was available commercially. In the early 1930s, the first commercial communications receivers were put on the market and this stopped the ham building of receivers almost completely. There were not enough hams to make it profitable to build commercial transmitters, so hams still had to build their own. My visits to hams all over Brooklyn ... hundreds of them... showed me that though hams built their equipment from articles in the ham magazines, they had little understanding of what they were doing. We had one or two real technicians and these chaps were the "experts" who were able to find out what had gone wrong during construction and get the rigs working.

In my estimation, 90% of the hams today know far more about radio than 10% of the hams did forty years ago. Tube sockets were often wired upside down so the grid connections went to the plate circuit. Ask anyone who was there. The top technician for much of Brooklyn was Sy W2IXJ... now retired as W4IXJ. With a small light bulb as an rf detector, he fixed and tuned up transmitters. I'm not sure he even owned a VOM... and he was the best we had!

It was around January, 1940, that the music rule came through. It was phrased in a way to make it illegal to transmit for other than purposes of communications. The FCC hadn't thought about this affecting duplex operation, which was very popular on 160m at that time. During the afternoons, when interference was low, stations all over the major cities would group together into duplex nets and sit talking with each other. It was incredible fun to do and very popular. It hurt nothing. Stations with crystals on one end of the band would relay stations from the other end of the band. All were using low power, so it was not difficult... calling mostly for separate antennas.

It didn't take long after the new rule went through for a ham at one of the FCC monitoring stations to decide that the use of six carriers on the band at once for a six-way duplex round table conversation was no longer permitted. The ARRL, hating phone, did nothing to stop this, so duplex disappeared... forever.

COLORADO SPRINGS

One of the reasons I would like to see a ham manufacturer's organization with some real strength is our need for lobbying for amateur radio on a three-level basis. We need to have a strong lobby in Washington to see that we get the rules we need to keep amateur radio growing and the freedom we need to allow amateurs to invent new systems and modes and then pioneer them. With little clout in Washington, we are pushed around by any group which does have an organization.

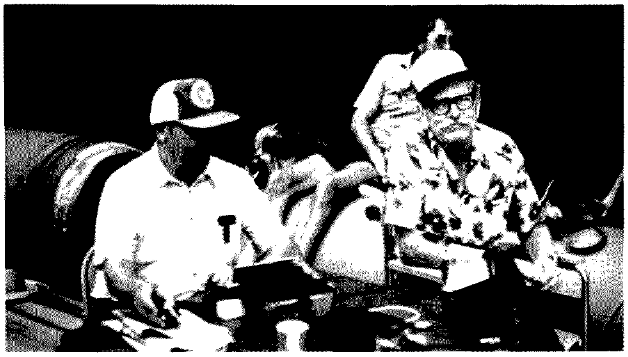
We saw that very clearly when amateur manufacturers went to the FCC to testify against the ten-meter linear ban and saw their lack of organization losing the battle. EIA walked in, testified for five minutes, and won hands down.

We also need lobbying on a national basis to get grass-roots support for hamming... and to help bring newcomers into our clubs to participate in our license study classes. The supply of newcomers has almost dried up, due in a large part to a lack of persistent publicity by ham clubs and a lack of any national organization to coordinate such publicity.

The third level is interna-

tional. We need to work continually to get amateur radio going in more and more Third World countries. We want to be able to go to an ITU conference in the future and *know* that we have done our homework and not have to rely on blind luck and the good will of some chap from Algeria.

In line with the need for good PR for amateur radio, one of the best examples I can think of happened a few months ago out in Colorado Springs. The amateurs there got together and provided the communications for the National Sports Festival . . . and they provided superb communications. It was a perfect



In the Field House at the Air Force Academy, I found Frank Freiler WBØPAJ (L) and Mint Tanner WAØYTK providing the communications for the wrestling events. All of the communications were on 146.52 MHz. They passed along the names of the winners of each event and kept all of the Sports Festival officials in close touch with each other.

Not far from the yachting event we found the softball competition. Here are Bob Poirier KØDJ (L) and Ron Seats KØLZD (R) with HT providing the communications.

Not too far from town, at the Garry Barry Stadium, we found the soccer games going full tilt. The communications here were being provided by Dennis Smith WBØYKH.

The base station was set up at the Olympic Headquarters in Colorado Springs. Here we see Art Mayer WAØAEH at the mike and Dave Vierling NØDV helping him. This was the center of all communications as well as a liaison to low-band relaying of messages from contestants to their families.

Don Lohse KAØCHA (L) and Barbara Remy WBØNUW handled the equestrian events, working through the local repeater, which was reserved just for the Sports Festival events for the duration of the show.

At the volleyball event, I found Karl Perry WBØYEO keeping Headquarters informed on scores . . . passing along scores from other events to officers at this event, etc.

The base station at the Air Force Academy, several miles from town, was mostly on 146.52 and used the call WAØRFB. Seen operating are David Stivers WBØSSG (L), Jerry Farkasofsky WBØHZG (center), and Allen Bailey ADØZ (R). This station coordinated all of the events taking place at the Academy and relayed the results to the Olympic Headquarters in town. They also handled a lot of messages from contestants sending word of winnings to parents and friends.

Jim Wilkinson NØAIN passed along the yachting winners and times to Headquarters from Prospect Lake.

lesson in what amateur radio can do and one which should be repeated in every part of the country.

The club bit off a big chunk. The Sports Festival was spread out over 400 square miles, making communications far more complex than just one repeater could handle. They fielded 112 members to handle the communications needed for thirty different events spread out over a six-day period. During that time, they kept every part of the Sports Festival people in communications. They found missing people, got ticket counts to headquarters, got scores and winners' names to everyone, and in general held the entire Festival together.

Sherry and I flew out to see how they were managing and I was most impressed by the organization, the willingness of everyone to cooperate, and the hard work and hours they put in,

At the conclusion of the Festival, the club got together for a dinner at Guiseppi's Old Depot Restaurant. Here Sherry and I had an opportunity to meet many of the other club members who were involved in the six-day effort, but who were not on duty at the exact time that I was taking pictures. For instance, here we see Kim Schlueter WBØUUW (14 years old, on left), father Dick Schlueter WBØPNX, mom Lorna WDØBTF, and daughter Susie WDØFXR (12 years old, on right).

Later, at the same lake, Tom Purdon ABØA (L) and Jim Mullikin AEØH (R) kept track of the sailboat events. Those round badges hanging from strings allowed the club members to get into all of the events without hassles from the gate watchers. Note that most of the members are wearing the official National Sports Festival hats . . . supplied by Coca Cola.

Here we see (left to right) Bob Card AEØW, Gordon Denno WBØTIC (a very well-known foot surgeon . . . tops in his field), Jim Mullikin AEØH, and Louie Preller WØPCZ.

Mike Stansberry KØTER kept the officials up to date on the weather. Every now and then, a rain squall would head through the area, making some events stop for a while until things cleared up. Mike kept close track of these squalls and their probable path over the various events.

Dave Acree WØMBZ is standing; seated (left to right) are Ken Keyte WØTGL (known as Two-Guy Louie, a very well-known sideband pioneer), Oak Stockton KØROL, who made the arrangements for Sherry and me to watch the club in action (including the trip from Denver out to Colorado Springs), Oak's XYL, Ruth, and an unknown W4 visitor. Gordon Denno got us back to Denver after the show . . . and a very interesting trip that was.

with many events starting at 8 am and others running until late into the night.

The coordination of all of the communications teams was a job in itself. I found myself shuttling from one area to another, often having to drive several miles to the next sports event, and always finding the club members there with everything under control. They even had one chap out at the weather station to pass along word of rain squalls which might interfere with outside events.

The main club communications center was set up near the Olympic Headquarters buildings. I visited these buildings, watching communications sort out ticket problems and locate some missing officials. Nearby was the hockey field, where I watched some field hockey. From there, we drove to the lake in Prospect Park where the yachting competition was in full swing. Then off to the middle of town and a roller-skating competition at Skate City. From there out to Broadmoor Arena for ice hockey. Then a long drive to the Air Force Academy to see the archery competition, wrestling, and water polo.

As you can see, I took some pix of the club in action.

One of the props the club found necessary was signs which identified the ham stations as being amateur so credit would go toward amateur radio rather than commercial or even Citizen's Band. We've now made such signs and they are available for clubs setting up communications centers.

The job done by the Colorado Springs amateurs in providing communications for this Sports Festival was superb. I only hope that their example will be followed by ham clubs all around the country.

If you see an opportunity to provide community service, get your club organized and have at it. Be sure to get credit for the job, too. That's most important. Get information to the local papers and to the radio and television stations about what you are doing. You can perhaps help these media to gather news or the names of winners of events.

Part of the charter of amateur radio is for us to provide communications in emergencies and to help our communities. Think in these terms and have at it. Remember that *73* would like pictures and a story.

Jerry Haberer WAØWSY on left, Chuck Myers WØRNT, Dave Acree WØMBZ, and Dick Thompson WBØDUL on right.

FCC

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47 CFR Part 97

[SS Docket No. 79-22; FCC 80-14

Amateur Radio Service; Telegraphy Examination Credit

AGENCY: Federal Communications Commission.

ACTION: Report and Order.

SUMMARY: This Report and Order amends the Amateur Radio Service Rules to delete Section 97.25(d). This Section allowed credit for the telegraphy portion of the Amateur Extra Class examination to those who presented proof of having continuously held the Amateur Extra First Class license and its successor licenses. The Commission deleted the Section because it had proved to be obsolete.

EFFECTIVE DATE: August 1, 1980.

ADDRESSES: Federal Communications Commission, 1919 M Street NW., Washington, DC 20554.

FOR FURTHER INFORMATION CONTACT: Judith St. Ledger-Roty, Rules Division, Private Radio Bureau, (202) 634-2443.

Report and Order

Adopted: January 16, 1980.
Released: January 22, 1980.

By the Commission:

In the matter of deletion of § 97.25(d) from the Amateur Radio Service Rules. SS Docket No. 79-22, RM-3001.

1. On February 14, 1979, the Commission adopted a *Notice of Proposed Rulemaking in Docket No. 79-22*, 70 F.C.C. 2d 1918 (1979), 44 Fed. Reg. 12473 (1979), to consider the deletion of Section 97.25(d) of the Amateur Radio Service Rules. That Section presently provides that: "[a]n applicant for the Amateur Extra Class operator license will be given credit for examination element 1(c) if he so requests and submits evidence of having held the Amateur Extra First Class license. [and] having continuously held its successor license." It was proposed that the effective date for this amendment be set for six months after approval by the Commission in order to give any persons affected one last chance to apply for the Amateur Extra Class license under the current rules.

2. From June 1923 to June 1933, the Department of Commerce and subsequently the Federal Radio Commission issued Amateur Extra First Class operator licenses. The Federal Communications Commission, upon its creation, issued the equivalent license, designating it a "Class A" license, and then later, an "Advanced" license.

3. In 1952, the Commission created the Amateur Extra Class license. To obtain this license, the applicant must successfully complete a written examination testing nine areas of basic, general, intermediate and advanced amateur practice. These written examination requirements are far more stringent than those that were associated with the Amateur Extra First Class license. The telegraphy proficiency requirement for the Amateur Extra First Class license was twenty words per minute; the telegraphy requirement for the Amateur Extra Class license is also twenty words per minute.

4. In recognition of this identical telegraphy requirement, the Commission amended Section 97.25(d) to allow credit for the telegraphy portion of the Amateur Extra Class examination to those who presented proof of having continuously held the Amateur Extra First Class license and its successor licenses. *Report and Order in Docket No. 19163*, 37 F.C.C. 2d 202 (1972).

5. Section 97.25(d) was adopted in order to eliminate any inequity that mandatory repetition of the telegraphy examination might create for former holders of the Amateur Extra First Class license who have remained active. In the *Notice* released in this docket, the Commission noted that the number of persons seeking examination credit pursuant to this Section has declined to such an extent that it might well be considered obsolete. In fact, the Commission has averaged less than one applicant per year over the last few years. It therefore appears that Section 97.25(d) has fulfilled its purpose and should now be deleted.

6. In response to the Notice proposing deletion of Section 97.25(d), the Commission received only one comment. That participant agreed that Section 97.25(d) should be omitted if it was no longer useful, but requested that we delay the effectiveness of any order for one year so that remaining applicants might have time to study for and take the examination under the current provisions.

7. Section 97.25(d) has been in effect since 1972. Because of the lack of applications for credit, and the apparent lack of interest in this rule, we must assume that those who were eligible have applied for and received credit during the past seven years. It does not appear necessary to delay the effectiveness of the amendment for any more than the six month period originally proposed. Six months should be ample time to study for and take the examination, especially considering that prospective applicants for credit have already had several years for preparation.

8. The Commission also has under consideration a petition for rulemaking, RM-3001, submitted by Mr. Frank Carman of Otis, Oregon. Mr. Carman petitions the Commission to amend its rules to provide that applicants for the Amateur Extra Class license who were licensed amateurs prior to 1925 and currently hold General of Advanced Class licenses be granted credit for the 1 (C), 4 (A) and 4 (B) examination elements.

9. Mr. Carman's petition expresses views similar to those considered and rejected in Docket No. 19163. *Report and Order*, 37 F.C.C. 2d 202 (1972). At that time, we clearly expressed our views with regard to the Amateur Extra Class license, stating that:

> As the highest grade amateur license, the Extra Class signifies that its holder has clearly demonstrated his technical qualifications based on both minimum licensing time and passage of a rigorous examination. Although the Commission realizes that length of licensed operation can be a valuable asset toward establishing one's eligibility for the Extra Class license, this in itself is not considered sufficient basis for determining the amateur's total qualifications. In addition, to allow attainment of the Extra Class license on the basis of age or term of license tenure alone, would, we believe, discourage amateurs from studying toward license achievement in keeping with the Commission's incentive licensing program. 37 F.C.C. 2d at 204

The Commission is unable to discern any benefit which would accrue to the Amateur Radio Service if this petition were adopted. Rather, we remain of the belief that the only appropriate basis for issuing an amateur operator license is the successful completion of the examination elements designed to establish the qualifications prescribed for a particular class of license.

10. In view of the foregoing, the Commission finds that the amendment to Part 97 of the Amateur Radio Service Rules, as set forth in the Appendix, is in the public interest. Authority for promulgating this amendment is contained in Sections 4(i) and 303 of the Communications Act, as amended.

11. Accordingly, it is ordered that, effective August 1, 1980, Part 97 of the Commission's Rules is amended as set forth in the appendix.

12. It is further ordered, that the petition of Mr. Frank Carman, RM-3001, is denied after due consideration.

13. It is further ordered that this proceeding be terminated.

(Secs. 4, 5, 303, 48 Stat., as amended, 1066, 1068, 1082; 47 U.S.C. 154, 155, 303)

Federal Communications Commission.

William J. Tricarico,

Secretary.

Appendix

1. The Federal Communications Commission amends Chapter 1, Part 97 of the Code of Federal Regulations as follows:

§ 97.25 [Amended]

(a) Paragraph 97.25(d) is deleted, and paragraph 97.25(e) is redesignated as paragraph (d).

propagation

by
J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21A	21	14	14	7A	7A	21	21A	21A	21A	21A	21A
AUSTRALIA	21A	21	14	7A	7B	7B	7B	14	14	14	21A	21A
CANAL ZONE	21A	21	14	14	7	7	14	21	21A	21A	21A	21A
ENGLAND	14	7	7	7	7	14	14	21	21A	21	14	14
HAWAII	21A	21	14	7	7	7	7	14	21	21	21A	21A
INDIA	14	14	7B	7B	7B	7B	14	14	14A	14A	14	14
JAPAN	21	14	7B	7B	7B	7	7A	7	14	14B	14	21
MEXICO	21	14	14	7A	7	7	7A	21	21	21A	21A	21A
PHILIPPINES	21	14	7A	7B	7B	7B	7B	7B	14B	14	14	14A
PUERTO RICO	21A	14	14	7	7	7	14	21	21A	21A	21A	21
SOUTH AFRICA	21	14	7	7	14	14	21A	21A	21A	21A	21A	21A
U. S. S. R.	7B	7	7	7	7	14	14	14	21	21	14	7B
WEST COAST	21A	14A	14	14	7	7	7	14A	21	21	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
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ARGENTINA	21A	21	14	14	7A	7A	14	21A	21A	21A	21A	21A
AUSTRALIA	21A	21	21	14	14	7B	7B	14	14	14	21A	21A
CANAL ZONE	21A	14A	14	7A	7	7	14	21A	21A	21A	21A	21A
ENGLAND	14	7	7	7	7	7	14	14	14	21	14	14
HAWAII	21A	21	14	14	7	7	7	14	21	21	21A	21A
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	21	21	14	7B	7B	7	7	7	14	14	14	21
MEXICO	21	14	7	7	7	7	7	14	14	21	21A	21A
PHILIPPINES	21	14A	14	7B	7B	7B	7B	7B	14B	14	14	14A
PUERTO RICO	21A	21	14	7A	7	7	14	21	21A	21A	21A	21A
SOUTH AFRICA	21	14	7	7	7B	7B	14	21A	21A	21A	21A	21A
U. S. S. R.	7B	7	7	7	7	7	7	14	14	21	14	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	14A	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21A	21A	14	14	14	7A	14	21	21A	21A	21A	21A
AUSTRALIA	21A	21A	21A	21	14	14	14	14	14	14	21A	21A
CANAL ZONE	21A	21	14	7A	7	7	7	14A	21A	21A	21A	21A
ENGLAND	14	7B	7	7	7	7	7	14	14	14	14	14
HAWAII	21A	21A	21A	21	14	14	7	14	21	21	21A	21A
INDIA	14	14	14	14	7B	7B	7B	7B	14	14	14	14
JAPAN	21	21A	21	14	7B	7	7	7	14	14	14A	21
MEXICO	21A	21	14	7A	7	7	7	14	21	21	21A	21A
PHILIPPINES	21	21A	21	14	14B	7B	7B	7B	14B	14	14A	21
PUERTO RICO	21A	14A	14	7	7	7	7	14A	21A	21A	21A	21A
SOUTH AFRICA	21	14	7	7	7B	7B	7B	14	21	21	21A	21A
U. S. S. R.	7B	7B	7	7	7	7	7B	7B	14	14	14	7B
EAST COAST	21A	14A	14	14	7	7	7	14A	21	21	21A	21A

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

april

sun	mon	tue	wed	thu	fri	sat
		1 G	2 G	3 G	4 G	5 G/SF
6 G/SF	7 G/SF	8 G/SF	9 G/SF	10 F/SF	11 F/SF	12 G
13 G	14 G	15 F	16 F	17 P	18 F/SF	19 F/SF
20 F/SF	21 G	22 G	23 G	24 G	25 G	26 G
27 G	28 G	29 F	30 G			

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Antennas!

73 Magazine for Radio Amateurs

Info

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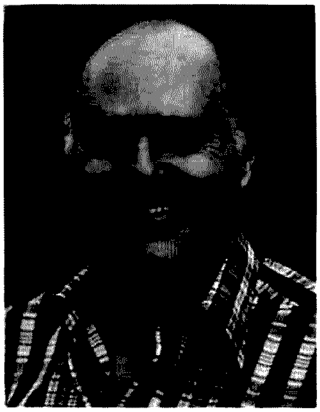
W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



1990

Holy Moly! By 1990, I'll be doddering into my 50th year in amateur radio. By then, I should have managed to alienate well over half a million hams, if we can get amateur radio into a growth mode again. As I've said before, whether anyone likes me or not is his problem . . . I love amateur radio and I like most amateurs . . . there are some exceptions . . . and that makes *me* happy.

But, let's take a look at amateur radio today . . . reflect a bit on the changes I've seen over the last few years . . . and then see if I can make some shrewd guesses as to what we have coming up in the future. I'll try not to be as impatient as I usually am about change. I invariably want and expect changes to happen a lot faster than they do.

The mere concept of change sets many people off. And others are continually trying to either stop change or else make things the way they were. It is fruitless to try to prevent change . . . or to try to make things the way they were. You have to accept the fact of change and go with it. Oh, it doesn't hurt to push a bit to make change go in a direction you feel beneficial. But trying to make the ham bands the way they were in 1940, as a small group tried to do back in 1963 with Incentive Licensing, was impossible.

Some ham bands have changed little over the years . . . others have gone through enormous changes. Take six meters, for example. For many years, this was a truly deserted band. I remember being the *only* active amateur on six meters in New York City . . . and that was over a period of several years. In those days, circa 1948-55, everyone was crystal controlled and I could tell immediately exactly who was on the air just by measuring the frequency of the transmission. I kept a chart showing call letters vs. calibration on my frequency meter. There were only perhaps about 20 hams active on six meters within range of Brooklyn at that time. Most of them were in New Jersey, but there were some in upstate New York and even some in Connecticut, such as Ed Tilton in Hartford.

When six was opened to the Techs, it filled up quickly and, on openings, the band was filled solid from the low end all the way up to 51 MHz . . . with sparser population to 52 MHz. Those were the AM days.

Then they opened two meters to Techs and there was a mass exodus. Six never got as quiet as the early 50s, but it is not an active band these days, nor is it likely to become one unless someone comes up with a new activity or mode which will populate it. I see nothing like that in serious prospect, so I suspect that by 1990 we will have a bit more activity than we do at present, but not a lot. We may see more FM activity as more repeaters set up with crossband facilities. This will be channelized. But since six meters offers very little over the two-meter band in range and since most of the repeater activity is on two meters and likely to stay there, there won't be a lot of pressure for six-meter growth.

One of the major factors which will influence the ham bands of 1990 will be the number of active amateurs we have. I see two serious prospects for getting amateur radio off dead center and into a growth mode again. One would be a concentrated effort by the ham clubs to get their license study classes going again, filling them with high-school students . . . and the other would be a relaxing of the rules to permit a no-code license and a resulting flood of CB-type immigrants. I think that I may be able to talk clubs into the former approach to growth . . . I sure hope so.

Presuming that we can get back to a 10% or so growth pattern, we are going to need some new modes of communications which will be far more efficient of spectrum (frequency × time) use. This means that we had better start pressuring the FCC for some rule changes which will untie the hands of ham experimenters and inventors so we can try out various spectrum-saving ideas.

The band which may hold the most rosy prospects for the future will surprise you. I think this will be 160 meters. Yup. You see, as I wrote recently, that was

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the most active ham phone band before The War. With the demise of loran and the return of the band to amateur radio, I think 160 will rise again. This is a beauty of a band and it will just have to be popular.

It doesn't take a lot of power or any complex or expensive antennas for this band. You can throw up wire and tune it up. Heck, you can tune up some wire hooked to a window screen and get out. With a hundred Watts or so, you can work half the country at night. And you can work over a twenty-mile radius or so during the daytime.

With the use of sideband, we should be able to go back to the real old days of duplex operation. The only legal impediment to duplex was the rule against transmitting a blank carrier, so by using sideband . . . with a separate transmitter and receiver system and separate antennas . . . we will be able to link up into groups of two to six, or either, all sitting and talking just as if we were in the same room.

The old 160m band, as I recall, ran from 1715 to 2050 kHz. I don't know how much of that we can regain, but I think we should push for as much of it as we can. You can appreciate the size of the old 160 band when you understand that the only other two popular phone bands were 100 kHz wide and 160 was 250 kHz wide . . . and few stations ran over 100 Watts.

Will we see much in the way of changes on 75/80 meters? Well, we haven't seen much in the last 50 years. Oh, we changed from AM to SSB and we added a bit of RTTY around 3620, but not much else has changed. If a ham were to drop out of amateur radio today and come back in 1990, I'll bet that only the model numbers of the rigs would clue him in. (Unless, of course, I am able to make some major changes within the next few years, which I fully intend to attempt.)

Forty meters has changed a lot over the last forty years, but much less in the last twenty. Sideband evolved further since 1960, but it was fairly solid even by 1960, so the changes have not been substantial. In 1940, we had no phone band and no vfos, as I've written about recently. I don't see any such major changes in prospect in the next ten years . . . or even twenty.

We've had two major mode changes in the last 25 years and each took about ten years to grow from beginnings to universal acceptance. The first big one was sideband . . . the other was FM. Single sideband suppressed carrier, SSSC, as it was first called, was a mode which was known and used commercially way back in the 20s, but at that time, you had to get rid of the second sideband and the carrier with antenna filters, throwing away the energy as heat. Obviously, this was incompatible with amateur radio since it was impossible to change frequency.

The first practical SSB system was unveiled in *QST* in the early 50s. After a couple of exploratory articles, *QST* dropped the whole subject. *CQ* picked it up along in 1956 and pushed it hard. By 1960, when *73 Magazine* started and continued the push, SSB was becoming widely accepted. It took a good ten years to go from the rare use of the mode in 1955 to universal acceptance by 1965. Little has really changed with SSB in the last 15 years.

The early days of FM and repeaters were in the early 60s. In 1969, after six years of a no-growth situation in amateur radio, I decided to see if I could get things going again by spreading enthusiasm for repeaters. Hundreds of articles in *73*, a *Repeater Bulletin* publication, and FM symposiums around the country helped get the word out. Within five years, two meters was the most used ham band in the country . . . if not the world.

While I don't see any significant changes coming in sideband, I do think we will be seeing some changes in repeaters as more groups get courage to develop crossband systems to other VHF bands and even to the low bands. I think we have reached a plateau on the number of repeaters needed to handle voice communications, but as computer and digital communications systems evolve, we will, I'm sure, find repeaters gearing to accommodate or even being set up for this specialized requirement. I think we'll begin seeing this coming on strong within the next five years.

The computer revolution will really have to have some impact on RTTY, making it far more popular than it is today. The scarcity and cost of Teletype® machines has held back the growth of interest in RTTY . . . as has the slowness of communications. Interfacing microcomputer systems to our ham rigs may overcome many of the problems and bring about rapid growth of written communications over the air. This may be helped by some sophisticated addressing systems which could virtually eliminate our present traffic system. The use of computers and digital techniques offers some fundamental changes in our prospects of being able to contact specific stations at will.

The techniques for this were known and used thirty years ago, but were not evolved because of the equipment problems. In 1950, we had a net of some thirty or more RTTY stations in and around New York. We had our own repeater on the Municipal Building in Manhattan. We could send specific messages to any station we wanted and get back a confirmation that the message had been received, all with no operator present at the other end. Now, with low-cost computers and digital techniques, this type of communications is becoming practical on a universal basis.

If we can get the FCC to improve our rules so we will be able to use whatever mode we want on any ham frequency, we would be able to switch from voice to RTTY to SSTV at will, without having to move from one end of the band to another. It's nice to talk . . . and it's nice to write, too. If I get talking about cars, I'd like to be able to put a piece of writing over the air for a few seconds and then go back to talking. And if I want to stop and take a few seconds to send a picture now and then, why should I have to move from a RTTY part of the band to an SSTV-allowed channel?

I have a lot of really great recipes which I could send to those interested via RTTY. My spareribs will drive you right out of your mind . . . if you know how to make 'em. But you need this information in writing. I think we will be able to develop these ideas during the next ten years.

A few years back, I was deeply involved with audio and every now and then I run into someone

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Looking West

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Regardless of what letters to the *QST* FM/RPT column might say (*QST*, March, 1980, p. 70), the 220-MHz band in southern California is not a land of totally private repeater operation. True, there probably are more private- and closed-category systems than found on 2 meters, but many are systems that relocated from two meters to make way for open systems. Nor does the level of current activity make it mandatory that such systems relocate again. In my opinion, they would not relocate even if requested to do so. The vast majority of 220-MHz repeaters operate with an open format, but open on 220 holds a different meaning than open on 2 meters.

As I said in this column a long time ago, most of those coming onto 220 are refugees from the abomination that two meters has become. As such, they are aware of the problems that two meters is facing and are dedicated to preventing such problems from ever happening on 220. In this area, to locate most 2-meter repeater owners, you must have an "in" with someone who knows the guy or gal you want to get hold of. Two meters in the southland is the aloof repeater owner who has placed his system into operation and, for the most part, has "walked away" from all but the technical aspects of its operation. Now, I grant that there are exceptions, but, in general, this seems to be the trend. 220 MHz is just the opposite. If I need to get hold of a particular system owner, I need only dial up the system and give a call. If he or she is not around, I can usually get hold of someone who will take and deliver a message. Invariably, I get a call, note, or some form of communication from the person I want to contact.

There is another aspect to operating the 220 FM band out here that takes a bit of getting used to. I call it the "Old 12-4 Routine." The term "12-4"dates back to the days when the almighty "seven six secret service" ruled two-meter FM with a tongue-in-cheek iron hand and means: "I hear you but you are being totally ignored." Basically, it's the concept of never giving a potential troublemaker any audience. If a turkey shows up (and this has happened) and builds for himself an obnoxious reputation, he soon finds that he has not a soul on the band to talk with. It only takes a short time in most cases for the party in question to get the idea that he'd better shape up or ship out. I've operated 220 FM for almost 5½ years and have yet to hear one cussword, yet to hear one derogatory comment about another ham or an on-the-air argument. The people of 220, both system owners and those who use them, will not tolerate such abuses.

From all this, you might get the idea that 220 FM in southern California is kind of boring—far from it. In fact, it's probably the most interesting of all the VHF bands in that it's possible to carry on a worthwhile discussion for hours, over a repeater, no less, and not be interrupted every five minutes by someone wanting to make a call and then shuffling you to the side for an hour once he has his party. If someone "breaks" a QSO, they ask permission from those in QSO to use the frequency or repeater, and once they establish their QSO, they move elsewhere. There's always a "thank you," to boot. It's been years since I've heard this kind of operation on two meters out here in the greater Los Angeles area.

I suspect that the type of respect for one's fellow man that you find on 220 stems from the manner in which the band has been developed and, moreover, from the group which has guided this development the past few years. It's called the 220 MHz Spectrum Management Association of Southern California and is more than just a repeater council. The 220-SMA was founded on the simple principle that everyone who invests in a 220-MHz radio, regardless of the mode he or she prefers, has a vested interest in the development of the spectrum. To that end, the 220-SMA has within its structure representatives of every mode and every special interest, all sharing equally in the responsibility of orderly spectral development. One need not own a repeater to belong to the 220-SMA, and the organization encourages every 220 user to voice his opinion on matters of interest and importance. It's basically a very technically oriented group, as opposed to its two-meter counterpart, TASMA, which is more politically oriented.

Being technical in nature, the 220-SMA tends toward moving very conservatively on all matters, though on occasion when the viability of the spectrum has been threatened by such entities as Class E CB and marine radio, they have been known to become very vocal rapidly. By and large, they favor the conservative approach and any change to the structure of the band is well researched prior to any commitment. An example of this can be seen in the accompanying spectral diagram. It took over 1½ years of research to bring it to the membership for a vote. I was at the meeting where it was voted on. There was only one dissenting vote and that was mailed in. The single person dissenting did not attend the meeting. In preparing the changes, the 220-SMA technical committee met with representatives of all aspects of 220 usership, including many non-FM-oriented groups and individuals. It went out of its way to be sure that every voice which could be located would be heard. In January of this year, the revised band plan was initiated and, for the most part, everyone is happy with it. Moreover, it's a band plan with tomorrow in mind and which ensures spectrum availability for new modes yet to come. I'm sure that ASCII will be prominent among them.

There is no way to compare 220 with 2 meters out here. The similarities that exist are only in mode. That's where it ends. The people of 220 are a very together lot. Technically oriented, for the most part, and intent on building a better tomorrow. It's what two meters could have been if self-centered egotism had not replaced reason and if a fat checking account had not become the criterion for repeater ownership. It's interesting to note that the people of 220 want nothing to do with 2 meters' political problems. Nobody's standing on a podium yelling "user rights," as

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Band Plan
220 MHz
Southern California Area July, 1979; Revised January, 1980

220.00–220.05	Weak signal (non-relay), 50 kHz (Note 7)	
220.06–220.70	Outputs for two (2) frequency non-repeater systems (Note 1)	33 channel pairs (Note 2)
220.72–220.90	One-way control or auxiliary links, 10 channels (Note 5)	
220.92–221.10	Non-relay direct communication, 180 kHz (Note 3)	
221.12–221.24	One-way control or auxiliary links, 7 channels (Note 5)	
221.26–221.90	Inputs for two (2) frequency non-repeater systems (Note 1)	
221.92–222.18	Weak signal (non-relay), 160 kHz	
222.20–223.38	Repeater inputs	60 channels pairs (Note 4)
223.40–233.78	Simplex, FM, 20 channels; 223.50 National simplex calling	
223.80–224.98	Repeater outputs	

Notes:
1. 220.00 to 220.50 is restricted to weak-signal use by current FCC regulation. In southern California, weak-signal activity is centered at 222.00.
2. Two-way links or auxiliaries are coordinated with 1.2-MHz separation on even 20-kHz channels.
3. The SMA encourages use of new modes of communication on the 220 band and has allocated the segment 220.92 to 221.10 for this purpose. It is not called simplex because that may imply that the segment is exclusively for FM simplex.
4. Repeaters are coordinated on even 20-kHz increments with 1.6-MHz input-output separation.
5. Control channels are coordinated with multiple users. Channel protection with PL (private line™) tone is required. PL frequencies are coordinated by the SMA.
6. Frequency coordination of control and auxiliary channels is not published by the SMA unless permission is granted by the user.
7. The SMA plans to increase weak-signal subband another 50 kHz (to 220.10) as soon as existing auxiliary links can be moved.

RTTY Loop

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In all the years I have been writing this column, I never thought I would have to stoop so low as to use a four-letter word to get your attention. This month, I must! Because that word is the hottest topic in ham RTTY, and to cover it, I will delay the conclusion of my demodulator series by a month or so.

What is the four-letter word? Why, "ASCII," of course! Oh, wait, A-S-C-I- . . . hmmm, so it has five letters, I got your attention, though, didn't I? The point is that the FCC has realized, at last, that the Baudot/Murray code is ancient and has authorized the use of ASCII on ham RTTY frequencies. Docket 20777 has passed, and implementation of the order occurred on March 17, 1980. Specifications for this new mode are detailed in this month's FCC column.

But, before we can work ASCII, we need to understand what ASCII is, why it is better than the code we are now using (assuming that it is!), and how we can best go about putting it on the air. That is the subject of this month's column.

Described several times in this column, the Baudot or Murray code, which all five-level teleprinters use, until now has been the code authorized for amateur use. This code uses five data bits to encode 32 possible combinations, which represent all capital letters and machine functions. A shifted set of 32 additional characters is implemented to support numerals and punctuation. That only limited punctuation and no lowercase letters can be supported is obvious, and this resulted in the development of several alternate schemes. I shall not go into them, except to mention that six, seven, eight, and more bits have been used to define character sets. In 1963, an American Standard Code for Information Interchange was devised. Normally referred to by the acronym "ASCII," this standard defined how seven bits could be encoded to represent 128 possible code combinations. Unlike the Baudot code, in which characters are represented in no particular order, ASCII maintains a strict order, making many code manipulations easy. A commonly used chart, showing the "full" ASCII code, is presented in Fig. 1.

The first two columns contain the so-called "control codes." These are non-printing characters that maintain various functions in line circuits. Although some of them, such as CR, LF, or BEL, are universally observed, even on home computer terminals, others are frequently redefined by the end user. Many terminals, for example, have internal functions and modes controlled by these characters, thus the grouping into "control codes."

								0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_7	b_6	b_5	b_4	b_3	b_2	b_1	COL → / ↓ ROW	0	1	2	3	4	5	6	7
			0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
			0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
			0	0	1	0	2	STX	DC2	"	2	B	R	b	r
			0	0	1	1	3	EXT	DC3	#	3	C	S	c	s
			0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
			0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
			0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
			0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
			1	0	0	0	8	BS	CAN	(	8	H	X	h	x
			1	0	0	1	9	HT	EM	)	9	I	Y	i	y
			1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
			1	0	1	1	B	VT	ESC	+	;	K	[	k	{
			1	1	0	0	C	FF	FS	,	<	L	\	l	|
			1	1	0	1	D	CR	GS	-	=	M	]	m	}
			1	1	1	0	E	SO	RS	.	>	N	^	n	~
			1	1	1	1	F	SI	US	/	?	O	_	o	DEL

Fig. 1. The ASCII code.

Punctuation, numerals, and uppercase letters follow in ascending sequence. Note that by shifting four columns to the left, each control code corresponds with an uppercase letter. The control codes are sometimes referred to in that way, so that BEL is control G or DC1 is control Q. Most ASCII keyboards have a "CTRL" key, which, when held down, shifts the output to produce the corresponding control code.

Although not implemented on older eight-level Teletype® machines and other uppercase-only machines, the last two columns of the ASCII character set contain lowercase letters. Again, note the correspondence with the uppercase set. This makes shifting case easy, and allows most uppercase machines to respond to lowercase with the appropriate uppercase letter.

Similarly to Baudot, serial transmission of ASCII is accomplished with a START bit, eight data bits, and one or two STOP bits. Conventions dictate that at slower baud rates, where mechanical teleprinters are more likely in use, two STOP bits be sent. As the speed of transmission is increased, only one STOP need be sent. Unlike Baudot, data bits are sent from the least significant bit (LSB) to most significant bit (MSB), exactly backwards from Baudot. An example will help clarify. The letter "S" in Baudot is normally represented as 11000. In hex, this would be $18. When transmitted, the sequence is START-1-1-0-0-0-STOP. The ASCII for "S" is 1010011 or $53 hex. But this is transmitted START-1-1-0-0-1-0-1-0-STOP. Now, before you get all bent out of shape about that last "0", let me explain.

If you have been paying careful attention so far, you have noticed that I have sometimes referred to ASCII as "seven bits" and sometimes as "eight bits." Well, there is a reason for this inconsistency. As defined, ASCII uses seven data bits to represent 2 to the 7th (128) characters. As transmitted, however, an eighth, or "parity" bit is added as the MSB. This parity bit may be defined in any of several ways. In many home systems, it is fixed as either a "1" or a "0". Since it is always the same, it may be stripped without concern. Although this solves the "what do I make it tonight" dilemma, it wastes the value of the extra bit. What parity is supposed to do is provide a means of error-checking on a character-by-character basis. Two types of parity are commonly used: even and odd. With odd parity, the parity bit will be added if the number of data bits is even, and with even parity, if the number of bits is odd. To elaborate, whatever the type of parity, that type represents the odd or even state of all transmitted characters. Let's run through a few examples. The letter "A" is 1000001. This has two bits, so, no parity bit is added for even parity, producing 01000001, or one is added for odd parity, producing 11000001. The "C", on the other hand, is 1000011, possessing three (odd!) bits. No bit is needed for odd parity, one is added for even parity. So, even parity = 11000011, and odd parity = 01000011. Simple, yes? No? OK!

Now that you understand parity, look at one more thing. ASCII characters are frequently, as we have done here, represented with their hex equivalent. Thus, "A" is $41, "B" is $42, etc. But, if parity is considered, strange things start happening. Depending on whether fixed, odd, or even parity is used, some very familiar codes can change. Thus, CR, normally $0D, can become $8D, or "A" can change to $C1. Just thought I'd point that out!

So, how will we use ASCII? To tell you the truth, I don't know. The *Federal Register* indicates that ASCII will be handled similarly to current RTTY. Between 3.5 and 21.25 MHz, ASCII will be allowed on F1 (conventional FSK), where F1 is currently authorized. The speed at these frequencies will be limited to 300 baud. In the spectrum ranging from 28 to 225 MHz, ASCII will be permitted at speeds up to 1200 baud, via F1, F2, and A2 (AFSK), again, where those forms of communication are presently authorized. Above 420 MHz, baud rate is limited to 19.6 kilobaud! Modes remain F1, F2, and A2, where authorized. I hope we can all settle on standards and conventions early! At first, it would seem that conventional FSK techniques

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Leaky Lines

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After many, many years of listening, just listening, to the ham bands, I have concluded that it is no longer necessary for me to subscribe to such publications as *Scientific American, Science, Sky and Telescope,* or any of the others. Nor is it essential to own an encyclopedia or to become an associate member of the American Museum of Natural History or the Smithsonian Institution. I discovered that if you listen to hams long enough, you will learn everything there is to know about any given subject in the universe.

The reason is simple. The ham population consists of experts in every known field of knowledge and discipline in the world. At least that is what I gather from the authoritative manner in which these experts expound on the bands.

Just this very morning, I listened to a prime example of this. The guy doing all the talking was named Floyd, Lloyd, Clyde, or Claude . . . I've forgotten which. And he was holding forth about the Russians.

"They visited the Tesla Museum in Yugoslavia," he said. "And they were highly interested in all the papers Tesla wrote concerning his theories about control of the weather. They spent a great deal of time poring over all those documents.

"But," he announced triumphantly, "it backfired on them." (I got the unerring impression that he was about to disclose something so startling and stunning that it would revolutionize human civilization.) "Just look at the mild winter we've been having here in America, and over there in Russia, they've been getting horrible weather." He laughed diabolically.

It was clear that he sincerely believed that the world's weather pattern for the winter of 1979-80 had been engineered because the Soviets had inadvertently misapplied the theories of Nikola Tesla. Moreover, Floyd, Lloyd, Clyde, or Claude was quite firmly convinced that they had done so because the papers had been deliberately doctored by our CIA or some other American cloak-and-dagger outfit who had been planted there for the specific purpose of fouling the Russians up. (It was something like that old tale about allowing the Japanese to build a naval vessel from altered American plans, and then the damned thing capsized . . . just rolled right over on its back when it was launched.)

He made it abundantly clear that the whole thing had resulted from some alleged undercover operation carried out by American agents, probably for the purpose of engineering a crop failure in the U.S.S.R., for what reason, God only knows . . . that is, God and Floyd, Lloyd, Clyde, or Claude.

He interrupted the QSO. "I'll see you later, Elmer," said he. "I've got to go to collect my unemployment insurance."

Some other joker was expatiating at great length on all those psychics and parapsychologists recently called in to assist police in tracking down murder victims and missing persons. He went through a lengthy enumeration of such cases, in which such psychics had succeeded where all else had failed . . . bloodhounds and detectives hadn't even come close.

Then he went off on an inexplicable tangent, recounting some personal experiences dealing with his own dreams. It seems that whenever he dreams of some individual, that unfortunate party usually succumbs within a month or two.

I have no idea, not the remotest clue, of the explanation of this business of his dreams within the context of the discussion about psychics. Indeed, I'm not sure there is any connection.

He also claimed that in these dreams of his, he was constantly in communication with his own parents, as well as with a large group of other persons "from the other side." According to his allegation, they were forever giving him advice and guidance. And he said, "You mark my word, Charlie . . . one day the world will learn. It's much later than they think."

I don't know why, but a shudder went up my back and I could feel the hairs on the back of my neck rise. I suppose I instinctively knew what was to come next.

Then came the crusher! He asserted that he had actually seen God! Well, not precisely the Deity, but a super-bright light which practically blinded his eyes when it lit up the entire bedroom as though the afternoon sun were streaming in through the windows. His wife had not seen it at all . . . had said to him, "It must have been a dream. Go on back to sleep."

He explained this by saying that his wife had simply not been chosen, as he had been, to witness this great light, so how could she, poor outcast, be expected to know that it had been meant for his eyes alone, as a sort of sign?

The fellow on the other end of this QSO must have been so moved by the story that he was unable to answer. He was probably dumbstruck with the wonder of it all and totally incapable of reply. Or maybe, like me, he had spun the dial of his receiver to some other frequency.

Last summer, I was listening to a net discussing the ancient civilizations of the world. A couple of fellows got into a lengthy colloquy about Egypt, and one blurted out the astonishing news that he had been present on the very day that Alexander the Great had conquered Egypt in 332 BC. I took it to mean that this had occurred during some previous existence of his . . . he regarded himself as a sort of male Bridie Murphy, I suppose. He also said that he had seen Ptolemy, Cleopatra, and at least four or five different pharaohs.

I was holding my breath . . . anticipating that he would announce that he had accompanied Moses and the Children of Israel out of the Land of Bondage. But he never had a chance to get that far. Someone had the gall and temerity to suggest that perhaps he had visited the "greenhouse" once too often that evening.

"Are you calling me a liar?" challenged the indignant one.

I kept listening, hoping to hear more, but the frequency had become bedlam, rendering all speech unintelligible. Sadly, I tuned my 75S-3B to some nearby frequency where a couple of ordinary mortals were discussing an ordinary topic . . . the relative merits of yagi antennas versus quads.

Some guy in Connecticut was holding forth on a pet theory regarding forward and reflected power. He said that in order to determine the power of a transmitter, one had only to add the indicated reflected power to the forward power. In other words, if your transmitter produces 100 Watts and your bridge shows a reflected power of 20 Watts, you simply add them together, and you are running 120 Watts!

The other fellow pointed out that if this were the case, all one would have to do to develop more power would be to increase his vswr more and more, and the more out of resonance that one could manage to get the antenna, the greater would the mismatch become, resulting in a maximum of reflected power. "According to your theory," he said, "it would be to your advantage to have as high an swr as possible, for that would give you more output than if you had unity match. If that's possible with the aerial you are using, I'd be much obliged if you would send me a drawing of it so that I can build one, too." (By the way, would some kind reader please give me the inside story on why so many hams nowadays have reverted to that old-fashioned word, "aerial"? And while you're at it, see if you can find out why they are now using the word "radio" in place of transmitter, transceiver, and receiver.)

Well, anyway, when this fellow had finished demonstrating how foolish he thought the other guy's theory was, the antenna genius abruptly terminated the QSO. "Sorry," he announced. "I've just gotten the chow call. Gotta sign off."

This was rather odd, for I glanced at the clock and it read half past three in the morning!

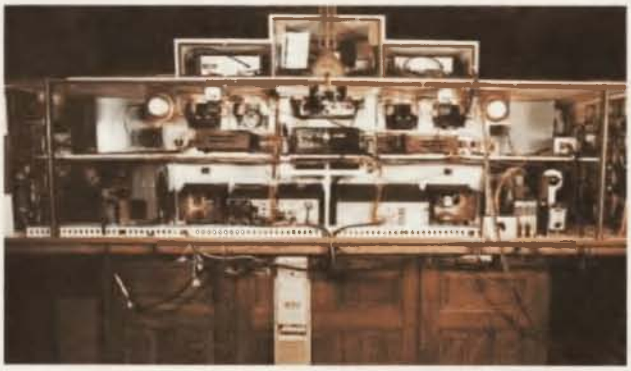
They must keep strange hours in Connecticut . . . at least in that asylum where this fellow is being kept!

I would greatly appreciate hearing from anyone who may be familiar with the particulars of a certain burial which took place in the mid-50s in California. I've been hearing vague dribs and drabs about it, but could never manage to find anyone who knew the whole story.

It seems that a certain ham arranged that a small transmitter would be placed in his

Continued on page 196

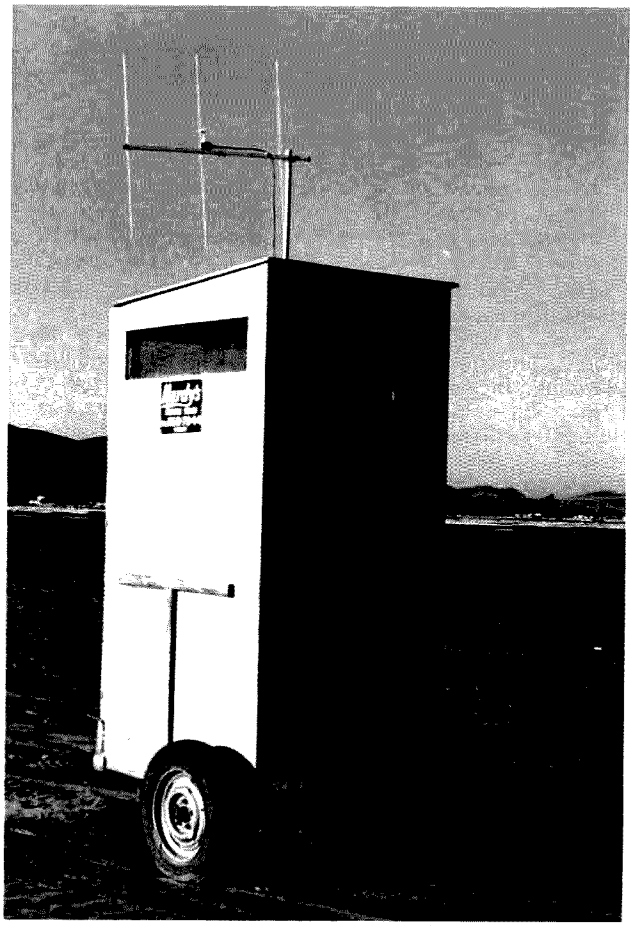
Faces, Places



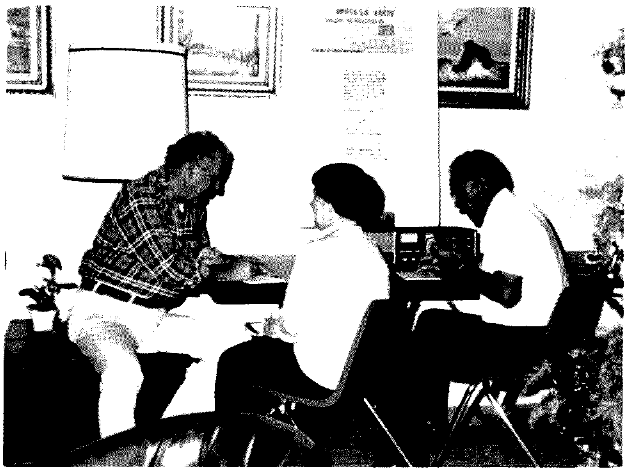
One of the Windy City's most prominent hams, Lee J. Knirko W9MOL, was featured in the Chicago Tribune Magazine *last fall. (Photo by Ken Thompson)*

E. J. Kundert W8YEK's "shack" has changed considerably since we ran a photo of his console on our February, 1975, cover. The shack is the CD Communications Headquarters for the city of Delphos OH. For emergency power, Gene uses his Kohler 12K diesel generator installed in the garage, which is started and stopped from the shack. The city of Delphos purchased a Spectrum 2-meter repeater, Phelps Dodge duplexer, and antenna, which is at 250' on a tower in the north end of Delphos. The .72/.12 repeater is under the control of the Tri-County Repeater Association. Since 1975, all equipment has been changed. There is now a mini console on top, which houses two scanners (2 meters and police, fire, etc.) and one CDE control box which operates rotators on two towers through the use of a rotary switch. For two meters, Gene has a self-supporting 64-foot tower; the other tower is motor-driven (40'-70') and its height is controlled from the console. A Teac A-170S cassette deck (not shown) is located in the top left drawer. In the right-hand drawer is a home-brew SSTV keyboard. The switches directly above the Drake Line control the inter-equipment and mode switching. Switching is done via RG-174 and no rf problems have been experienced so far. The power supply for the TR7 is located on a shelf in the kneehole part of the desk. The rear panel is made entirely of Plexiglas™. Air is brought in through the grills on each end of the front of the console, passes over all the equipment, and is exhausted out through a duct and hole in the rear panel. There are two thermostats and two blowers, which, even with the solid-state gear, run quite often (85°F). Since the console was built, the elapsed-time meter has now reached 11,505 hours.

The kids of Community School District 6 in New York City are shown taking part in an excellent amateur radio program administered by Len Latronica WB2KVU in their schools. Over 200 children have already earned their licenses, and teachers, students, and administrators continue to study together for their tickets. Top photo (left to right): Maria Sandoval, Leslie Sydnor WA2KVN, Alexis Skidan WB2RKG, Robert Stein WA2RJY, Ricardo Guzman, Eugene Campbell. Bottom photo: Eugene Campbell (left), Ricardo Guzman (center top), Robert Stein WA2RJY (center middle), Leslie Sydnor WA2KVN (center bottom), Leonard Latronica WB2KVU, Assistant Principal (right). (Photos courtesy of Photo Associates News Services, Inc.)



We've heard of automobile mobile, aeronautical mobile, maritime mobile, motorcycle mobile, and bicycle mobile . . . but a port-a-john mobile?! While it appears some operating time (formerly lost to the tending to of personal needs) might be saved, the propagation probably stinks. (Photo by David W. Hannah W6NBJ)



Jim Oberto WA9YYV of Joliet IL, Mrs. Gertrude Bongovia of Worcester MA, and Wayne Baldner of Ames IA (left to right) teamed up at a trailer resort, Desert Shadows, in Phoenix AZ, at Christmastime to "demonstrate ham radio by sending Christmas radiograms." The residents of the park sent 77 "grams." Many expressed an interest in learning to be a ham, and the three organizing hams now have a Novice class numbering 19 in progress.

Microcomputer Interfacing

Peter R. Rony
Jonathan A. Titus
Christopher A. Titus
David G. Larsen WB4HYJ

In many microcomputer applications, it is necessary to have the computer perform actions at accurately timed intervals. This allows the computer to make accurate measurements of an analog signal at 100 millisecond intervals. The period of 100 milliseconds may be "timed" through the use of a time-delay loop using software commands, or by using an external clock.

While a time-delay software routine may generate a delay of the required accuracy, the computer cannot do anything else while it is performing the timing software steps. This is a serious limitation. Although probably less obvious, the time-delay software steps may be interrupted by some external device and require immediate servicing by the computer. The overall effect is to "lengthen" the time required for the time-delay software steps. The actual time delay is the sum of the time spent in the software steps and time spent servicing the external interrupt.

In most instances in which accurate periods are required, an external circuit is used to time the necessary periods with the least interaction possible between the computer and the external clock. Such clocks are immune to external interrupts and changes in the normal flow of a program. Once started, they continue to time a period until it is completed and the time is up. In this way, the clock runs in parallel with the computer, allowing the computer to perform other tasks and service interrupts while the clock is running. This type of external clock is often called a *real-time clock* because its time is real and cannot be altered or delayed by events that would normally affect a program.

There are several different types of real-time clocks:

a) *The Programmable Real-Time Clock.* The actual period required is preprogrammed within the clock either through hardware or software. Once the clock has been started, it will continue timing until the period has ended. At the end of the period, the clock will signal the computer that the timing task has been completed.

b) *The Free-Running Real-Time Clock.* The clock runs continuously, signaling the computer at the end of each period. The periods are generally of equal length, approximately 10 msec.

c) *The Time-of-Day Clock.* This type of clock will provide the computer with the actual time, i.e., 16:20 hours. This type of clock is not frequently used in small computer systems.

The operation of an 8085-based computer system has been discussed in previous sections. The use of the 14-bit timer contained within the 8155 read/write memory and interface chip was described in terms of its real-time operation. In the 8085-based computer application, the 14-bit counter obtained its timebase from the crystal clock used to control the 8085 chip. An interrupt was used to signal the end of the timing period.

This was an excellent example of a programmable real-time clock. If we assume that a frequency of 1 MHz was used to control the clock, a 14-bit counter could provide us with a total count of 16,384 microseconds, or just over 16 milliseconds. This might be somewhat limiting if periods of several seconds are required, but the scheme is fairly flexible. If longer periods are required, the 14-bit counter could be programmed to time some integer fraction of the period. The computer could then be used to total the number of shorter periods required for the total period to have elapsed. The computer must increment and test a count only when the clock interrupted it. One drawback is that additional software is required; something we tried to avoid by using real-time clocks in the first place. The additional program steps, however, are quite minimal.

In many cases, it would be valuable for the real-time clock to be preset for the clock's basic frequency, i.e., 1 MHz, 10 kHz, etc., as well as for the actual count. If these various intervals were available, the timing of longer periods would be relatively easy and no additional software steps would be required. A simple series of divide-by-ten counters such as the SN7490 or SN74390 could be used to divide a high-frequency clock signal into lower frequencies for use by the real-time clock's counters. Various frequencies could be readily selected through the use of jumper wires on the computer board. A more sophisticated real-time clock scheme can use an electronic switching circuit that allows the computer to select the frequency required. Thus, a programmer could select the basic period and actual count by making software commands to the real-time clock.

The free-running real-time clocks are preset to time a period of predetermined length, 10 milliseconds, for example. This period is timed over and over again, interrupting the computer each time a period has been completed. In many computer systems, a line power frequency of 60 or 50 Hz is used to provide a stable, fixed-length period that may be used equally well. The free-running type of real-time clock is not as independent of the computer as the programmable real-time clock is. Software steps to accumulate the number of periods are still required, and the total timing period may have an error of up to two of the basic frequency periods.

Since the free-running real-time clocks have a regular period, they are often used to signal the processor that it's time to start a software routine that will check various input/output (I/O) devices to determine whether they require some computer service. By using a software table, the computer can check to see what devices are enabled or disabled. It can also determine the frequency at which they must be checked. It's useless to check a 10 character per second teletypewriter every 10 milliseconds, so it's only checked every 80 or 90 milliseconds. A faster device, however, is checked at the end of each 10 millisecond period. Such a scheme allows the computer, and the programmer, to have a great deal of flexibility in the way real-time operations are handled, particularly in situations where the computer is required to perform many real-time operations simultaneously.

In almost all cases, the computer and real-time clock are connected by an interrupt signal. In this way, the clock can immediately signal the computer that the current period has been completed or "timed out." Since interrupts can be quite complex, as we have described previously in our columns, only one real-time clock should be used with a microcomputer. It will be up to the user to determine the priority and thus the importance of the real-time clock. Often the real-time clock is assigned the highest priority.

Ham Help

I need information, schematics, etc., on a Gonset IV 6-meter transceiver. I will pay for reproducing and shipping. Thank you.

Richard McCubbin
535 Church Street
Portland MI 48875

I need a schematic, manual, and parts list for a 23-channel Skyfon OM 423 CB and, also, a schematic to convert same to 10 meters. I will be happy to copy and return. Thank you.

Kenneth W. Underhill
7301 East 11th Street
Indianapolis IN 46219

I am in need of Galaxy III service manuals. I will pay for an original or a copy. Thank you.

H. C. Fields W5SGX
4116 Morgan Circle
Ft. Worth TX 76118

Would you like a QSO with Turkey? I would like to set up schedules with all those who are interested. Send your callsign, address, and mode (CW or SSB), with three IRCs. I will send you a 4-week schedule of when I will call you.

Talat Turgay
PO Box 133
Ankara Turkey

LETTERS

GO AWAY

I agree with K4FNE's letter in the November (1979, p. 190) issue of *73*, except that it's not "sour grapes" as your editorial people titled it, but an accurate assessment of the problem.

I find *73 Magazine* technically to my liking, considering the wide variety of my amateur radio pursuits. However, your excesses in ranting about the ARRL, Wayne, have caused me to reconsider renewal of my subscription when it is due in 1980. It is really sad because you have the means to accomplish much for amateur radio with or without the ARRL, but you seem content to take monthly potshots at them, which, in the long term, accomplish nothing. Granted, the ARRL has faults, but it is a strong voice for amateur radio where no other exists, save for some abortive attempts at raising a competing national organization, which, I'm sure, some of your readers will remember.

My feelings can be summarized by quoting the late U.N. Secretary General, Dag Hammarskjold, from his diary, *Markings*: "When shut out of the room you must not peep through the keyhole. Either break down the door, or go away."

Jack C. Parker WØRIB
Bismarck ND

MOBILE MANUALS

From time to time, in Ham Help, I see needs for mobile radio equipment manuals. After 18 years in the mobile radio biz, I changed careers and am in computer components manufacturing. I have an 18-year collection of mobile radio manuals that I no longer need and would love to disseminate into the ham fraternity.

The dates span 1948-79, from the 5V to Micor, Link, Pre-prog through Mastr II, and a lot of off-brands and models. I can supply a list of manuals available (subject to prior sale) for an SASE. I will charge $1 to $3 per manual to cover my mailing costs. I don't need them taking up space in the garage if some hams can put them to good use.

Alan Christian WA6YOB
PO Box 5314
San Jose CA

ANTIMATTER

Paul Lutus' article (February, p. 116) on Albert ($E = mc^2$) Einstein was a lot of fun to read. But, what's he got against antimatter?

If a spaceship in space containing a ball of antimatter fires its engines and accelerates toward the left, then the antimatter will also accelerate toward the left, squishing itself up against the nose cone. From the antimatter's point of view, it looks out the porthole and sees the mass of the universe ganging up on it (accelerating) to its right; therefore, it panics to get away from the mass by moving to its left toward the front of the spacecraft just as it would if the spacecraft were sitting on the Earth.

Barry Dorfman KB6CV
Brentwood CA

2UO/WHO

Congratulations on the 2UO/WHO *New York Times* station article by W3CFC (February, p. 54). It is light reading, historical, with good pictures, and of general interest. Many fellows have called it to my attention over the air.

I am somewhat familiar with the station (and its history) and feel the story is accurately documented. If anyone could give Rex accurate information, certainly Iverson could.

The AWA Museum *almost* got the last WHO SW shortwave transmitter, which I believe is pictured on page 59. We got our bid in two weeks late and were told that they had junked it while cleaning out one of the upper floors of the building!

Bruce Kelley W2ICE
Antique Wireless
Association, Inc.
Holcomb NY

QRP ON TEN

About a year ago, I, along with thousands of other amateurs, took your advice and got on 10-meter AM QRP with converted CB rigs using your recommended band plan. Recently, it seems that the high-powered SSB stations also are using your AM band plan.

Maybe you could explain in *73* what a gentlemen's agreement is or what it used to be. The QRP operators would like to have a few channels above 29 MHz.

AM activity is picking up. In addition to the QRP rigs, many hams are dusting off *their* old Elmacs, Gonsets, Globe Scouts, Rangers, etc., and rediscovering what amateur radio used to be.

I have worked 20 states, a G2, a G3, a YS1, and a UB5 with 4 Watts and a vertical antenna. I am glad that I took your advice; it is great fun.

I would like to see a calling channel and an emergency channel. Channel 9 would be a good emergency channel since some rigs are set up with channel 9 as a priority channel.

Keep up the good work with *73*. It is a great magazine.

Mike Collins W4ACC
Winchester VA

KUDOS

Please let me take this opportunity to congratulate you for the great article in the February issue of *73* entitled "Albert and his Momentous Theories."

I very proudly took this issue to the office and showed the staff that amateur radio could be more than just rag-chewing and DXing with an exchange of signal reports and weather conditions. An article like this does begin to show that there are a few hams left interested in science at large and not just dots and dashes.

I'm just a bit sorry that I didn't subscribe to *73* a long time ago!

Norman S. Bernat K2GYX
Livingston NJ

STAY THE SLEDGE

A recent article, "In Search of Power Line Interference" (February, p. 66) by Henry Luhrman, contained a lot of practical information on the sources of RFI from power lines, as well as several valuable detection procedures. However, one detection scheme mentioned—hitting the suspected pole with a six-pound sledgehammer—is a potentially dangerous practice.

As Mr. Luhrman has discussed, a probable cause of power-line RFI is loose hardware, as well as cracked insulators. Hitting the base of a suspected pole with a sledgehammer might send an impulse to the defective material, causing a break. At a minimum, the power company's property has been damaged and they would rightfully expect to be reimbursed financially (it is a lot cheaper for them to replace a cracked insulator than it is to pick up conductors that have been burned down). Worse yet: 7,000- to 13,000-volt lines could land on the ham's head!

I urge all hams not to strike, tap, jiggle, or hit any power lines—least of all ones that have defective material.

R. W. Coleman WA4JDD
District Manager,
Florida Power & Light Company
Punta Gorda FL

STAMP PLAN

Many amateurs have responded to my letter in the January issue of *73 Magazine*, regarding an issue of a commemorative amateur radio stamp. WB2FYB advises that such a stamp was issued several years ago in a five-cent denomination, but thinks it is time for a second issue. WB2EUF suggested that it be issued in celebration of the forthcoming band expansions.

The Muskogee Amateur Radio Club is urging that all amateur radio operators write their congressmen, suggesting that they press for the issuance of such a stamp. We are suggesting that the stamp be of the 31¢ denomination, with the American flag prominently displayed, to be used on letters *containing* QSL cards which are mailed direct to points all over

Continued on page 184

Awards

Bill Gosney WB7BFK
2665 North 1250 East
Whidbey Island
Oak Harbor WA 98277

DX AWARDS FROM CZECHOSLOVAKIA

If you've never seen the beautiful DX awards available to licensed amateurs from the Central Radio Club of Czechoslovakia, then you're in for a real treat. It has been my pleasure this past month to have received the full details of their entire awards program and they are described in the paragraphs to follow.

S6S AWARD

The S6S Award is afforded those amateurs who have a QSO with at least one station located in each of the six continents as defined by the IARU since January 1, 1950. Awards will recognize those contacts of CW, phone, and RTTY, either all-band or single-band achievements. Mixed-mode contacts are recognized.

P75P AWARD

This award is for having worked at least 75 ITU zones as defined by the ITU Geneva Conference of 1959. All contacts must be made since January 1, 1960, and awards are available in three levels of achievement: 1st Class – 70 zones, 2nd Class – 60 zones, 3rd Class – 50 zones. Zones may be determined in accordance with a special map made available by the Central Radio Club for the cost of 3 IRCs. Also, it is important to note that all contacts must be made with "fixed" stations only.

ZMT AWARD

To qualify for the ZMT Award, applicants must have confirmed contact since April 26, 1949, with at least one station located in each of the following 39 areas: OK1, OK2, OK3, HA, LZ, UA1, UA2, UA3, UA4, UA6, UA9, UAØ, UB, UC, UD, UF, UG, UH, UI, UJ, UL, UM, UN, UO, UP, UQ, UR, DM (3 different regions determined by the last letter of the callsign), SP (3 different districts), YO (3 different districts), YU (3 different districts).

ZMT 24 AWARD

For those interested in pursuing the ultimate in DX endurance, the ZMT 24 Award is just for you. The requirements are exactly the same as for the basic ZMT Award detailed above, with the exception that all contacts must be made within a 24-hour period. Sound impossible? Absolutely not, but don't be discouraged if it takes you several attempts using the stopwatch!

100 OK AWARD

Check your QSL cards. If you can find a total of 100 OK stations, then you will qualify for the 100 OK Award. All contacts, however, must be made on or after January 1, 1954. Endorsement stickers are available for every additional 100 stations confirmed, up to a total of 500. Stations may be worked any band, any mode.

OK SSB AWARD

This award requires the applicant to have two-way SSB contact with different Czechoslovak stations totaling 25 points, without a date limitation. 1 point will be scored for QSOs on the 28-, 21-, or 14-MHz bands and 2 points for a QSO on the 7- or 3.5-MHz bands. There are no mode restrictions.

As an added tip to those wishing to pursue these very respectable awards, this editor recommends that you keep a close eye on the Contest Column in *73 Magazine* and consider making a few contacts during the annual OK DX Contest. Dates and times will be announced at least a month in advance of the scheduled event. The Awards Manager of the CRC also mentions that QSOs made during the contest will not require QSL confirmations. There is one stipulation, however: Application must be submitted along with your logbook entry for the OK DX Contest.

All the certificates are issued free of charge only for members of clubs or associations which accept this rule reciprocally. The fee for all others is 10 IRCs for the P75P Award and 5 IRCs for all the other awards offered by the Central Radio Club of Czechoslovakia. General certification rules apply by which contacts may be verified by two amateurs of a local club, a club official or a notary public.

Applications shall include details for each contact, i.e., callsign, GMT, date, frequency, mode, RS(T), and any additional information required for the award. Send to Central Radio Club, Awards Manager, PO Box 69, 113-27 Praha 1, Czechoslovakia.

Right at presstime, I received still another award incentive being offered by CRC. I encourage readers to take a close look at the Slovensko Award.

SLOVENSKO AWARD

The DX Club of Radio Amateurs of Slovakia offers this award to all licensed amateurs who can show proof of contact with stations in the different districts (OKR) of Slovakia (OK3, OL8, OL9, OLØ; districts listed below) after January 1, 1946.

Stations in countries which have a common border with Slovakia must contact 35 districts, 20 districts are required of stations in other European countries, and 10 districts are required for stations outside the European continent.

There are no band or mode restrictions. Applications with a GCR list and award fee of 5 IRCs may be sent to: Central Radio Club, PO Box 69, 113-27 Praha 1, Czechoslovakia.

Districts which qualify are: Banska Bystrica, Bardejov, Bratislava, Bratislava-Vidiek, Cadca, Dolny Kubin, Dunajska Streda, Galanta, Humenne, Komarno, Kosice, Kosice-Vidiek, Levice, Liptovsky Mikulas, Lucenec, Martin, Michalovce, Nitra, Nove Zamky, Poprad, Povazska Bystrica, Presov, Prievidza, Rimavska Sobota, Roznava, Senica, Spisska Nova Ves, Stara Lubovna, Svidnik, Topolcany, Trebisov, Trencin, Trnava, Velky Krtis, Vranov, Zvolen, Ziar nad Hronom, and Zilina.

TEN-TEN INTERNATIONAL NET AWARDS

For those of us who frequent the ten-meter band, a minute doesn't elapse that you don't

hear reference being made to the Ten-Ten International fraternity.

The 10-10 organization was formed in 1962 by a group of amateurs in southern California. To this date, there have been better than 27,000 amateurs join their ranks. The unique awards program for this international group was founded and managed for years by Frank Orcutt W4JO, who is now a silent key.

To qualify for membership into Ten-Ten International and to move up on their awards ladder of achievement, you first must make contact with ten (10) individual Ten-Ten members on the ten-meter band. From each QSO, you must obtain the station's call, 10-10 number, name, and exact QTH. Once this has been achieved, you may submit your list to one of the following area or district vice-presidents, along with your check of US $4.00 (includes fee for the quarterly 10-10 publication): 1—Earle W1NC; 2—Larry WA2SUH; 3—Jim WA3RBQ; 4—Clint K4EKX; 5—Grace K5MRU; 6—Dick W6ANK; 7—Ron WB7ADO; 8—Les W8ATK; 9—Del W9BPU; Ø—John NØADJ; New Zealand—Mac ZL3RK; Australia—Art VK2BXN; Europe—August DK5UG; DX at large—Jim K6PJO

Your application is checked against the 10-10 Net roster and if found correct, you will be issued your very own 10-10 number and Black Cat Certificate.

Once you obtain your 10-10 number, you may begin work toward various "bar" awards. The bar awards are issued in multiples of 100 individual 10-10 contacts. To apply for any bar award, you must not duplicate contacts previously claimed. In each case, submit only 100 contacts per application and no more. Each must show the callsign of the station worked, the 10-10 number, name, and exact QTH.

Award applications must show *contacts in 10-10 number* sequence. Applications received in any other order will be returned. There is no award fee for "bars"; however, an SASE sent along with your application is appreciated. Send to: Wm. "Bill" Risher WB6OMH, 10542 Loch Avon Drive, Whittier CA 90606.

This same process is repeat-

Continued on page 185

Contests

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

SENARC TOTEM POLE CONTEST
Starts: 0000 GMT May 3
Ends: 2400 GMT May 4

Sponsored by the Western Washington DX Club of Seattle, Washington, the contest is intended to promote the upcoming ARRL National Convention (SENARC). The convention is to be held in Seattle July 25th through the 27th. Entries must be for single operator, single transmitter. Operate either phone or CW, but not both. Use all amateur bands from 80 through 6 meters.

EXCHANGE:

Signal report and state or country.

SCORING:

All stations located outside the state of Washington will receive 2 points for each contact with a Washington state station and 1 point each for all other contacts. Washington state stations receive 1 point per QSO regardless of location.

ENTRIES & AWARDS:

All entries, consisting of contest logs or copies and claimed score, must be received by May 31st. Address all entries to: Totem Pole Contest, W7FCB, PO Box 499, Issaquah WA 98027. Awards will be presented at the SENARC Convention on July 26th at the Red Lion Inn, Seattle WA.

ERIE QSO PARTY
Starts: 0000 GMT May 3
Ends: 0000 GMT May 5

Sponsored by the Radio Association of Erie. Erie stations sign their calls followed by "ERIE" to alert passersby! Each station may be worked only once.

EXCHANGE:

Erie stations send RS(T) and serial number starting at 001; all others send RS(T) and state.

FREQUENCIES:

Phone—3980, 7290, 14340, 21420, 28600, 28835.

CW—3650, 7060, 14060, 21060, 28060.

Novice—3730, 7130, 21150, 28150.

AWARDS:

An attractive certificate will be awarded to one amateur in each of the ten US call districts and Alaska and Hawaii, one amateur in each of the Canadian districts, and one amateur in any non-US, non-Canadian district working the most Erie hams. The "Worked Erie, Pennsylvania" award will also be given to any station working 10 Erie hams. The Erie amateur working the most stations participating in the contest will receive a special certificate.

ENTRIES:

Send a signed copy of your log with contest QSO callsigns underlined by May 31st to: The Radio Association of Erie, PO Box 844, Erie PA 16512.

DARC CORONA 10-METER RTTY CONTEST
Contest Period:
1100 to 1700 GMT May 10

This is the second of four tests during the year sponsored by the DARC eV to promote RTTY activity on the 10-meter band. Each of the four tests is scored separately. Use the recommended portions of the 10-meter band.

EXCHANGE:

RST, QSO number, and name.

SCORING:

Each station can be contacted only once. Each completed 2-way RTTY QSO is worth 1 point. Multipliers include the WAE and DXCC lists and each district in W/K, VE/VO, and VK. Also count each different prefix as a multiplier. The final score is

Calendar

May 3-4	SENARC Totem Pole Contest
May 3-5	Erie QSO Party
May 10	DARC Corona 10-Meter RTTY Contest
May 10-12	Georgia QSO Party
May 11	Worked All Britain Contest—HF CW
May 17	Dogwood Festival QSO Party
May 17-18	Florida QSO Party
May 17-18	ARRL EME Contest II
May 17-18	Tri-State QSO Party
May 17-19	Massachusetts QSO Party
May 17-19	Michigan QSO Party
May 24-25	CQ Worldwide WPX Contest—CW
May 24-25	Hollywood ARC Anniversary QSO Party
Jun 14-15	ARRL VHF Contest
Jun 14-15	VK/ZL/Oceania RTTY DX Contest
Jun 22	Worked All Britain Contest—LF Phone
Jun 28-29	ARRL Field Day
Jun 28-29	QRP ARC International QRP Field Day Contest
Jul 1	Canada Day Contest
Jul 12-13	IARU Radiosport Championship
Jul 20	Worked All Britain Contest—LF CW
Aug 2-3	ARRL UHF Contest
Aug 9-10	European DX Contest—CW
Aug 31	Worked All Britain Contest—VHF
Sep 13-14	European DX Contest—Phone
Sep 13-14	ARRL VHF Contest
Sep 13-15	Washington State QSO Party
Sep 14	North American Sprint
Sep 27	DARC Corona 10-Meter RTTY Contest
Oct 4-5	California QSO Party
Oct 4-5	ARRL Simulated Emergency Test
Oct 11-12	ARRL CD Party
Nov 1-2	ARRL Sweepstakes—CW
Nov 8-9	European DX Contest—RTTY
Nov 8-9	IPA Contest
Nov 9	International OK DX Contest
Nov 15	DARC Corona 10-Meter RTTY Contest
Nov 15-16	ARRL Sweepstakes—Phone
Dec 6-7	ARRL 160-Meter Contest
Dec 13-14	ARRL 10-Meter Contest

Results

RESULTS OF THE 1979 OK DX CONTEST

	1 operator, all bands			
1. N4YF	295	574	41	23,534
2. K2SX	230	386	51	19,686
3. W9RE	228	369	34	12,546
4. KA1EP	287	489	24	11,736
5. W1LQQ	170	253	32	8,096
6. WA4OML	174	332	19	6,308
7. W6UA	123	205	21	4,305
8. K1KI	124	205	16	3,280
9. W3GTN	84	102	29	2,958
10. W5QF	86	141	16	2,256
11. N1RI	71	122	17	2,074
12. W6NNV	58	93	22	2,046
13. WB4WHE	70	105	19	1,995
14. AA6EE	74	93	21	1,953
15. K4BAI	85	162	12	1,944
16. WA4QMQ	73	116	16	1,856
17. W4DGX	24	38	8	304
18. WA2SIT	12	30	3	90
19. W1OPJ	4	6	3	18
	1 operator, 14 MHz			
1. W4KMS	52	84	9	756
2. W9QWM	34	34	17	578
3. WØLHS	7	13	4	52
	1 operator, 21 MHz			
1. W3CBF	42	86	5	430
	1 operator, 28 MHz			
1. N4CCJ	19	31	2	62
	Multi-operator, all bands			
1. N4OL	677	1,065	105	111,825

Log for checking purposes: W1CM

the total number of QSOs times the total multiplier.

AWARDS:

Plaques will be awarded to the leading stations in each class with a reasonable score present. Operating classes include Class A for single- or multi-op and Class B for SWLs.

ENTRIES:

Logs must contain name, call, and full address of participant. Also show class, times in GMT, exchange, and final score. SWLs apply rules accordingly. Logs must be received within 30 days after each test. Send all entries to: Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee, West Germany. The remaining contest periods are on September 27th and November 15th.

GEORGIA QSO PARTY
Starts: 1600 GMT May 10
Ends: 0200 GMT May 12

Sponsored by the Atlanta Radio Club, Inc., the contest is open to all. No restrictions as to mode or operating time. Stations may be single- or multi-op, but only one transmitter is allowed in operation at one time. No crossband or repeater contacts except via OSCAR.

EXCHANGE:

QSO number, RS(T), and state, province, country, or GA county. GA to GA contacts are permitted.

FREQUENCIES:

Phone—3900, 7245, 14290, 21360, 28600.

CW—1805, 3590, 7060, 14060, 21060, 28060.

Novice—3718, 7125, 21110, 28110.

Try 160 meters at 0300 GMT. Try 10 meters on the hour and 15 meters on the half hour during daylight hours.

SCORING:

Count one point per QSO. GA stations multiply QSO total by number of different states, provinces, and DX countries. Others multiply QSO points by number of different GA counties worked (159 max.).

AWARDS & ENTRIES:

Plaques awarded to highest-scoring GA and non-GA stations. Certificates to highest station in each state, province, country, and GA county. Special certificates to highest-scoring GA and non-GA Novice and Technician.

Logs should show QSO number, date and time in GMT, station worked, RS(T) sent and re-

Continued on page 196

New Products

BTA-1 RTTY CONTROL CENTER

The MS COMM Associates' BTA-1 is a microprocessor-based RTTY control center. With its ASCII-Baudot and Baudot-ASCII conversion capabilities, the BTA-1 has features to satisfy the requirements of the most demanding amateur operator.

The BTA-1 is based upon the Intel 8085 microprocessor family and all functions are operator switch-controlled. The device is designed to enhance the capability of any RTTY station by processing the data passed to and from the station terminal unit (TU).

Automatic conversion between ASCII and Baudot codes is provided and a precision crystal-controlled clock permits the selection of four popular Teletype® speeds. Switches select 60 and 100 wpm, as well as 110 and 300 baud. Custom baud rates are available.

The BTA-1 has a 1024-character FIFO buffer to facilitate speed conversion. The buffer may be pre-loaded with data prior to actual transmission. A three-character LED readout indicates the number of characters in the FIFO at any time and a buffered TTL output is provided to sound an alarm when the buffer is three-quarters full.

All received and transmitted data is processed by UART devices to ensure minimum distortion. The BTA-1 can interface terminal units with either FSK RS232 (voltage level) protocol or TTL-compatible signals. The Mark level is jumper-selectable. The processor interfaces station printer equipment by driving a 20- or 60-mA loop. TTL inputs and outputs are also provided.

FCC CW ID requirements are handled automatically by the BTA-1. A custom ID message is programmed into the device and is automatically transmitted every ten minutes when the station is on the air. A buffered TTL output drives the station CW ID input. A switch allows the ID to be sent upon demand if desired. While the ID is in progress, data from the station keyboard is diverted to the FIFO buffer for transmission following the ID.

A unique feature of the BTA-1 is its "canned message" capability. With the flip of a switch, the operator can type a message into the memory of the BTA-1. This message is recalled whenever desired by depressing another switch; the message is placed in the buffer following any data already present.

A SELCAL (selective-calling) feature allows the station printer to remain off until a predetermined five-character code is received. A TTL output is provided to turn the printer on (through an external relay) when the correct sequence is received. The printer is turned off when an NNNNN sequence is transmitted. Once again, the SELCAL code is entered by the operator and may be changed at any time!

MS COMM Associates provides the BTA-1 RTTY processor in kit or ready-built and tested form. The processor is contained on a single 8" x 11" PC board with a standard 44-conductor edge connector. All critical IC devices are socketed, as well as the LED display chips. Edge connector and control switches are included with the BTA-1. A comprehensive manual provides interfacing hints and techniques. A QSL brings complete specs and an order form. *MS COMM Associates, Box 225 Slip Road, Greenfield NH 03047.* Reader Service number 479.

CORRECTION

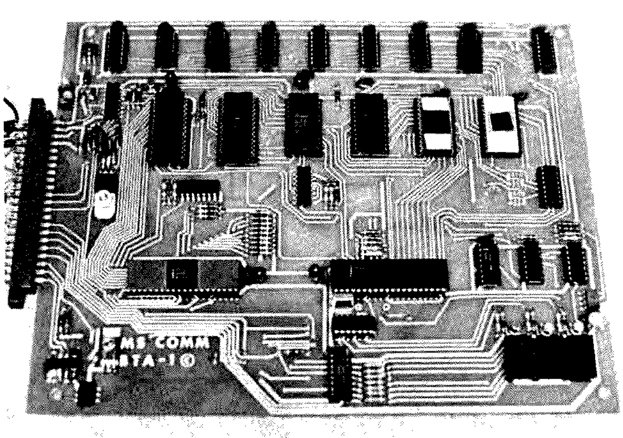
The Maggiore Electronics advertisement which appeared in the March issue was incorrect. Please refer to the Maggiore ad elsewhere in this issue for the correct prices. *73* apologizes for the error.

AZDEN PCS-2000 2-METER FM TRANSCEIVER

One of the newest arrivals on the amateur radio market, the Azden PCS-2000 2-meter radio, is quite a radical piece of gear. It is manufactured by Japan Piezo Company, Limited, which has been around for some time. The company is known in Japan as a maker of audio equipment such as microphones and hi-fi tone arms. Perhaps because of its relative newness in the field of ham radio, its outlook toward our hobby has a unique slant. For example, there is no tuning dial on the PCS-2000; frequency control is accomplished by push-button switches. In fact, the only knobs are the controls for volume and squelch.

In conjunction with other testing labs, I have performed a thorough technical evaluation of this radio. This was no casual once-over, but a rigorous EIA shakedown that took days. The purpose of this exhaustive testing was to determine the suitability of this unit, both electrically and mechanically, for marketing. I do not intend to reel off a long, highly technical treatise here, but rather to discuss the operation of the unit from a hands-on, user-oriented point of view.

Japan has been flooding the American market for several years with everything from ham gear to electronic games. The quality of these products is getting better and better, and in many categories the price is diminishing because of rapid technological advances. This is especially true of microcomputers. The Japanese people also have pride in their work. Many of them work twelve hours a day, six days a week. In the course of the engineering work for the PCS-2000, I had an opportunity



MS COMM Associates' BTA-1 RTTY control center.

The Azden PCS-2000 separates into two units. The transmitter and receiver circuitry is housed in the larger, heavier cabinet, which can be located conveniently under the passenger seat or in the trunk. The small, light, control head contains the microcomputer. The display LEDs are unusually large (½ inch). The unit is shown in memory channel 5 using a split of + 600 kHz.

to meet with Export Manager Takano and Chief Engineer Fujino. Their seriousness about 2 meters is reflected in the first piece of ham gear they are selling here.

Unusual Features

The first thing that strikes an observer is the 12-button keyboard on the front panel. These twelve keys control the microcomputer, which is responsible for all the scanning and frequency functions of the transceiver. Microcomputers (also sometimes called microprocessors) are now available at a cost so low that they can be used in everyday consumer items. The frequency is chosen by first selecting the MHz digit and then individually setting the digits for 100 kHz and 10 kHz. The digit in the 1-kHz place may be set to either 0 or 5. Hence, the radio covers 800 channels in the range of 144.000 to 147.995 MHz.

There are six memory channels with scan in three modes, called "busy," "vacant," and "free." The "busy" mode is for finding an occupied channel and the "vacant" mode is for locating an empty channel. The scanner runs continuously in the "free" mode, no matter what's happening on any of the channels.

The scanner also will operate in the automatic mode, meaning that it will scan the band in increments of 10 kHz. It does this within a 1-MHz range as chosen by the MHz UP key on the keyboard. For example, if you're on 145.000 MHz and start up the autoscan, the PCS-2000 will move in 10-kHz steps until it reaches 145.990 MHz, return to 145.000 MHz, and continue upward again.

A modification can be performed to change the autoscan so that it will scan from 144.000 to 147.990 MHz in a single sweep; information on this may be obtained from the distributor. (I personally prefer to have it the way it is. Most repeaters are in the upper 2 MHz of the band, and scanning non-FM channels is a waste of time. Each channel is encountered four times as often in the given scanning range with 1-MHz scan width. A short transmission is thus less likely to be missed.)

Whether the microcomputer is scanning the memory channels or the full band, scanning resumes once the transmission

✓Reader Service—see page 226

General Specifications

Frequency Range—144.000-147.995 MHz.
Power Requirements—13.8 V ±15% negative ground, 0.7-A receive, 5.0-A transmit (high power).
Dimensions—HWD 62 x 158 x 246 mm (2.4 x 6.2 x 9.7 inches).
Weight—Approximately 2.5 kg (5.5 lbs).
Transmitter Output Power—Nominal 25 W (high), 5 W (low).
Receiver Sensitivity—Better than 0.28 μV for 20-dB quieting.
Spurious Emissions—Down more than 60 dB from level of fundamental carrier.

is complete (in "busy") or when a transmission begins (in "vacant). Scanning always will stop immediately when the microphone PTT button is depressed. This makes it impossible to transmit while scanning. (Multiple-repeater saboteurs had better pick another radio!)

The PCS-2000 has a "detachable head." The control part of the radio comes apart from the transmitter and receiver circuitry. This feature will no doubt prove extremely popular since in many of the newer subcompact cars there isn't room for even a small piece of gear without a major comfort sacrifice. Also, if your car is like mine, the dashboard is made out of plastic. On a bumpy road, the mounting bracket for a piece of heavy gear could tear out, sending it tumbling down underneath the brake pedal! But the control head alone is very light, and the chances of it breaking free are quite minimal.

A 15-foot cable, available as an accessory, connects the control head to the main unit. The main unit can go under the passenger's seat or even under the hood or in the trunk. You'll have to wire up a remote speaker if you use this feature, because the internal speaker is in the rear part of the radio. The control head and main unit both have remote speaker jacks.

The PCS-2000 provides the usual simplex, +600, and −600 operating modes. There also is a provision for non-standard offsets. The PCS-2000 comes with a crystal that gives nonstandard offset values of +400 kHz, +1 MHz, and +1.6 MHz. I'll discuss this in greater detail later.

With a minor modification, the frequency coverage can be extended to the range of 142.000 to 149.995 MHz receive and yet a bit further for transmitting. This should interest MARS and CAP enthusiasts. An instruction sheet that describes the necessary changes is provided with each radio.

The microphone for this transceiver is especially interesting. Controls for volume, squelch, frequency (within a 1-MHz range as determined by the front-panel keyboard), and instant memory-channel-1 recall are built right into the thing. In addition, a kit is available for the installation of a touchtone™ pad on the back side!

Microcomputer

Operating the PCS-2000 is an experience that in some ways is like working a calculator. You can spend a week playing with the 12-button keyboard and not make a single transmission, and you still might not be acquainted with everything.

The keys operate on the principle that "the first key wins"—that is, if you hit two keys at almost the same moment, the microcomputer will perform only the function of the first key. If a key is held down, all others are disabled. Transmitting also disables the keyboard. It is difficult to actuate the wrong key by mistake.

The MHz UP key sets the MHz digit of the operating frequency. Pressing this key repeatedly will cause the MHz figure to change from 4 to 5, 5 to 6, 6 to 7, and 7 to 4. While in the automatic scan mode, the MHz figure can be changed by pressing this button and scanning will not be interrupted.

The 100k UP key advances the 100-kHz digit. Each time this key is pushed, the frequency increases by 100 kHz, except that the MHz figure will *not* change. (That is, if the 100-kHz figure is 9, pushing this key will change it to 0, a frequency drop of 900 kHz.) The 100k DOWN key reduces the 100-kHz digit by one figure.

The key labeled 10k UP advances the frequency upward by 10 kHz but will not affect the MHz figure. Holding this key down for more than one second moves the frequency up rapidly in 10-kHz increments. This gives the feeling of tuning a vfo. As you draw near the desired frequency, you can release this key and then actuate it 10 kHz at a time until you're there. The 10k DOWN key works in the same way, but in the other direction. Both of these keys are duplicated on top of the microphone. This feature is extremely useful in mobile operation since it allows you to tune anywhere within a 1-MHz range without reaching for the panel. It's easy to locate these keys by feel.

The four kHz UP and DOWN keys (and the two on the microphone) have an additional common function: to stop the scanner. No matter in what mode the radio is scanning, the scan will stop when any of these keys is pushed. Suppose you're driving along and scanning the range of 146.000 to 146.990 MHz for a busy channel. The scanner comes across a station and stops. You are interested in the conversation and want to keep listening. So you tap the DOWN key on top of the microphone, and the radio will stay put. Otherwise, the scanner will start up again as soon as the carrier disappears.

The AUTO SCAN key will initiate scanning from the displayed frequency in steps of 10-kHz upward continuously without changing the MHz figure. The scan rate is eight channels per second. Hence a 1-MHz range is covered in about 12.5 seconds. Modification instructions are available from the distributor to allow the autoscan to cover the entire 4-MHz range in one sweep. There are advantages to either scan bandwidth, but as I said before, I prefer the 1-MHz segments.

The key labeled ±600 SHIFT will change the offset from simplex to +600 kHz, +600 kHz to −600 kHz, or −600 kHz to simplex. When operating with either repeater offset, the display changes to show the transmit frequency when the PTT button is depressed. However, if the receiving frequency is within 600 kHz of either band edge, any attempt to transmit outside the band using these splits will result in simplex operation. (This microcomputer is foolproof!)

It's important that the OFFSET/SCAN selector, a six-position rotary switch in the upper right-hand corner of the front panel, be to the right of center. If it is left of center, an additional split will be thrown in and you'll sit there trying to figure out why you can't raise a repeater only three blocks away. I'll have more to say about this switch later.

There are six memory channels. The memory address is shown by LEDs under the row of numerals 1 through 6. In the photo, the memory address is at memory channel 5. When scanning memory, the LEDs light up in succession as each channel is passed. The fluctuating display and the sweeping red dot make an impressive sight indeed!

Operation in the memory mode is carried out by means of five keyboard buttons: M ADRS, M SCAN, M1 CALL, M CALL and M WRITE. A detailed description of the interaction of these five keys would get too complicated for this review. It's pretty hard to grasp fully all the memory capabilities even by reading the manual! Far be it for me to recommend that we stop reading instruction manuals (to those few of us that do!), but an integral part of learning the microcomputer operation of the PCS-2000 is just to sit down and play with it. Suffice it to say that each memory channel can be programmed and reprogrammed, and that the unit will hold memory when power is removed.

There are a couple of especially unique and useful memory functions. You actually have access to seven, not just six, channels at a given time, although you can *scan* only six: The frequency in use just prior to entering the memory mode is always instantly available. Let's use an example. Suppose you're on 147.330 MHz and not in the memory mode, and that this frequency is not in any of the memory channels. You call memory channel 3. (It could be any of the six.) You have, in fact, immediate access to *three* different frequencies. Push M1 CALL and you'll go to memory channel 1; hit M CALL and you'll be back on channel 3. Hit the 10k UP or 10k DOWN key and you return to the frequency prior to calling memory—147.330 MHz. These three frequencies can be accessed in any order, as many times as you like, by touching only one key. It is possible to access memory

Continued on page 190

C. J. Klinert WB6BIH
1126 Division Street
National City CA 92050

Home-Brew Rf Impedance Bridge

—indispensable tool for antenna fans

In the construction and adjustment of HF antennas, an undesirable standing wave ratio may be experienced even though the antenna appears to be operating at resonance. The exact antenna impedance may be unpredictable because of interaction with other objects, or variations in physical configuration as a result of mechanical restrictions. The use of a simple impedance measuring device can eliminate the uncertainty of estimating antenna impedances and allow an intelligent approach to antenna matching. This article describes the construction of a high-frequency rf impedance bridge capable of measuring resistive impedances of 5 to 500 Ohms at frequencies up to 30 MHz. Calibration and operating instructions are included.

Theory of Operation

Fig. 1 shows the simplified schematic diagram for the impedance bridge. The meter compares the voltage at the unknown R with the voltage at the variable R when rf voltage is applied. If the variable R is adjusted for a minimum meter indication, the voltage at the wiper of the variable R is equal to the voltage at the junction of the fixed R and unknown R, and the bridge is balanced. Now the voltage division ratio of the variable R is equal to the voltage division ratio of the other two resistors. Since the fixed R resistance is known and the variable R resistance can be calibrated, the unknown R can be determined. In practice, the dial of the variable R is marked with resistance values while various known-value resistors are substituted for the unknown R when the bridge is balanced.

Design Points

Fig. 2 shows the schematic diagram of the impedance bridge. A 250-Ohm potentiometer is smaller and less expensive than a differential capacitor. The use of two separate diode detectors, D1 and D2, provides convenience of operation, since the zero-center meter will indicate the direction of the null even when pinned. This also eliminates the need for a sensitivity control, since D3 and D4 will limit the voltage across the meter and its series resistor.

The use of two 2-Watt, 100-Ohm resistors for the fixed 50-Ohm element provides for power dissipation. The 250-Ohm value for the potentiometer was also selected for power considerations. A nominal 5-Watt (53-Ohm) input results in a sharp null with moderate component heating. The use of a hot-carrier diode such as the 1N5711 for D1 and D2 may seem indicated, but diodes can be selected for matched characteristics at less expense, and errors can be calibrated out. It was decided not to include reactive measurements in the impedance bridge since this would add expense, increase size, and complicate calibration. If the unknown antenna can be first tuned to a resistive impedance by using a grid-dip oscillator,

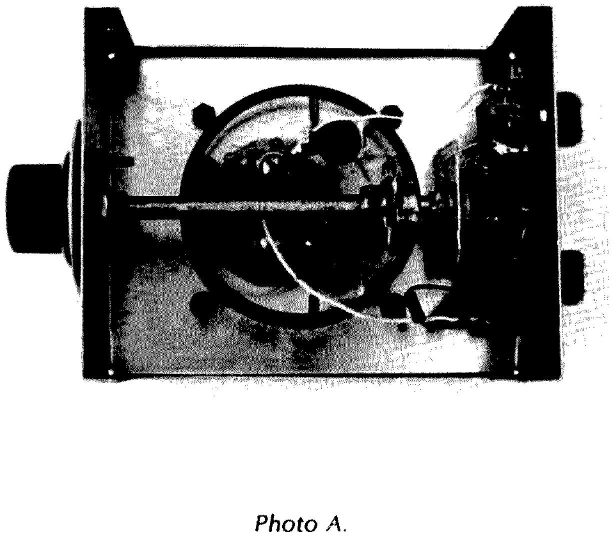


Photo A.

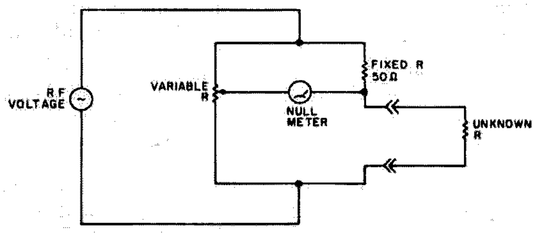


Fig. 1. Simplified schematic diagram.

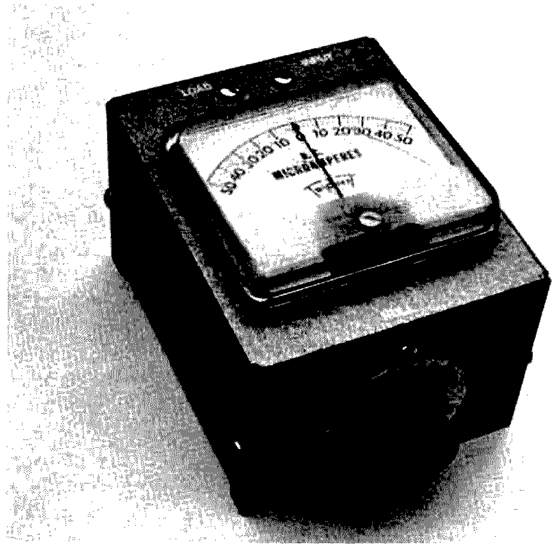


Photo B.

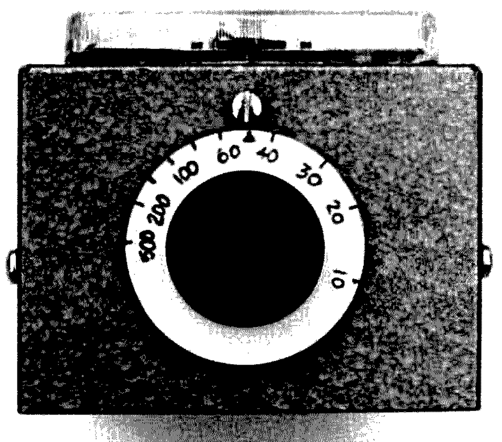


Photo C.

reactive measurements are unnecessary.

Construction

The impedance bridge is built in a California Chassis M-60 aluminum box. The most important mechanical consideration is to provide short connections for the portions of the device. The potentiometer is a Clarostat RV4NAYSD251A, and must be mounted near the two SO-239 connectors. A shaft coupling and extension allow a convenient location for the dial at the front of the meter movement location. A small aluminum bracket is used to mount the potentiometer. The meter is a Triplett 327-PL, 50-uA, zero-center (100-uA, end-scale) movement. The dial can be made from a knob with a large flat washer attached for a scale. The calibration marks are then written on the washer in pencil. A screw-head slot provides the index mark. Fixed resistors are half-Watt carbon unless otherwise indicated in Fig. 2. The capacitors are disc ceramic.

Alignment

Table 1 lists the test equipment used in the preparation of this article. Connect the equipment as shown in Fig. 3. Adjust the rf source for a five-Watt power meter indication. Connect a 50-Ohm (approximately) calibration resistor to the impedance bridge LOAD terminal. Set the impedance bridge NULL potentiometer to each end of its range and verify an impedance bridge meter indication of approximately 50 uA at each end of the meter scale. The most convenient use of the impedance bridge will result if the meter is connected so that a clockwise NULL control setting will cause a positive meter deflection. Change the meter connections if required. If a symmetrical meter indication cannot be obtained while manipulating the NULL control, try changing any of the diodes. Diodes have been found to be shorted, "weak," or accidentally marked with reversed polarity.

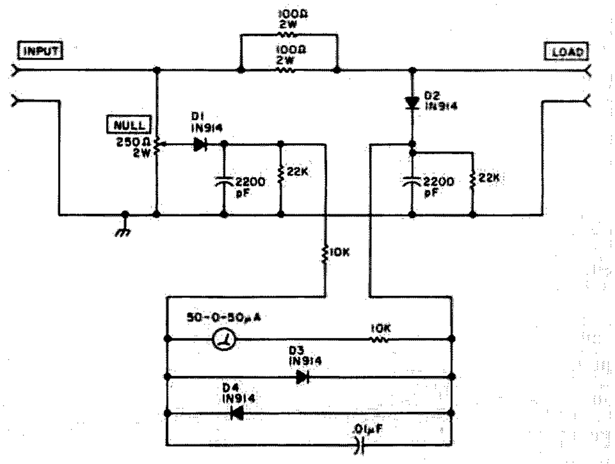


Fig. 2. Schematic diagram. Capacitors are disc ceramic; resistors are ½-Watt unless otherwise indicated. Boxes indicate panel markings. Connect meter polarity so that clockwise rotation of NULL potentiometer causes positive meter deflection.

Name	Application	Model/Part no.
Rf source	Drive impedance bridge and swr bridge	Heathkit HW-32
Swr bridge	Antenna measurements	Heathkit HM-2102
Grid-dip oscillator	Resonate antenna	Heathkit GD-1B
Calibration resistors	Calibrate impedance bridge and swr bridge	2-Watt Carbon, P/N RCR42 (assorted)
Volt ohmmeter	Check Calibration resistors	Micronta 22-204A
Dummy load	Load for rf source (50-Ohm nominal)	Heathkit HN-31
Precision resistor	Resistance calibration standard	P/N RN-, RLR-, RD-, or RBR- prefixes
Power meter	Measure rf source output	Swan WM-1500

Table 1. Equipment requirements. (Selection of these items does not indicate a product endorsement or evaluation of their performance. Use of other equipment may result in perfectly satisfactory results in the procedure.)

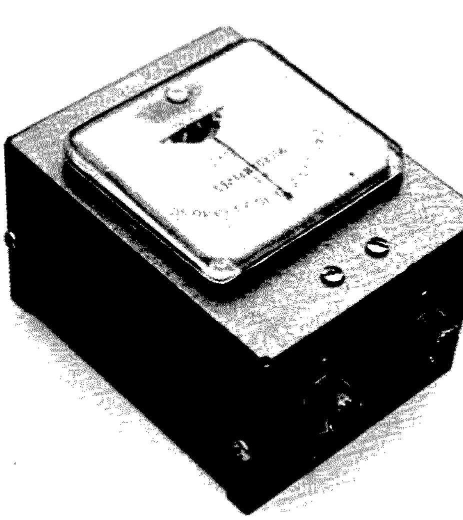


Photo D.

Photo E.

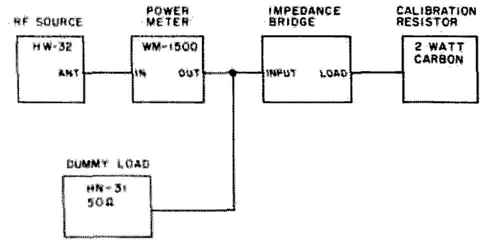


Fig. 3. Test configuration.

Calibration

Calibration is the periodic verification of essential performance parameters. Traceability of all measured values to a higher accuracy standard is essential. Fig. 4 shows a suggested flow of traceability for the impedance bridge. Note that the impedance bridge could be calibrated directly from the carbon calibration resistors. However, some type of testing is required to verify the accuracy of the calibration resistors since it is known that this type of resistor is not extremely stable or very precisely specified. Also note that *periodic* calibration of the impedance bridge is required since it is

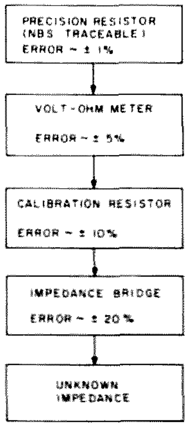


Fig. 4. Typical calibration traceability.

made from the same type of resistor. Check the calibration resistors with a calibrated volt ohmmeter and mark the resistors with their indicated values. Check the volt ohmmeter with a precision resistor. The precision resistor can be any of the marked film or wire-wound resistors. If the resistor is purchased new and undamaged, calibration traceability in the manufacturing process is (hopefully) assured. Part numbers for precision resistors beginning with RN-, RNR-, RLR-, or RBR- are excellent.

Connect the equipment as shown in Fig. 3. Connect a calibration resistor to the impedance bridge LOAD terminal and adjust the impedance bridge NULL control for a zero (center) impedance bridge meter indication. Mark the calibration resistor value on the impedance bridge NULL dial. Repeat this procedure for all resistance values desired.

Note: The swr bridge also can be calibrated by this method. Standing wave ratio is given by: swr $= Z_1/Z_2$, where Z_1 and Z_2 are the impedances of the source (swr bridge) and the calibration resistor. The larger resistance value is used for Z_1 so that the swr will be a number greater than one. The swr measurement will give the ratio of the resistances, but will not indicate which is larger.

Typical Applications

A shortened 20-meter vertical ground-plane antenna was constructed to demonstrate the use of the impedance bridge. Impedances of vertical antennas of varying length are well known[1] and provide some indication of the impedance bridge's performance.

The ultimate objective was to construct a 20-meter antenna from a 12-foot length of aluminum tubing. Fig. 5 shows the results of various configurations. The following procedure was used to adjust the antenna:

1) Make rough adjustments for antenna resonance by using the grid-dip oscillator coupled to a loop of wire at the antenna base.

2) Make fine adjustments with the swr bridge by varying the rf source frequency and observing where the minimum swr is.

3) Measure the resistive base impedance of the antenna with the impedance bridge.

4) Use the best available means to match the antenna impedance, or,

5) Change the antenna tuning method to change the base impedance and allow application of the matching devices available, and,

6) Repeat steps 1 through 5 until the antenna is matched.

Fig. 5 shows that a perfect match for a 53-Ohm system was not found. To illustrate a simple matching system, ¼-wavelength transmission-line matching sections were applied. The length (in feet) of a ¼-wave coax section is $\lambda/4 = 246(V)/F$, where V is the transmission line velocity factor (0.66 for RG-58 and RG-59) and F is the frequency in MHz.[2] The impedance, looking into the end of a terminated section is $Z = (Z_o)^2/Z_L$, where Z_o is the

matching-section characteristic impedance and Z_L is the termination impedance at the other end of the section. Manipulation of the equation shows that a good match to a 73-Ohm system can be obtained with a 53-Ohm matching section for the antennas of Fig. 5(b) and (d). This is a popular matching technique for vertical antennas. The Fig. 5(a) antenna could be matched with a 4:1 toroidal transformer (2:1 turns ratio).

To accomplish a match to a 53-Ohm system, two matching sections were used. Fig. 6 shows this approach. This method provides a good match to the antennas of Fig. 5(e) and (c). The Fig. 5(e) approach was finally settled upon since the capacitive top loading allowed the use of a very small base-loading inductance, thus increasing antenna efficiency. A large base inductance will cause loss since it is used at a high-current point. The amount of capacitive and inductive loading was adjusted while keeping the antenna resonant (one was balanced against the other), until the desired base impedance was obtained. Actual measured values are shown in parentheses in Fig. 6.

For the record, the capacity hat for Fig. 5(e) was four 30-inch pieces of 3/8-inch diameter tubing. The inductor was two turns of #18 wire, ¾-inch in diameter, and ¼-inch long. The antenna vertical element was a 12-foot length of 2-inch diameter tube, and radials were made from six 17-foot lengths of #18 wire spread around the roof. The antenna was mounted with two chain-link fence clamps bolted into a piece of plywood nailed to the gable of the roof. The bottom of the antenna was insulated with plastic tape. A California Chassis box was used to cover the base of the antenna, which extended through a hole in the top of the box. The hole was insulated with a free sample of caterpillar grommet from Weckesser. UHF connectors (PL-259, etc.) were used to connect the coax sections for ease of measurement, but connections could be simple splices for permanent use.

Conclusions

The previous exercise may seem pointless, but it serves as a good illustration of typical measurement and matching methods. Anyone would be most inclined to feed the ¼-wavelength antenna with 53-Ohm line and tolerate the 1.5:1 swr. Also, the antenna length could be increased to 0.28-wavelength[1] and tuned with a capacitor to match a 53-Ohm line. The point is that the use of a simple impedance bridge will allow the employment of all these techniques and provide verification of antenna theory application.

The Ben Lowe article[3] provides impedance measurements made with only an swr bridge, and performance of some calculations. It is felt, however, that many amateurs will prefer the use of the impedance bridge to avoid doing the calculations, particularly if many measurements are to be made. Also, many inexpensive ham and CB swr bridges don't have the resolution to make precise swr measurements since they are intended primarily to find 1:1 swr. ■

References

1. *Reference Data for Radio Engineers*, Howard W. Sams & Co., Inc. (ITT), Sixth Edition, pp. 27-8 (Fig. 6).
2. *The Radio Amateur's Handbook*, ARRL, Newington, Connecticut, November, 1978 (1979 edition), pp. 19-1 to 19-6.
3. Ben Lowe K4VOW, "Impedance Measurements Using an Swr Meter," *Ham Radio*, April, 1979, p. 80

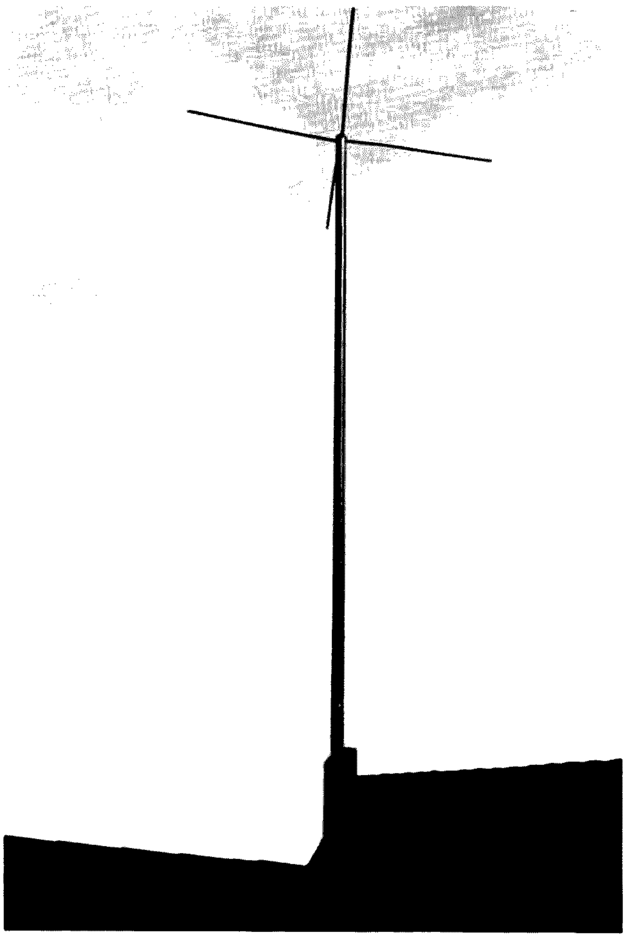


Photo F.

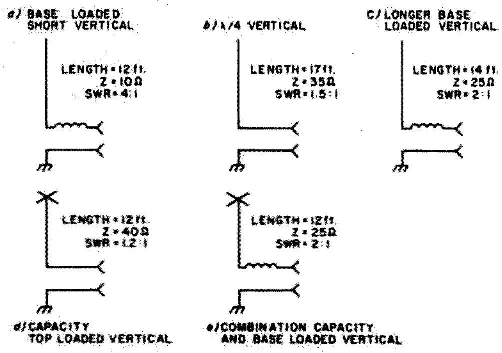


Fig. 5. Antenna measurements. Numbers are measured values; swr is referenced to 53-Ohm (nominal) system; frequency is 14.2 MHz. Measurement setup is shown in Fig. 3.

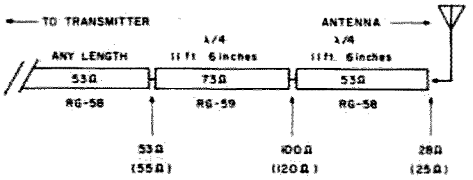


Fig. 6. Coaxial matching exercise. Values in parentheses are measured values; impedances are measured "looking toward" antenna with components to the transmitter end disconnected. Measurement setup is shown in Fig. 3.

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Rotary Beam for 10 or 15: the LB-2

—eliminates nasty matching problems

My first rotary-beam antenna was a two-element, 10-meter "signal squirter" manufactured by the late M.P. Mims W5BDB. During the forty-odd years since then, I have owned many beam antennas, some homemade and some factory-made. Most of my homemade arrays used the gamma-matching system, and I always had problems during the rainy season when moisture collected on the variable capacitor plates. Another problem with both the commercial and homemade arrays was noisy reception, thought to be due to corroded electrical connections after the antenna had been on the tower for several months.

About a year ago, I began experimenting with the design of an "ultimate" antenna—one which would stand up under all kinds of weather conditions and remain in adjustment for long periods of time. At the same time, I carried out a number of experiments aimed at reducing the high noise-level problems on the 15- and 10-meter bands. The end result is the LB-2 array described here. Two of these antennas have been built—one for 15 meters and another for 10 meters. Except for size, the characteristics of the two antennas are identical and the performance of each leaves little to be desired. Although both antennas will be covered, the 15-meter array will be described in more detail.

Design Frequency (In MHz)	Radiator	Director	Spacing	Stub
21.1	Notes 1, 2	21' 4"	5' 1¼"	49"
21.3	Notes 1, 2	21' 1½"	5' 1"	48"
21.4	Notes 1, 2	21' ¾"	5' ¾"	47"
28.2	Notes 1, 3	15' 11½"	3' 10"	37"
28.6	Notes 1, 3	15' 8¾"	3' 9½"	36"
29.5	Notes 1, 3	15' 3"	3' 8"	35"

Notes

1. Radiator length will be determined by resonating and matching adjustments.
2. For 15 meters, start with a radiator (driven element) length of 22' 7" and adjust as required. See text.
3. For 10 meters, start with a radiator length of 17' and adjust as required. See text.
4. Stub dimensions are measured down the stub from the antenna end. These dimensions were taken from the prototype antennas after final adjustments were made. Actual position of shorting bar will depend upon the length of the radiator, since each interacts upon the other. Dimensions apply only to stubs made from ½" tubes spaced 3" on centers (300 Ohms Z_0).

Table 1.

Design

Why a two-element array? In the first place, I am retired and disabled and my budget is limited. Second, because of trees surrounding the ham shack, I am limited also in space. A long-boom, multi-element yagi was simply out of the question. Third, I wanted a low-cost, lightweight antenna that could be built from materials readily available at the local hardware or do-it-yourself builder's supply store, and one which could be turned by a heavy-duty TV antenna rotator. When properly designed and adjusted, the two-element parasitic array, consisting of a driven element and one parasitic director spaced 0.11 wavelengths apart, produces the highest forward gain per unit size of any type of antenna used by amateurs. The antenna described here is spaced for maximum forward gain—about 5.3 dB greater than the signal from a half-wave dipole at the same height above ground. When adjusted for maximum forward gain, the front-to-back ratio of the array is only about 7 to 10 dB.

If you wish a greater front-to-back ratio, adjust the spacing to about 0.125 to 0.150 wavelengths. Although the front-to-back ratio improves with wider spacing between the elements, the forward gain goes down to about 5.0 dB over the dipole. Nevertheless, a 5.0-dB gain will give a considerable boost to your signal on either 10 or 15 meters when it is compared with the signal from a dipole or quarter-wave vertical antenna. When the array is adjusted for the maximum front-to-back ratio,

the discrimination between signals off the front and back of the array will be in the order of 15 to 17 dB.

Matching

In addition to the features listed above, I wanted a matching system that would be easy to adjust and one that would remain in adjustment for long periods of time, unaffected by the weather. After much searching and reading, I finally found a description of a "line bazooka" (balun) matching device in the Collins military technical manual, *Fundamentals of SSB*, published in 1959. A similar device was described by William I. Orr W6SAI, in the 19th edition of the *Radio Handbook*, published by Howard W. Sams & Co. This device first attracted my attention as a means of getting rid of the troublesome gamma capacitor. However, it has several other desirable characteristics, as well. As it is a shorted stub less than a quarter wavelength long, it acts as an inductance and introduces an X_L component at the driven element feedpoint. The driven element itself is adjusted to introduce an X_C component across the open end of the stub. The two reactive components tend to oppose each other as the operating frequency is made higher or lower than the array design frequency, producing a broadband effect.

In the array described here, when adjusted for a line swr of 1:1 at 21.3 MHz, the line swr was still less than 1.75:1 at either 21.0 or 21.450 MHz. If you have read about line bazookas in the handbooks, you may get the wrong impression of this device. The quarter-wavelength bazooka is used as a 1 to 1 impedance transfer device. The short line bazooka matches a coaxial line input to the approximately 18 Ohms of impedance at the center of the driven element. It also acts as a balun, since the 53-Ohm input is unbalanced (coaxial line) and the output is 18 Ohms balanced. It also acts as a decoupling device to prevent rf currents from flowing on the outside of the 53-Ohm coaxial transmission line from the antenna to the transmitter. The impedance-transfer ratio of the device, unbalanced to balanced, and its broadbanding effect depend upon the Z_0 of the stub, which, in turn, depends upon the center-to-center spacing between the two ½-inch copper tubes and the position of the shorting bar across the two conductors.

I spent much time experimenting with the size, length, and spacing of the two copper tubes that make up the matching section before the optimum dimensions were found. If the tubes are spaced too closely, the bandwidth will be narrow; if they are spaced too wide apart, the coaxial inner-conductor loop at the open end of the stub begins to exhibit inductive effects in the circuit. The surge impedance of the two ½-inch tubes, spaced 3.0 inches on centers, is about 300 Ohms. If the reader constructs the matching section exactly as described here, he will have no difficulty in making the proper matching adjustments. The most important consideration is to mount the two tubes rigidly so that the same spacing is maintained throughout their parallel lengths. To start, each tube was made 53 inches long. In this array, at the final adjustment at 21.3 MHz, the distance from the open end of the stub at the antenna feedpoint to the position of the shorting bar was 49 inches. After it was made certain that this was the correct dimension with the antenna on the tower, the shorting bar was soldered in place and the un-

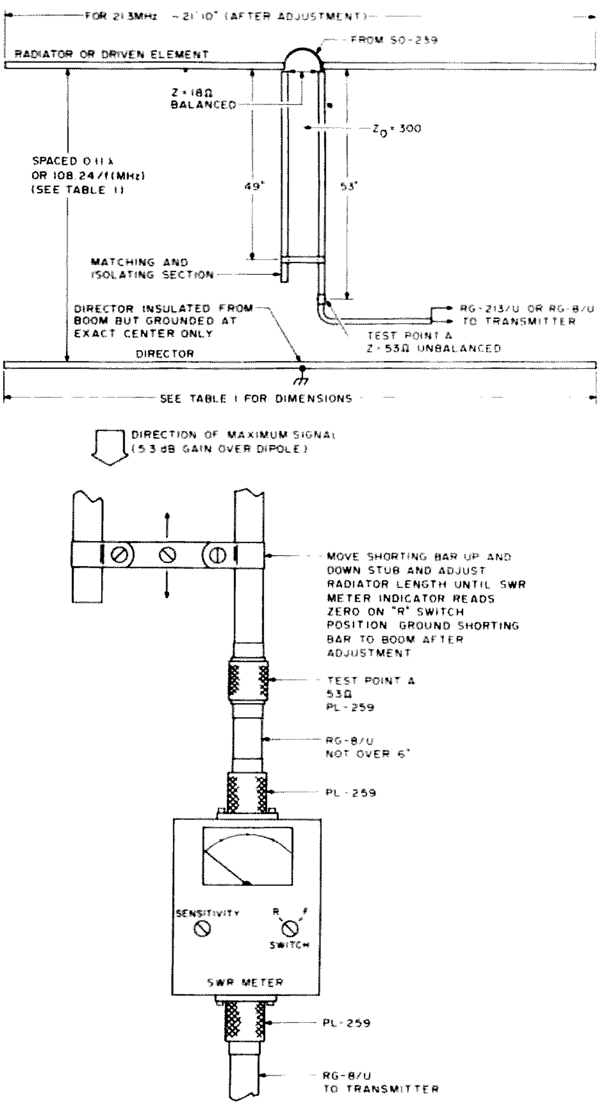

Fig. 1. General layout of the LB-2 array, and the proper connection of the swr meter.

used end of the single tube was cut off. The other tube, however, was left 53 inches long and was fitted with an SO-239 coaxial connector as shown in Fig. 2. The construction and adjustment of the matching stub will be covered later. At this time, let us discuss the construction of the boom and elements.

Elements and Boom Construction

The first step is to locate and select the proper size aluminum tubing for the elements and the boom. In California and other states, lightweight and relatively inexpensive aluminum tubing made by the MD Corporation is sold by the Ace Hardware stores. Most of the do-it-yourself builders supply stores sell either the MD tubing or a similar tubing made by Reynolds Aluminum Corporation. This "hobby" tubing comes in either 6- or 8-foot lengths and in various diameters. Although I have seen on display only 1, 7/8, 3/4, 1/2, and 3/8-inch o.d., and 0.055-inch wall thickness tubing in the 6- and 8-foot lengths, I am informed that the Ace Hardware stores will order other sizes made by MD. For telescoping elements,

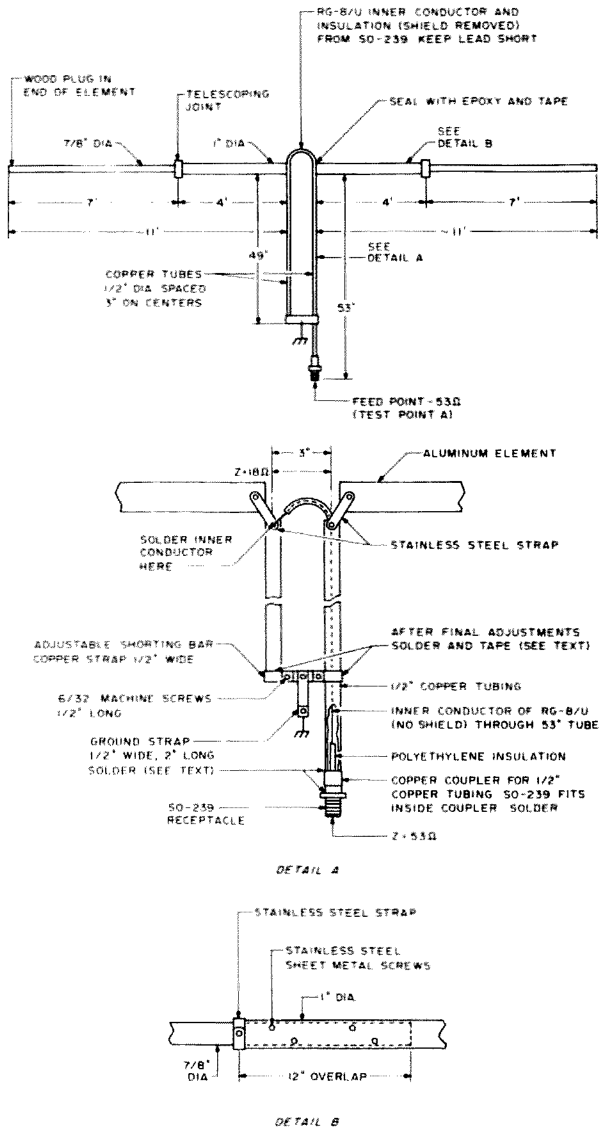

Fig. 2. LB-2 array for 15 meters. Use same matching section for 10 meters but see Table 1 for shorting bar position. General dimensions of driven element are shown. Detail A shows matching section. Detail B shows method for joining element sections.

the ideal wall thickness is 0.058 inches. However, the 0.055-inch wall thickness material will be perfectly satisfactory if the precautions given below are observed.

In the array shown in Fig. 2, a single 8-foot length of 1-inch o.d. tubing is used to make the two halves of the driven element center section. To increase the mechanical strength of the split driven element, a 6-foot length of 7/8-inch o.d., 0.055-inch wall tubing is cut into two sections of equal length and inserted inside the 1-inch diameter sections. To further improve the mechanical strength of the driven element, a hardwood dowel, about 18 inches long, is sanded down to a tight fit and driven into each 7/8-inch section before the driven element is assembled. This arrangement permits the use of heavy-duty standoff insulators with 1/4-inch machine screws through each element section without introducing any appreciable mechanical weakness at the point of mounting.

The two driven element end sections are 7/8-inch o.d. tubes, 8 feet long and with a wall thickness of 0.055 inch. As the adjusted overall length of the driven element will be about 22 feet for 21.3 MHz, there is a telescoping overlap of about 12 inches where each half of the center section and its end piece join. The hobby aluminum tubes are manufactured with a dull oxidized finish that is a poor conductor of electricity at radio frequencies. This finish must be removed from the inside of the larger tubing and from the outside of the smaller tubing where the two pieces join; this is done easily with sandpaper and steel wool. To remove the finish from the inside of the larger tubing, wrap a piece of sandpaper around a wood dowel, or use a round file, and work it up and down inside the tube until the inner surface is bright and clean. The ends of the 1-inch tubes are slit with a hacksaw for a distance of about two inches, as shown. Before inserting one tube inside the other, coat both contacting surfaces with an anti-oxidizing compound and wipe each surface with a clean, dry cloth or paper napkin. Leave only a thin film of the compound on each surface. The compound is sold under various brand names and is available in 5-oz tubes at most electrical supply houses.

During the preliminary adjustments, the two tube sections are maintained in good electrical contact by placing a stainless steel strap-type hose clamp around the slit end of the larger tubing and drawing it tight. After the final adjustments are complete, a half dozen 3/8-inch stainless steel sheet-metal screws are inserted through both tubes and arranged in a spiral around the larger tube for a distance of three or four inches to ensure a permanent electrical and mechanical joint. Finally, all joints are tightly wrapped with plastic vinyl tape to prevent the entry of moisture.

After the final adjustments of the driven element and the shorting bar, the shorting bar is soldered in place with a propane torch. When soldering the copper tube containing the coaxial cable inner conductor, do not use excess heat at the junction, as this might melt the polyethylene insulation and cause the inner conductor to short circuit to ground. To check the inner conductor for a possible short circuit after soldering, disconnect the inner conductor lead at point B and measure between the end of the disconnected lead and ground (boom). The ohmmeter should indicate an open circuit. The main transmission line from the transmitter should be disconnected from the antenna before making this test. The center point of the shorting bar is grounded to the boom through a short length of 1-inch-wide copper strap.

The director element is not split at the center, so a smaller diameter center section is used. In the prototype array, the director center section is a single 8-foot piece of 7/8-inch o.d. tubing. To add mechanical strength and to prevent wind vibration, two 3-foot long wood dowels are sanded down to a close fit and one is inserted in each end of the 7/8-inch tube. When the two dowels are pushed down toward the center, about a foot of clearance is left at each end of the director center section for insertion of the 3/4-inch o.d. end pieces. The ends of the 7/8-inch tube are slit, and both tubes are cleansed of the oxidized coating as

described above. Join together the center section and end pieces in the same manner as described above for the driven element.

Please note that the director is mounted on standoff insulators and does not follow the usual "plumber's delight" type of construction where the element is mounted directly on the boom. The insulated director element is then grounded to the boom at the exact center of the element. This type of construction is believed to be one of the reasons for the low noise level of the 15- and 10-meter antennas. The method of mounting the director element on the standoff insulators, however, is somewhat different from that of the driven element. The mounting details are shown in the photograph and drawings.

During the early stages of this antenna project, both the driven element and director lengths, and the spacing between them, were made adjustable. Unless you are building the array for greatest front-to-back ratio, there is no point in having so many variables in the system that it leads only to unnecessary complications in the adjustments. For the maximum-forward-gain version, the optimum director length for 0.11-wavelength spacing between the elements is equal to 450/f, where f is the frequency in MHz. In the 21.3-MHz array described here, the overall director length is fixed at 21 feet and 1 inch. The 0.11-wavelength spacing is also fixed, at 61 inches. The only variables left are the driven element length and the position of the shorting bar on the stub.

The boom is made from 2-inch aluminum irrigation tubing cut to a length of 66 inches. If you cannot find the irrigation tubing in your area, use 1-1/2-inch electrical conduit (EMT) or thin-wall steel TV mast material. After the boom is cut to length, remove all burrs and sharp edges with a file, sandpaper, and steel wool. To add strength to the aluminum tubing boom, a 12 inch long wooden dowel or plug, only slightly smaller than the inside diameter of the tube, is inserted inside the boom and pushed down toward the center. Secure the plug in place with a flathead wood screw driven through the aluminum into the wood. A similar but shorter wood plug is inserted in each end of the boom and secured in the same manner. The purpose of the wood plugs is to permit the use of automotive muffler clamps to secure the element assemblies to the boom without crushing the comparatively fragile aluminum tube. Searching for a source of the wooden plugs, I found a supply of old-fashioned hardwood kitchen rolling pins at a local supermarket. These happened to be of exactly the proper diameter for a snug fit inside the boom. One rolling pin was used for the center plug and the other was cut in half to make the two end plugs.

In addition to the wooden plugs inside the boom, I also used three 8-inch pieces of 2-inch i.d. electrical conduit (EMT) over the aluminum boom—one piece at the central balance point and one at each end of the boom. The inside diameter of the conduit is large enough so that the sections can be rotated by hand. The muffler clamps used for mounting the element assemblies and the rotor mount on the boom are placed around the conduit sections. During the preliminary adjustments, these conduit sections can be secured with a single sheet-metal screw through the conduit and aluminum tubing walls into the wooden plug. When the array is

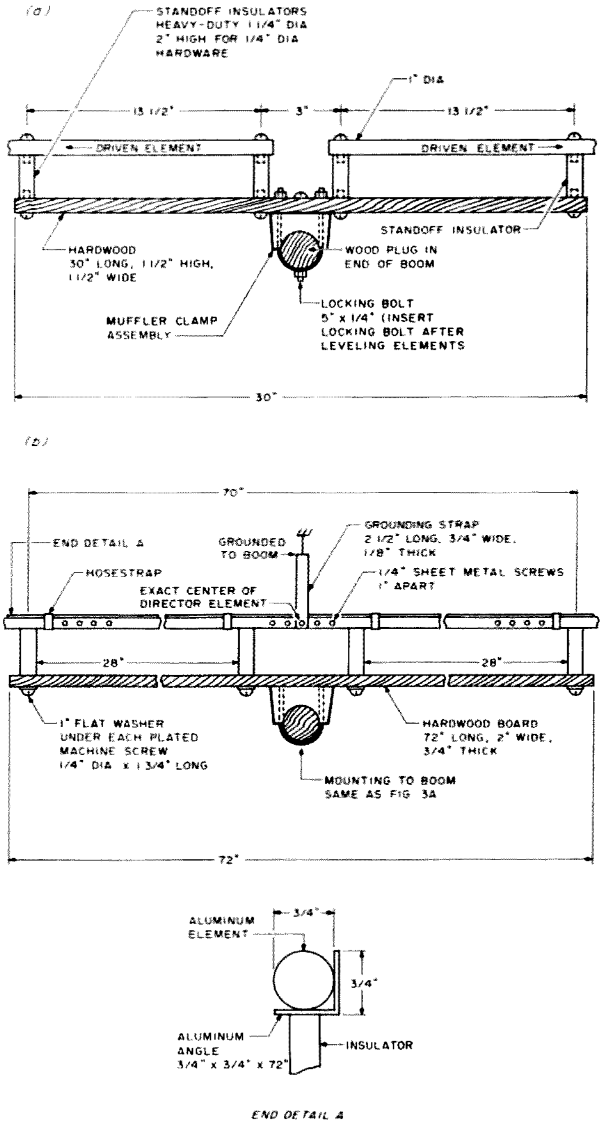

Fig. 3. (a) Driven element mounting details. (b) Director driven element details. Detail A shows element-to-angle construction technique.

placed on the tower, the conduit sections can be rotated on the boom to level the elements and place them in the same horizontal plane. After the elements have been leveled, secure them in this position by inserting several sheet-metal screws through the metal and into the wood inserts.

Resonating and Matching Adjustments

The preliminary resonating and matching adjustments may be carried out with the array suspended only a few feet above the ground. An 8- or 10-foot wooden stepladder functions very well as a support if the array is lashed to the top and kept level during the adjustments. Place the stepladder and array in an open space, away from buildings, trees, wires, or other antennas. Point the director toward empty space, if possible. Keep the ends of both elements away from any objects, particularly those made of metal. During the adjustments, the presence of your body in the field of the antenna will affect the adjustments and the instru-

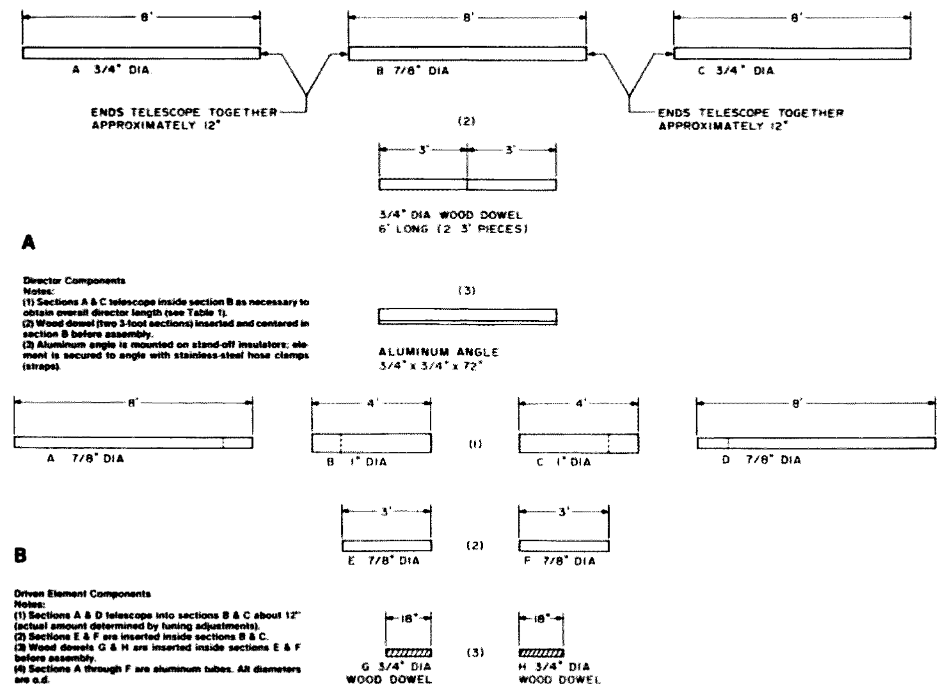

Fig. 4. Components for (a) director and (b) driven element.

ment readings. When adjusting sensitive arrays close to the ground, I usually use two swr meters—one at the point where the transmission line connects to the array and another at a point one-half wavelength down the line from the antenna. To obtain a true reading, walk out of the field of the antenna after making an adjustment and read the swr meter at a distance or at the half-wave point.

To start, adjust the driven length to 476/f, where f is in MHz, not including the 3-inch gap at the center. For 21.3 MHz, the length of each half of the driven element will be about 11 feet, 2 inches. The exact length at this point is not extremely important, but make sure that the two halves are exactly equal to each other. Now, beginning at the end of each 1-inch center tube section, scratch marks one inch apart on the 7/8-inch end sections in the direction of the tips. Four or five marks will be sufficient. Make the same number of marks on each end section. Adjust the shorting bar to a position about 36 inches down the stub from the antenna and tighten it just enough to make good contact with the copper tubes. Connect an swr meter in series with the coaxial line at the point where it joins the stub SO-239 connector. If you have a second swr meter, put in a pair of PL-259 plug connectors exactly 15 feet, 3 inches (for RG-213/U, RG-8/U, and 21.3 MHz) down the line from the SO-239 connector at the antenna, and insert the second meter at this point. Adjust the test signal to the proper frequency.

Adjust the signal level and the swr meter sensitivity to indicate exactly full scale in the "forward" position. Switch the swr meter(s) to indicate the "reverse" or "reflected" signal level. With the array adjusted as described, the reflected signal level probably will be less than full scale, but is not likely to be zero. Now, very carefully adjust each end section by telescoping it into the 1-inch center section the distance of one inch (one mark). Make sure that each end section is telescoped exactly the same amount so that the array will remain in electrical balance. While observing the swr indicator, move the shorting bar up and down the stub for the deepest indicator null. Alternately, adjust the driven element overall length, maintaining electrical balance, and the shorting bar position until the swr meter indicates zero in the reflected signal position. At this point, tighten the two stainless steel clamps around the driven element but do not insert the sheet-metal screws yet.

If it is possible, raise the antenna to about 24 feet above the earth and observe the change, if any, in the swr meter indicator. I use a wooden pole for a tower. An overhanging arm at the top of this pole was fitted with a rope and pulley so that the array could be pulled up to any height above ground. When the array was raised from 8 feet to 24 feet, the line swr at 21.3 MHz changed from 1:1 to 1.4:1. After several trial adjustments of the driven element length, the line swr was reduced to 1.2:1 at 21.3 MHz. The antenna was then lowered to the ground and the sheet-metal screws were inserted in the driven element. The entire joint was then wrapped with plastic vinyl tape. After the antenna was installed on the tower, the shorting bar was adjusted for a 1:1 swr at 21.3 MHz and soldered in place.

Electrical Height

Most amateurs believe that the higher the antenna, the better its performance, especially for DX work. I have found, however, that a height above ground from about a half wavelength to a five-eighths wavelength appears to be best for my location when working European DX. W6TYH is located in the foothills of the Sierras at about 500 feet elevation. In the direction of Europe, the Sierras are about 7,000 feet high. Low-angle radiators, such as vertical arrays, give very poor results toward Europe when compared with the little two-element parasitic arrays. The best signal reports from Europe on the 15-meter band were obtained when the array was about five-eighths wavelength above the earth. To establish the electrical height at five-eighths wavelength, a 1.5-Ampere thermocouple rf ammeter was inserted in series with the 50-Ohm transmission line at the point where it is connected to the SO-239 receptacle. The rf power input to the line at the transmitter was held constant while the array was raised and lowered. The maximum rf current was indicated when the array was about 28 feet above the earth. This also has proved to be an effective height for working European DX across the Sierras. Apparently, the vertical angle of the radiated signal is just right for the wave to clear the high mountain ranges to

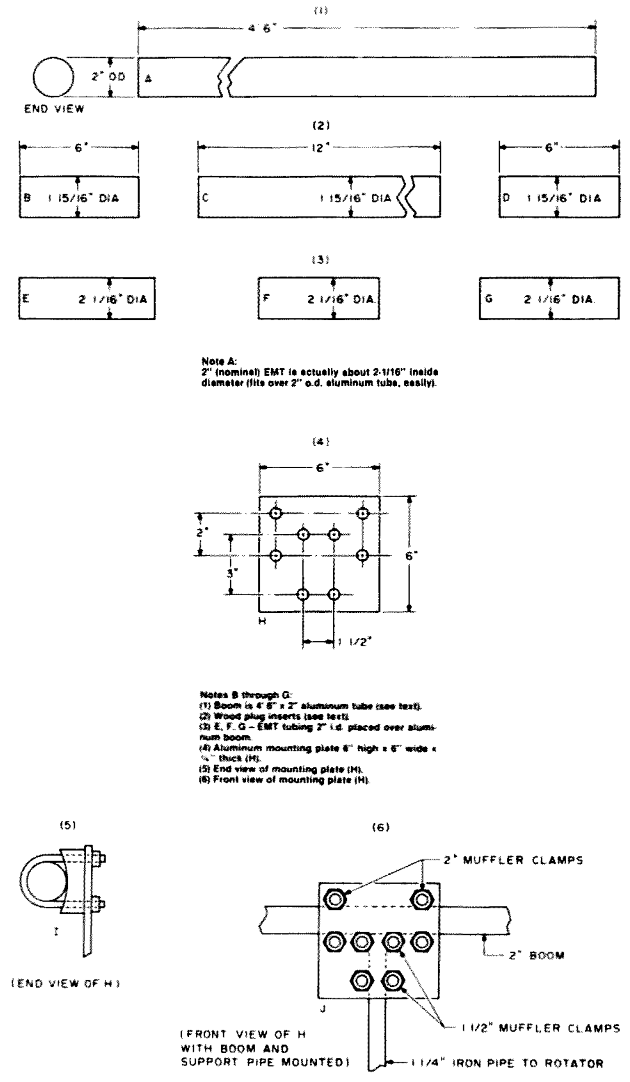

Fig. 5. Boom assembly and mounting details.

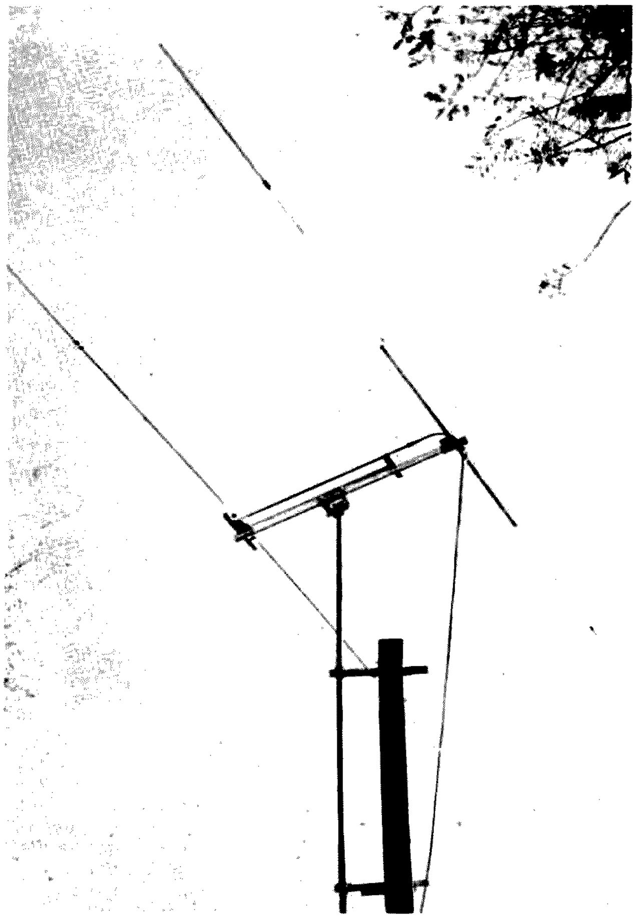

Fig. 6. LB-2 15-meter array. The split driven element is at the left in this photo. The director element, right, is insulated from the boom but grounded to it at the exact center to reduce noise pickup. Note coax line connection at end of 53-inch tube. As shown, maximum radiation will be toward the right. Maximum gain (over a half-wave dipole) is 5.3 dB. The rotator (not shown) is an AR-22 heavy-duty TV type.

the north and east.

Operating Performance

After almost half a century of amateur and professional radio communications experience, it requires outstanding performance in an antenna or a piece of ham gear to cause me to become enthused. I can truthfully say that I am delighted with the performance of the little two-element 15- and 10-meter antennas. The real worth of any antenna, as far as I am concerned, is proved by what it will do when I am competing with a dozen other stations for a rare DX contact. Many times when the competition was fierce, the DX station came back to W6TYH, and I have the QSL cards to prove it. During the past few months that the antennas have been in use, I have had good signal reports from all parts of the world. Most of the time, the PEP input to the transmission line was only 175 Watts. The antennas also work very well for reception, a signal standing up from the background noise like the proverbial "sore thumb."

Troubleshooting

This antenna design has been proved to be sound and, if the dimensions and adjustment procedures are carefully followed, absolutely no trouble should be experienced in obtaining top performance from either of the two arrays. However, some of us are like the new bride who burned water trying to boil it, and somebody will get into trouble with the array and write to me.

The most common problem is difficulty in getting the line swr down to 1:1 at the design frequency. In one case, the trouble was caused by harmonics of the test signal appearing in the line. The use of a low-pass filter in the transmission line at the signal source eliminated the problem.

Do not be tempted to change the spacing of the copper tubes in the matching section, or use different diameters from those specified. I have been through all this and it is not only tricky but very frustrating. Remember that this is a balanced driven element and feed system; when adjusting the overall length of the driven element, make sure that both halves are adjusted exactly the same amount. Mount the matching section tubes on standoff insulators about 6 inches above the boom and make certain that each copper tube is spaced the same distance from the boom to equalize the distributed capaci-

tance.

Although it is not likely if the instructions are followed, the driven element might not be resonant at the test frequency. To check, first measure the overall element length, not including the 3-inch gap at the center. Together, the driven element and the shorted stub act as capacitance and inductance, respectively, and resonate at the design frequency. With this type of arrangement, the overall length of the driven element will be about 2 or 3 inches shorter than the length calculated from the above formula. If still in doubt, you can check the resonant frequency of the element and stub combination by coupling a grid-dip oscillator to the inductive stub. The dip, at the resonant frequency, is quite pronounced. The grid-dip oscillator frequency must be monitored with a calibrated receiver.

If you have an RX bridge, use it to measure the array input impedance at the SO-239 receptacle. The input impedance should be exactly 53 Ohms and pure resistance, with the dimensions given and the array properly adjusted. When the array is properly adjusted, you will find that it is very sensitive to body capacitance, especially at the ends of the elements. When the hand is brought to within a foot or so of the driven element or director end, the swr reflected indication should go from zero to full scale. If it does not, the adjustments are not correct.

If you still have a problem after making the checks, write, giving complete details of the trouble. Your letter will be answered promptly if you include a stamped self-addressed envelope. ■

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The 20-Meter Double Bobtail

I have just discovered a new antenna which I think will be of great interest to many hams who have had trouble with radials but want to use phased verticals. I have never seen such an antenna, so I think this is the first description of a really interesting array.

I started out to make a 20-meter Bobtail in the classic way, because I do not have room for a 40-meter full Bobtail. My yard is only 73 feet wide, and it takes at least 132 feet for a 40-meter version. The antenna I was starting was the one shown in Fig. 1, and has been reported to have a gain of from 7 to 10 dB over a dipole at the same height. The pattern is shown in Fig. 2, and is broadside to the line of the antennas.

My yard is filled with trees, and I was concerned because the east half of the antenna would be running through the leaves of a large apple tree. I planned to use insulated aluminum wire to prevent the leakage into the leaves. I thought of aluminum wire, even size #8, as being light. However, I found that the 66 feet needed would, because of the insulation, weigh four pounds! That is a lot of weight to hang on the top of a pair of flimsy verticals.

I decided to try half of the antenna, which was in the clear, realizing at the same time that there would be no cancellation of the two horizontal wires and that the thing might not work well at all. See Fig. 3.

I installed radiators B and C, using 16½ feet of aluminum tubing, and mounted them on a pipe in the ground with U bolts and the usual mounting plate. It refused to tune properly. I remembered reading that if much metal were used in the mounting it would cause trouble because the bottoms of the radiators were at a voltage point. Of course, if you use wires suspended from wooden poles, as shown in Fig. 1, (D and E) then you will pull the wires down to a stake.

I sent to Sears for some fiberglass fence posts and epoxied two together for a very rigid mount, as shown in Fig. 4.

Sears sells two weights of fence post. The heavy, 48" green ones, catalog number 32G10434C, cost $1.99 each. They weigh 1 pound 2 ounces apiece (They also have 60" posts.)

For the coil, I used a 14-MHz coil from an old BC-610 transmitter and a 150-pF capacitor. It tuned the center of the phone band at midscale. It would be possible to use Air Dux or a hand-wound coil and tap up about two turns for the coax feed. These coils, incidentally, are available from Fair Radio Sales, Box 1105, Lima OH 45802.

At the top of each radiator I attached a ground clamp of the alligator type and fastened the end of the wire in the holder on the clamp.

I found that 66 feet of Belden 8000 antenna wire (or antenna wire available from Pace-Traps, Box 234, Middlebury CT 06762) weighed only 9 ounces, or 4½ ounces for 33 feet, if you build the bobtailed Bobtail.

A field-strength meter can be used at the antenna to peak up the tuning, but I evolved a more interesting way, requiring no help at the other end of the coax. I have a pair of 100-mW CB walkie-talkies on channel 15, and I held down the transmit button with a rubber band on one and fastened it to one earphone plugged into my transceiver, which was set at 14.275 MHz. The other I carried out to the antenna, and listened to the noise on 20 meters as I peaked up the tuning capacitor.

There are two other ways of doing this. One is just to plug in a line to the phone jack and carry a headset or speaker out to the antenna, and the other is to use a piece of four-wire rotator cable with two wires connected to the swr bridge and the other two to the keying jack on your transmitter. Set the off-resonance current to a safe level and then peak the tuning up to the center of the desired band. At the antenna, just key the transmitter and quickly dip the tuning capacitor and a series link capacitor for minimum swr.

I did not have a suitable link capacitor, which could be a 400-pF receiving type, so I used an L network to tune the link after I peaked up the tuning coil with my walkie-talkie method.

In the drawing I show some radials, which happened to be in the ground near where I mounted my driven radiator, but I could have just used an eight-foot ground rod, because the

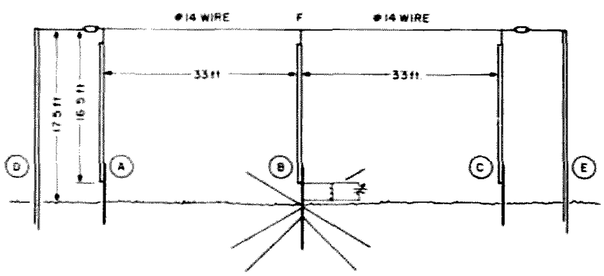

Fig. 1.

Bobtail does not need much of a ground. The high current is a quarter wave above ground and the ground losses are much less than with ground-mounted verticals.

The secret of the Bobtail is in the fact that the current maximum is at a quarter wave above ground, and that is where the maximum radiation is. Ground-mounted verticals have their maximum radiation at about ground level and therefore require a more extensive ground system, and are more affected by surrounding objects.

I found out several amazing things from this experiment. I had rather expected that the antenna array might end-fire, since the other antenna was a half wave out of phase by ordinary phased verticals standards. I listened to a California station which was 20 over 9 on my N/S delta loop, and when I switched to the verticals it was S5. I have my delta loop vertically polarized, and in the daytime I have S9 noise from my power line only 12 feet behind the antenna. When I switched to the Bobtail, the noise was completely gone, nulled out by the side rejection. It was astounding. This improved rejection causes me to believe that the Bobtail is more efficient than the ground-mounted array.

The tuning is not critical, and tuning to the center of the band gives good results.

When I first connected my 20-meter truncated Bobtail I was crestfallen. It was so quiet that I thought it was not working at all. The loss of the power line hiss, the lack of static or any electrical noise, and the weakness of the mostly western stations at night made it seem like the sort of blackout one hears when there is a solar flare and the band is dead. However, signals from the south were strong.

I called a friend who lives about six miles from me, KA8CGE, and he reported the delta loop was about 10 over 9 and the Bobtail was only about S7. I got out my county map and saw that he was west-southwest of me, showing that the pattern was quite narrow—perhaps 60°. See Fig. 2.

I made a test with WA4OLP in Duluth, Georgia, near Atlanta, and he reported that the Bobtail was stronger than the delta loop by about 10 dB.

That night, I called KC4USV at McMurdo Sound, Antarctica, and they gave me a report of 5 by 5 on the delta loop and 5 by 7 on the Bobtail. Remember, this is only a two-element Bobtail, and the three-element version with the cancellation of the horizontal sections could have been about S9. KC4USV was also S7 here, as the propagation was rather poor. Considering that they have a Collins 2-kW station and mine was only a single 3-500Z driven by a Hallicrafters SR160, I thought I was doing rather well.

I believe that this antenna could be current fed by running coax up the quarter-wave radiator of tubing and feeding the top wire at point F. I tried it that way first, actually, but it failed to tune correctly. After I had taken it down in disgust, I realized that previously I had disconnected one of the verticals, a fiberglass Columbia Products antenna top section, at one foot from the top to make it tune better as a ground-mounted vertical. I had clipped the center wire through the insulation, and thus had only the top 12 inches connected instead of the complete 16½-ft. antenna. It had been so much trouble that I had no desire to completely remount the array, and just went to the voltage feed. Now I believe that the other way will work. This would

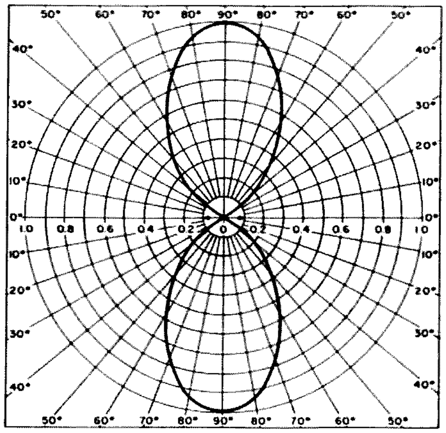

Fig. 2.

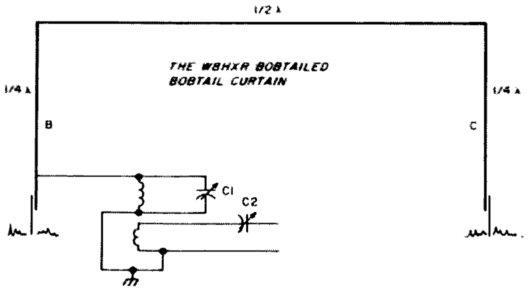

Fig. 3.

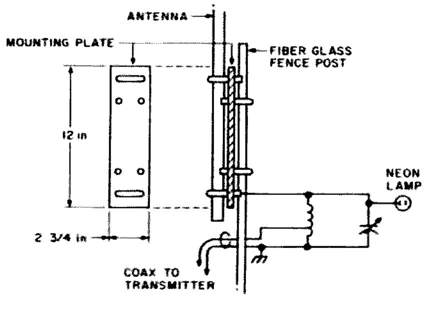

Fig. 4.

make the antenna tuner unnecessary.

I did not intend this article to be one which extolled the well-known but seldom-used Bobtail, but my accidental discovery that two elements worked so well made me realize that here is the answer to the problems of 40-meter phased verticals. Since the full 40-meter Bobtail takes more room than the average ham has available, and since the ground-mounted verticals take such a large radial ground system, using only two of the verticals in the "bobtailed Bobtail curtain" seems the answer to a dream. The high position of the high current section should make the signal at least an S-unit better than the ground-mounted verticals, and in the many years I spent with two phased verticals running phone patches for Antarctic stations, I never had so completely nulled out noise on the sides of my antenna, nor had such rejection of west-coast stations as well as those in between.

WA7NHU gave me over

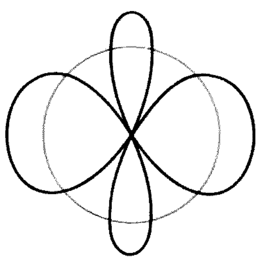

Fig. 5.

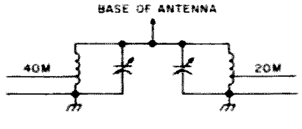

Fig. 6.

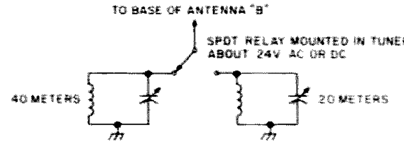

Fig. 7.

S9 on the delta loop and could not read me when I went to the Bobtail. Both were firing south/north. He is in Hereford, Arizona, and is so enthused that he is going to put up a full 40-meter Bobtail firing into Europe, and if it works, he plans to add a parasitic reflector and director. I wish I had that kind of space.

There are certain disadvantages: It cannot be rotated or changed to end fire. It would be best to have an inverted V or something for when you want to work stations not in the beam, or have two Bobtails. But if you have one firing in a direction where you want the best signals, then the two-way figure 8 will be good.

It is not a short-range antenna unless there is short skip. However, the fact that there is no cancellation of the horizontal section on a two-element array probably means that there will be high angle reception in the near distance.

The good results are not from gain in itself, but in the lowered angle of take-off, compared to a dipole. This advantage shows up on paths in excess of 2500 miles. Close-in there often is no great improvement.

About a week after I tried the two-element shortened Bobtail, I decided that I really wanted an antenna which would fire east/west since I had more interest in those directions than north/south.

I could not put up an antenna in that direction because trees and my house were in the way. I decided, therefore, to move the verticals back where they would not be in the trees, and space two elements 66′ apart, a full wave, which would give me the pattern shown in Fig. 5. This would give me a nice lobe E/W and a narrow one N/S. This I did, with the following results:

About 0750 UTC I heard IA3KWI/AC2 in Botswana. He had a pileup going and I could not hear him on the delta loop, but he was about S4 on the Bobtail. I gave several calls and he came back to me and gave me a 5-9.

The next day, August 15, at about the same time, I heard ZL2ASX calling CQ, and went back to him. We had about a 20-minute chat, and he said that I was S2 on the delta loop, which I had now turned so it was E/W for comparison. He said that I was S5, three S-units stronger, on the Bobtail. Conditions were quite poor, but there was no fading and we were both Q5.

Then at 0900 UTC I called KC4USV at McMurdo Station, Antarctica. Conditions were very poor, but the band was completely silent, so we conversed for 22 minutes. He said that I was not moving his meter, but that I was solid copy. The delta loop had stronger audio than the Bobtail. I was surprised until I checked the pattern. McMurdo is about 15° west of south, and is probably just outside the south lobe in the null.

I also found that Florida stations were weak on the Bobtail but strong on the delta loop. This rather confirms the pattern. Miami bearing is 167°; Atlanta is 187°.

I wish I could turn my array to fire NE/SW off the ends, but I can't. At least I have found an antenna which bears further investigation. I have decided that I will now add a center radiator and make it a full Bobtail as in Fig. 1. At least I can work South Pole Station and part of the South Pacific, and north, I can work into India, Pakistan, Mongolia, Central Russia, and the North Pole area.

I just couldn't resist trying out the full Bobtail, especially since I hear rumors of China showing up. The long range of the antenna means little or no interference from strong western or eastern stations, as I will null out or skip over most of them.

Of all the high-gain antennas, this is the simplest to construct for 20 meters that I have ever found.

So, I moved my Bobtail north about 6 feet to clear the trees and added a third element, so it is now as shown in Fig. 1. I tried it for only two days, and conditions are only fair, but I found some interesting results.

Last night I worked KC4USV, and while he was only about S5 to me, he gave me S8. The skip had moved west and was good into Grand Rapids, Michigan, where W8YCI reported him as 30 over 9. However, Pete at McMurdo said I was phone-patch quality.

Earlier in the day, I worked Tony WB4KKL on Captiva Island, Florida, and as I was 40 over 9, he would not believe I was barefoot. This was at 4:20 pm local time. I put on the linear for a few seconds, and he said I was 52 over 9. We talked about antennas for an hour.

At 0740 UTC, I worked G5CAX in Potton, 50 miles north of London, and compared the E/W delta loop with the Bobtail. I was 5/5 on the delta loop and 5/7 on the Bobtail, showing that the pattern is wide enough N/S for a good signal at 48°.

I plan to leave it this way for several weeks for a better evaluation.

There is one other thing I believe is worth trying. The 40-meter version should also work on 20, with a four-lobe pattern as shown in Fig. 5, with two coils, using separate feedlines, and without a relay as in Fig. 6. The coils should not react any more than a multiband dipole does.

With two half-wave verticals on 20 at one wavelength spacing this should be a really hot item. By orienting the array to fire northeast, there should be good lobes in all four DX directions on 20.

If some younger ham with some space should try this out, I am sure that *73* could use an article on the results. After 60 years of hamming, my mind still dreams up antennas but my energy reserve is getting lower. They certainly are fun, though. If you try the relay method in Fig. 7, the relay should have good insulation, as the rf voltage at that point is high.

A small wastebasket or plastic jar can be turned upside down over the coil and capacitor to protect them from rain and snow, and the bottom left open. The bases of my verticals are about 10 inches from the ground, but that is not critical. The ground lead should be as short as possible. Any leads from the coil become part of the antenna. ■

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Simple Switcher

—a remote antenna switch with no control wires

A remote antenna switch may be just what you need to solve your antenna switching problems. Even better, how about one with no control cables? Let me explain.

The idea of having a dc voltage and an rf voltage on the same antenna feedline at the same time may seem impossible to you. But, as I learned, this can easily be accomplished and there can be many applications. By using the antenna feedline as the control cable, you can supply a low voltage to power an antenna-mounted preamp or control relays mounted on an antenna. In this article, I will describe my remote antenna switch, which uses the antenna coax feedline to carry a dc control voltage for the antenna switching relays.

When I was designing my triband quad, I decided not to use a balun, but to feed each antenna with a separate feedline to the transmitter. This seemed to be a good idea until I added up the cost of all the coax cable! (And this was supposed to be one of those inexpensive projects.) So, again, it was back to the drawing board. The problem was how to feed three antennas with only one feedline.

Photo A. Power supply unit.

Then this was mentioned to me: Why not send 12 volts dc through the coax, mount a relay on the antenna boom, and do all the antenna switching at the antenna? I hadn't known that I could put a dc voltage on my coax and transmit at the same time, but it sounded like a good idea. That way I could connect each antenna's quarter-wave matching section into the relay box and use only one run of coax down the tower to the transmitter.

After more talking and reading, I saw a circuit in *The Radio Amateur's Handbook* that would do just what I wanted. My switch is a little different than the one described in the *Handbook*, but the principle is the same.

The theory behind the switch is simple. See Fig. 1. A power supply is needed to provide a positive and negative 12 volts dc and is connected in the feedline between the transmitter and the antenna (Fig. 2). At

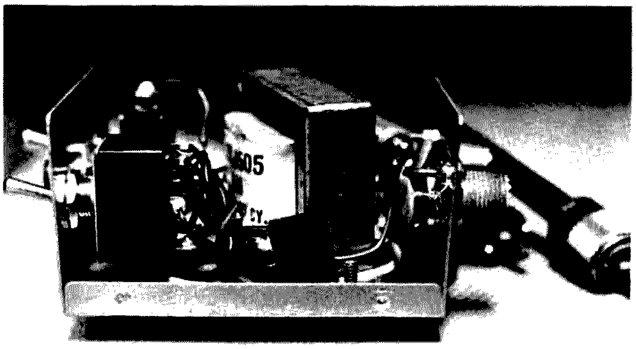

Photo B. Cover removed.

the antenna end of the coax is the relay box with two relays that switch the three antennas. See Fig. 3. A diode is used in the relay box to act as a gate to activate the correct relay. Rf chokes are used in the power supply and relay boxes to keep the rf out of the power supply and off the relay power terminals. Disc capacitors also are used in each box to isolate the antennas and transmitter from the 12 volts dc.

Construction Hints

The construction of each unit is very simple and straightforward. The power supply is housed in a 2" x 3" x 4" cabinet. Things will be a little cramped, but with a little care, everything will fit. The transformer is a 117/12.6 V, 1.2 A Radio Shack no. 273-1505. The full-wave bridge rectifier is an ECG 169. A pilot light is a nice feature to have so that you won't forget to turn the unit off. The capacitors are small .01-uF discs, and the rf chokes I used were 1 mH.

The relay unit is housed in a 2" x 2" x 4" metal box. The relays, the most expensive parts, are two Radio Shack 12-volt dc DPDT no. 275-206s with 3-Amp contacts. (SPDT relays will work, but I couldn't locate any.) These relays are mounted in a plastic case which makes it easy to epoxy them in the metal box. When assembling the unit, seal the box to make it watertight, but put a small hole in the bottom for ventilation.

Operation

Once the project is completed, be sure to check out the unit with a dummy load to make certain that each relay does work. This might save you an extra trip up the tower. When connecting the antenna to the outputs, connect the most often used antenna to output A. That way, the unit will be off most of the time and when the unit is turned on with switch S1, switch S2 is used to select antenna B or C.

My antenna switch has performed well for over two years and makes a neat installation. My transmitter runs 100 Watts, and I have had no trouble with the relay contacts. They probably will handle more power if you are careful not to switch antennas while transmitting.

Now that you have the basic concept of how this system works, you can apply it to solve your own antenna switching problems. This same unit could be used to select verticals or other antennas. In a future project, I am going to apply this same principle to power an antenna-mounted preamp. I am sure that there are many other applications using this concept, and I would be interested in hearing about them.

Thanks to Cliff WB5KCQ for his technical assistance on my projects. ■

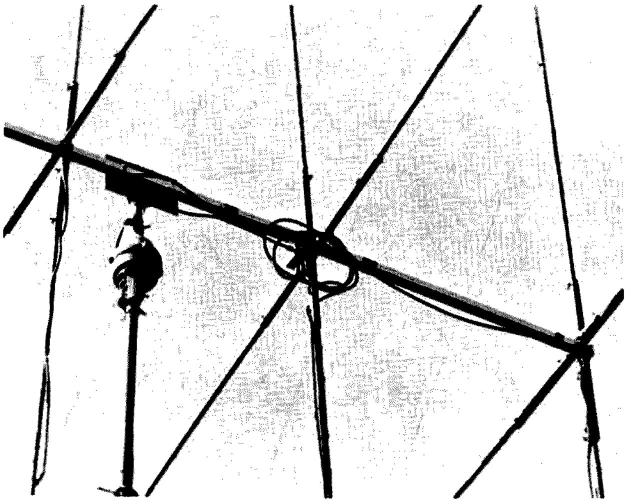

Photo C. Antenna mounted relay unit. Each antenna's ¼-wave matching section is connected to the bottom of the box. Only one run of coax is needed to connect the relay unit to the transmitter.

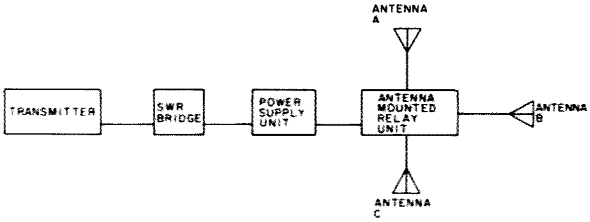

Fig. 1. Block diagram.

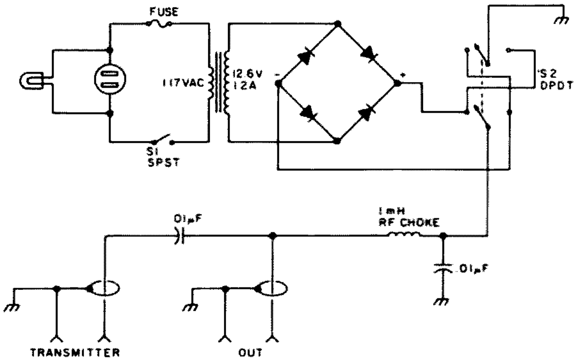

Fig. 2. Power supply.

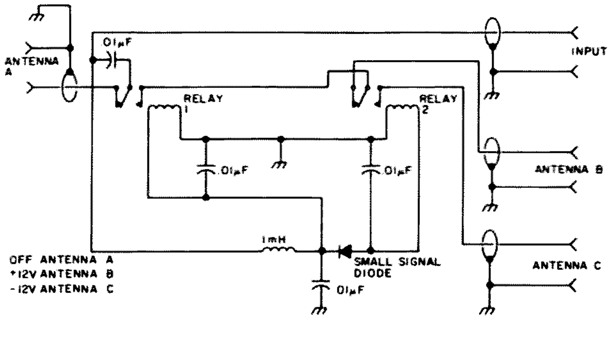

Fig. 3. Antenna-mounted relay box.

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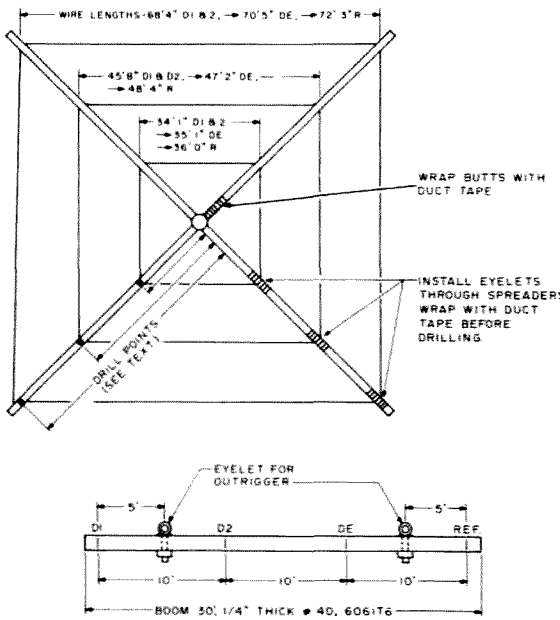
Taming the Monster Quad

—a four-element blockbuster you can build

It has been a long time since I have written an article for any amateur magazine, but after many on-the-air inquiries as to how my antenna performs and how I overcame various problems which seem to plague so many hams with multi-element quads, I decided to write a construction article.

For years I had used a four-element monobander, and after the loss of two towers, I decided to try the quad antenna. My first try was with two-elements on an eight-foot boom, but it did not compare with my four-element beam. Next, I used a four-element quad on a 20-foot boom. However, my beam still worked better. I was plagued with a low front-to-back ratio, high swr, and interaction between bands. So out came the books for many hours of research. The results were a quad with high forward gain, high front-to-back ratio, no interaction, and low swr with a wide bandwidth. (The following specifications as to gain are approximate but can be considered accurate by amateur standards.)



Four-Element Triband Quad:

boom length—30 feet;
element spacing—10 feet, all equal;
gain—13 dB;
front-to-back ratio—30 dB;
wire size—#14 enameled copper;
five-percent difference factor between elements;
design frequency—14.250, 21.300, and 28.600 MHz.

Directors 1 and 2 are the same size. I used the formula $975/f_{MHz}$. The frequency and wire lengths are 14.250 MHz—68'4", 21.300 MHz—45'8", and 28.600 MHz—34'1".

For the driven elements, I used $1005/f_{MHz}$. The frequency and wire lengths are 14.250 MHz—70'5", 21.300 MHz—07½", and 28.600 MHz—35'1".

For the reflectors, I used $1030/f_{MHz}$ to obtain wire lengths of 14.250 MHz—72'3", 21.300 MHz—48'4", and 28.600 MHz—36'0".

Spreaders:

I used one-piece fiberglass spreaders 13-feet long and screwed eyes through the arms to run the wire (see Fig. 1). This lets the arms move in the wind and not break the wire, and also lets the wire draw and sag with temperature changes and not bow the arms. A note of interest: Bamboo can be used but should be wrapped with two-inch-wide duct tape and then sprayed with krylon® or varnish.

Placement of the screw eyes is done by taking the wire length in feet for each band, dividing the result by four, and inserting that number into the formula $A=C/\sqrt{2}$, where A is the distance along the spreader from the center of the boom to the drill point and C is the length of the element divided by four.

Example: Find drill point for 20-meter driven-element wire:
14.250 MHz = 70'5"
70.5 divided by 4 = 17.625 = C
Using $C=\sqrt{2}$, $A = 17.625\sqrt{2}$, $= 17.625/1.414$, $= 12.46'$ or 12'5" from center.

Below are the drill points

for each element:

Directors 1 and 2:

14.250—12'1"
21.300—8'1"
28.600—6'0"

Driven element:

14.250—12'5"
21.300—8'3"
28.600—6'2"

Reflectors:

14.250—12'8"
21.300—8'6"
28.600—6'5"

These figures are to be used if you measure from the center of the boom out. To measure from butt of the arms, add 1 3/8" to each figure. This way the arms may be drilled before attachment to the boom spreaders. Each hole should be wrapped with duct tape after drilling, then a small nail can be used to punch a hole in the tape. Each spreader should be sprayed with krylon® or other type of coating to increase its life and prevent the eyelets from rusting. I also wrapped the butt ends with duct tape for added strength.

Feeding the Quad

I decided to use ¼-wave stubs after burning up a one-kw ring transformer. It's no fun waiting two weeks for a new transformer before you can operate! I used 72-Ohm coax, but kW-rated twinlead can also be used.

Below are the lists of lengths for both coax and twinlead using the formula $L = 246(VF)/f_{MHz}$, where VF is the velocity factor of the transmission line used.

Stubs: RG-11A/U coax, Z = 72 Ohms, VF = 0.66. Length to match driven elements: 14.250—11'4", 21.300—7'6", and 28.600—5'6". For 1-kW twinlead, Z = 72 Ohms and VF = 0.71, 14.250—12'3", 21.300—8'2", and 28.600—6'1".

The stubs should be cut as close to the lengths shown as possible, a PL-259 and barrel connectors installed on one end, attached to 52-Ohm coax to the shack. I tuned each 52-Ohm feedline to the shack using my noise bridge and R-4C so I would have little swr on my feedlines.

One problem many hams have is how to string the spreaders. I drove a 2"-diameter, 4'-long pipe into the ground and attached the arm supports to this pipe. I then drove 2 wooden 3' stakes into the ground for each arm to keep them straight. By using this type of jig, each element can be wired, removed, and then placed on the boom. I covered all nuts with General Electric clear silicone rubber, and then I sprayed them with krylon®.

Conclusion

After the antenna was installed, measurements were made. The swr was 1.6:1 at its highest point on any band, with very flat response across each band. I can operate either the CW or phone portions with the swr never going above 1.6:1. I have been using the antenna for about two years and have yet not to make it through the pileups. The work involved is well worth the time, considering the results obtained. My next antenna will be a two-element 40-meter quad.

I would like to thank Barry WA4POH. Without his help and encouragement, this project would have been scrapped. Barry also put up a quad like mine and is very pleased. ■

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For Cheapskates Only: A No-Frills Tilt-Over

—requires a friend with a welding rig

After pricing all types of tilt-over towers and masts and coming to the conclusion that I must have been at the airport when my ship came in, I decided that if I were ever going to have a tilt-over mast, I'd have to home-brew one.

A good friend of mine had obtained several tilt-over light standards

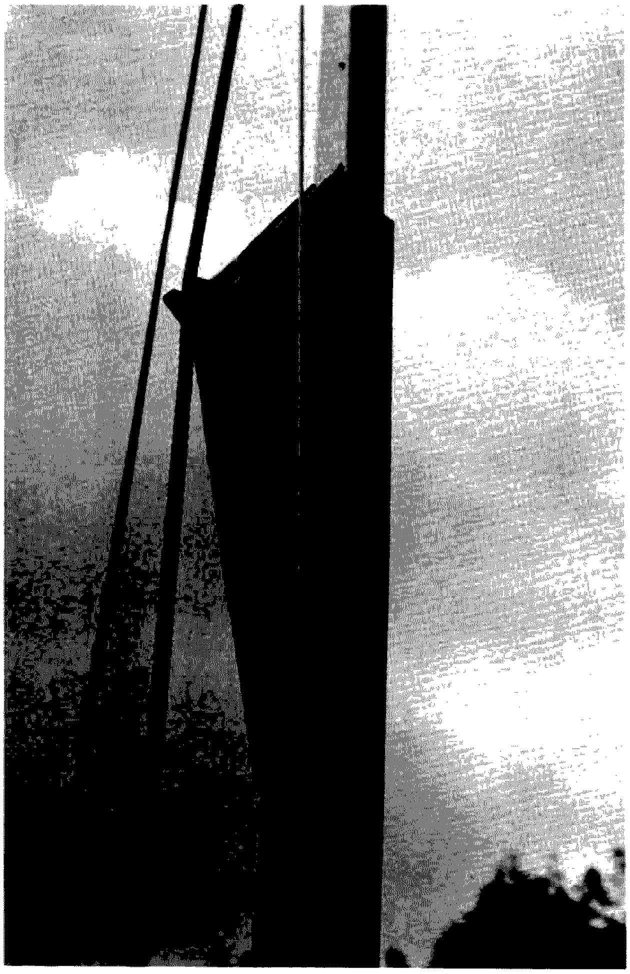

Photo A. Close-up of hinge section reinforced with ¼" boiler plate. Mast is in upright position.

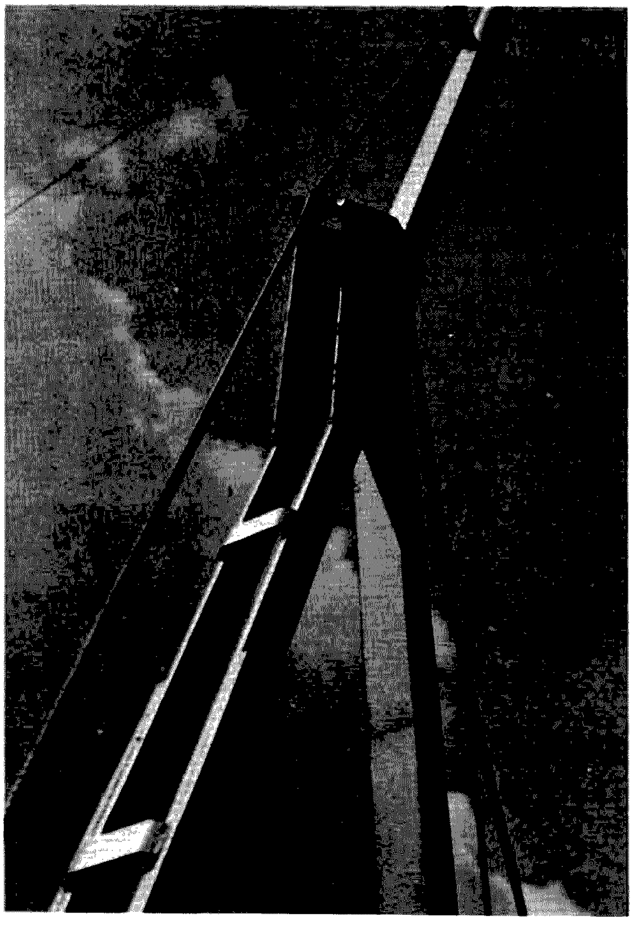

Photo B. View showing hinge section and ½" reinforcing rod which travels down the back of the mast and terminates near the bottom of the 6" channel iron. Mast partially tilted over.

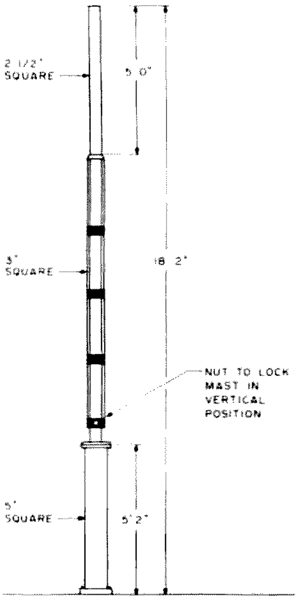

Fig. 1. Before conversion.

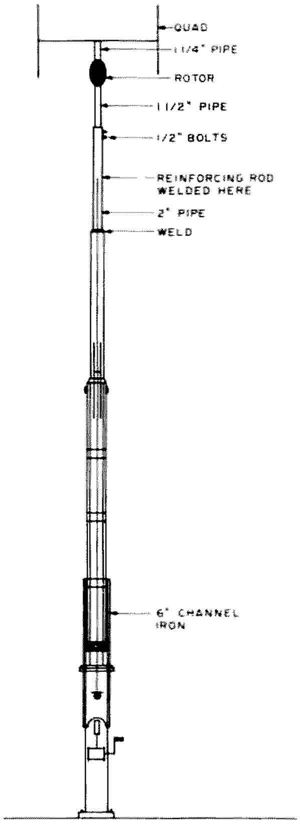

Fig. 2. Back view.

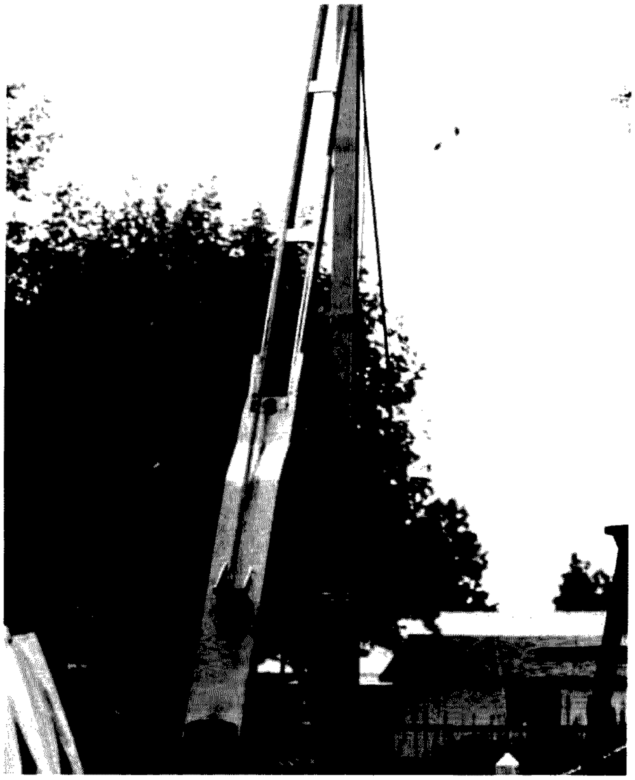

Photo C. View showing 6″ channel iron welded to the bottom of tilt-over section to increase fulcrum point.

(Fig. 1) from one of the major oil companies when they closed service stations in the area. After utilizing all but one, he graciously declared it "surplus." After spending several hours removing the old paint and some accumulated rust, I contacted a nearby ham, Harold Stark K9UBL, an expert machinist and welder. He had constructed his own tilt-over mast from heavy-duty pipe, and volunteered to do the necessary welding along with figuring stress points on our mast. All additional materials, with the exception of the boat winch, were purchased at the local junk yard. The finished mast is shown in photos.

A twelve-foot piece of 2″ pipe was telescoped into the 2½″-square section of the light standard and welded in place. Two holes were drilled near the top of the 2″ pipe, over which nuts were welded. These nuts receive two ½″ cap screws which secure the 1½″ pipe that telescopes into the 2″ section. The cap screws allow for varying the height of the mast. The 1½″ section is ten feet long and telescopes two feet into the 2″ pipe. The rotator sits atop the 1½″ pipe.

Since the added load of pipe and antenna were more than the mast was originally designed for, Harold reinforced the hinge section (Fig. 3) with two pieces of ¼″ boiler plate. A piece of 6″ channel iron was welded to the bottom end of the tilt-over section to increase the fulcrum point. To offset any bending of the mast as it is raised and lowered, a piece of ½″ reinforcing rod was welded to the 2″ section of pipe where it travels down the back of the mast, and terminates near the bottom of the 6″ channel iron. The end of the rod is threaded to receive a nut. This allows for varying the tension on the upper section of the mast.

A J. C. Penney boat winch was bolted to the bottom section, and just

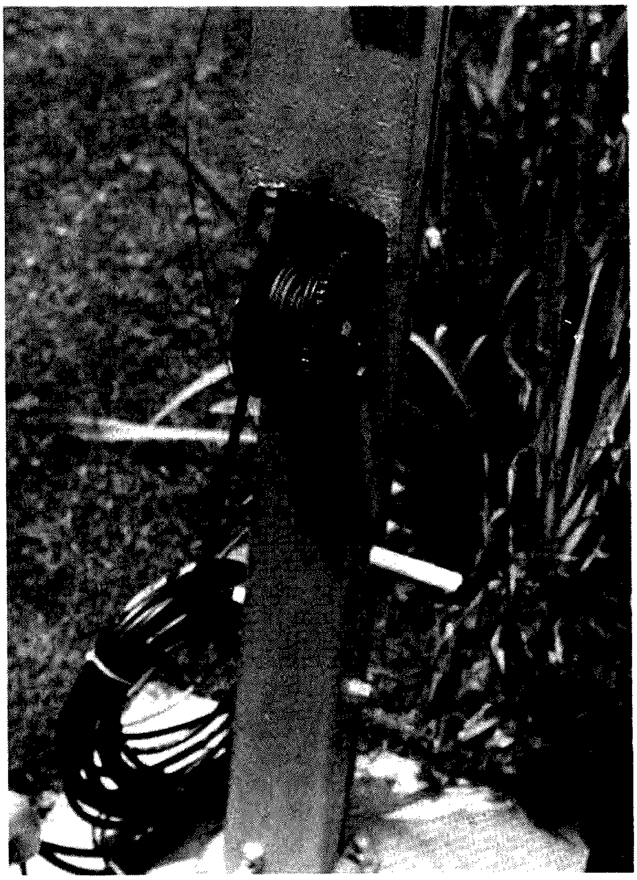

Photo D. Close-up of winch, bottom of 6″ channel iron, and base bolted to concrete base.

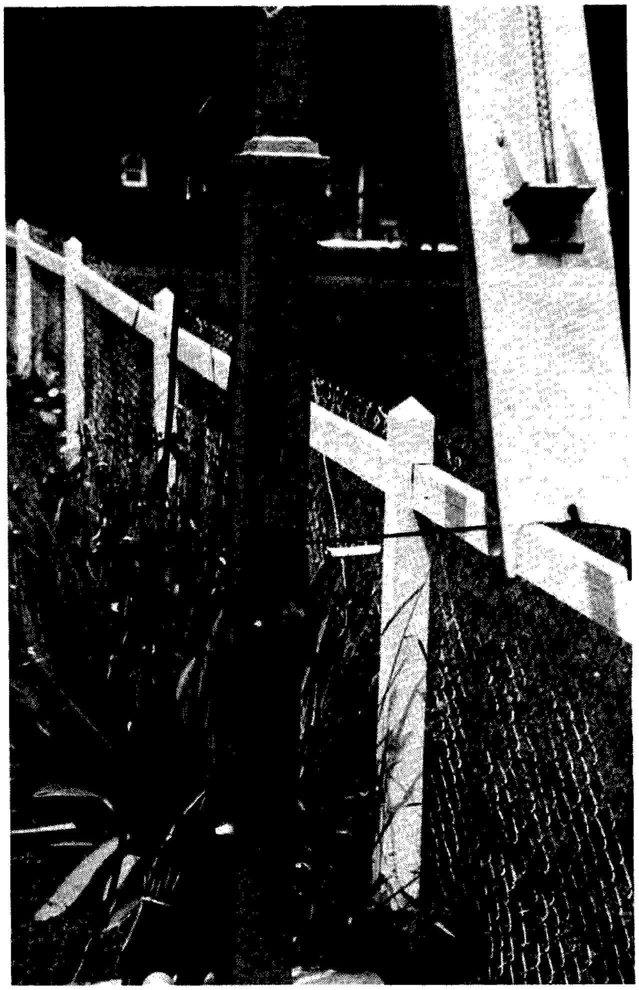

Photo E. Close-up of 6″ channel iron showing how reinforcing rod fastens to channel iron and is threaded to receive nut. Also shows slot in base section to receive pulley over which cable travels.

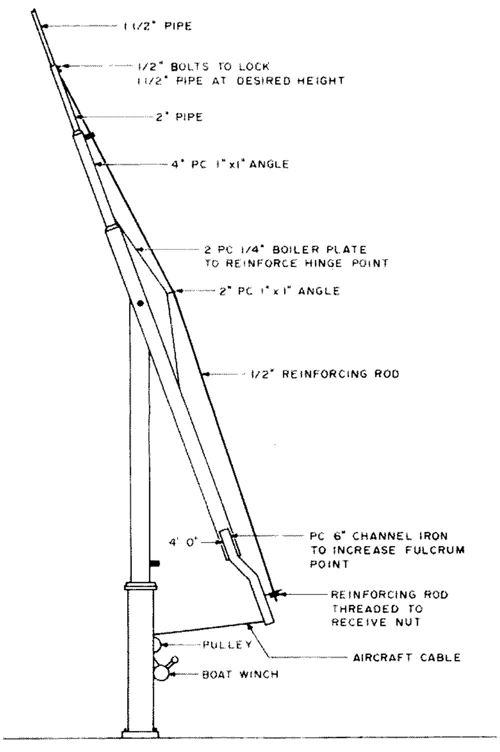

Fig. 3. Side view.

above the winch a slot was cut to receive a pulley. The aircraft cable passes over the pulley and onto the drum of the winch.

Due to space limitations, I am able to guy the mast in only two directions. At present, our ten-meter quad is sitting at thirty-two feet. Space permitting, I would feel that it was safe to raise it to thirty-nine feet. We had it at thirty-nine feet for several months last fall and had no trouble whatsoever tilting it over to work on the quad. However, with winter approaching, and the possibility of another blizzard like the one we had last winter, I became gun-shy and lowered it to thirty-two feet. I am happy to report that we made it through the winter with no problems despite heavy icing and strong winds.

I also have the center of my forty- and eighty-meter dipoles attached to the top of the mast just below the quad. These are raised and lowered by means of a pulley.

Anyone interested in putting up one of these masts should keep his eyes open for a tilt-over light standard. They are used in most service stations and shopping centers. Good sources of supply are the major oil companies and electrical contractors. With the future of gasoline being so bleak, they may become as plentiful as politicians. ■

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VHF Signal Diffraction

—why the highest antenna may not be the best

My QTH is down in a hole in the ground, and while it's not a big hole, it is still sufficient to cause problems on two-meter simplex when I try to communicate on RTTY with friends in Amarillo.

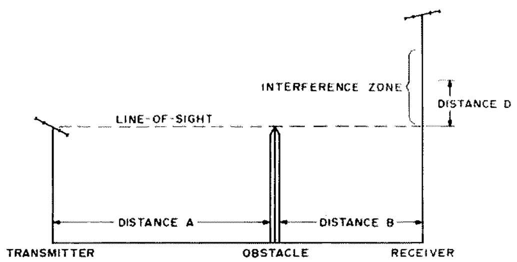

Fig. 1.

Having contemplated and rejected the "Superman approach,"[1] I searched for other solutions. As I climbed up my tower to recover last year's quad (which the West Texas wind had turned into a three-and-one-half-element bird-catcher), I happened to carry my handie-talkie with me. I tried in vain to hit the repeater from the top of my tower and then sadly started the climb to the ground. I had descended but a few feet, however, when the little transceiver squalked to life. "What gives?"

As it turned out, I was able to communicate with the Amarillo repeater, some twenty miles away, from a point not at the top of my tower, but somewhat lower down.

Never one to look a gift horse in the mouth, I mounted the new antenna on the side of the tower where the signal was strongest and then repaired to my desk and home computer to find out what in the

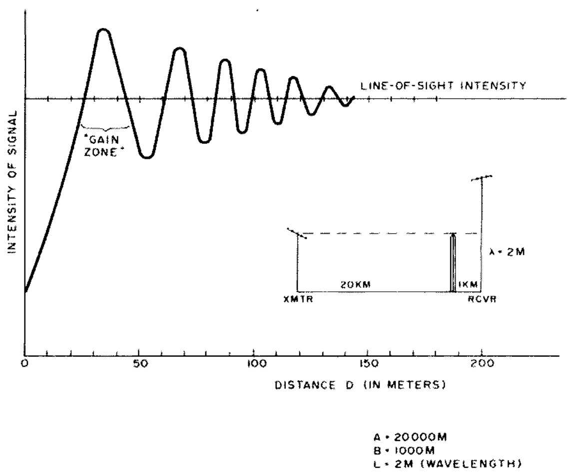

Fig. 2.

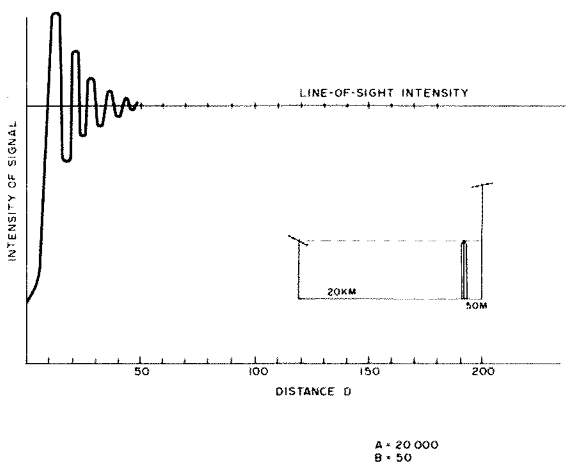

Fig. 3.

world was going on. What I learned may be of benefit to other hams in similar situations.

The answer I arrived at has to do with a phenomenon known as "diffraction" which many VHF operators have encountered in one form or another, often while driving in urban areas. Fundamentally, what happens is that when a light or radio wave front passes by a sharp, straight edge, the waves "interfere" with each other. See Fig. 1. This interference can take place in either a "constructive" or a "destructive" manner, causing the waves either to reinforce or destroy each other. At the places where reinforcement takes place, we realize an increase in signal—gain, if you will.

Oh, well, ho-hum. I guess that is what is happening on my tower. The top of the tower happens to be in a place where the interference is destructive, thus attenuating the signal from the repeater, while only a few feet down the tower the interference is constructive, resulting in readable signals. So, no problem; I will just lower the antenna into the zone of constructive interference and be done with it.

"What did I just say?!" Lower an antenna? Waydaminute! Back to the old APPLE, quick. Any old physics book will do. The APPLE models the system nicely and results in the very interesting graph shown in Fig. 2, which displays signal strength as a function of the distance, D. (See Fig. 1 again.) The horizontal line depicts the line-of-sight strength of the signal. Wow! I can, by proper placement of the antenna, realize a gain over the line-of-sight path. This gain is theoretically about 1.4 dB, and under marginal conditions this could make a difference.

The various graphs show different placements of the knife edge in relation to the transmitting and receiving stations. They show clearly that it may be possible to place an antenna in such a position that it can take advantage of the gain "offered" by an obstacle such as a hill or building and thus allow communication over paths which would otherwise not be productive.

The graphs are based on a wavelength of 2 meters, but since they were computed using formulae developed for light waves, they must be used mainly as a guide. There should be a slight difference in the way light and radio waves behave, although it should not be large. It is possible, by a judicious placement of the base of the antenna tower, to maximize the size of the zone of constructive interference.

```
   3  X1 = 0;Y1 = 0
   4  HGR
   5  HPLOT 279,53 TO 0,53
   6  HPLOT 0,159
  15  INPUT "HOW FAR IS IT FROM TRANSMITTER
      TO OBSTACLE ";A
  20  INPUT "HOW FAR IS IT FROM OBSTACLE
      TO RECEIVER ";B
  25  INPUT "WHAT IS THE WAVELENGTH ";L
  30  FOR L0 = 0 TO 250
  40  V = L0/SQR(B•L•(A + B)/(2•A))
  50  GOSUB 1000
  60  PRINT L0; TAB(12);V; TAB(25);(X + .5)↑2 + (Y + .5)↑2
  70  GOSUB 2000
  75  NEXT L0
  80  END
1000  X = 0:Y = 0
1010  FOR I = 0 TO V STEP V/200
1020  X = X + COS(3.14159/2•I•I)•V/200
1030  Y = Y + SIN(3.14159/2•I•I)•V/200
1040  NEXT I
1050  RETURN
2000  IT = (X + .5)↑2 + (Y + .5)↑2
2010  X1 = L0
2020  Y1 = 158 – 158•IT/3
2030  HPLOT TO X1,Y1
2050  RETURN
```

Program listing.

Examination of the graphs also shows that there is more than one zone of constructive interference where gain is realized over the straight line path. One would have to be careful to place the antenna in the zone of greatest signal. The graphs show also that there is no use going any higher on the tower after a certain point is reached. Instead, moving lower on the tower may bring you into a zone of constructive interference and thus allow you to carry out communications over difficult paths.

The graphs are shown for several representative situations. The computer program takes advantage of the HIRES capabilities of the APPLE, but could be modified for other machines. The mathematics of the situation are not entirely trivial and require numerical integration of Fresnel integrals. ■

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1. "Predicting Radio Horizons at VHF," *QST*, June, 1978.

2. Jenkins and White, *Fundamentals of Optics*, 3rd edition, McGraw-Hill, New York, 1957.

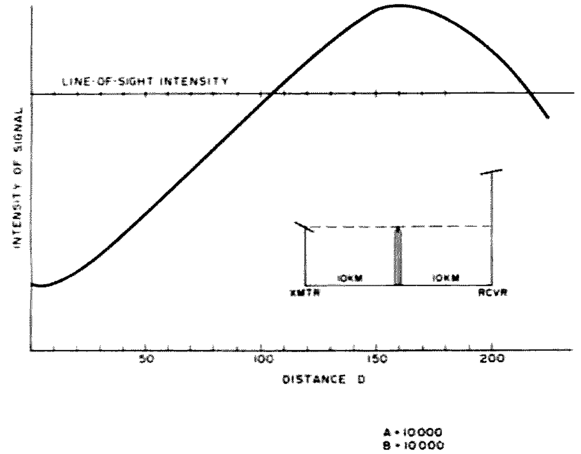

Fig. 4.

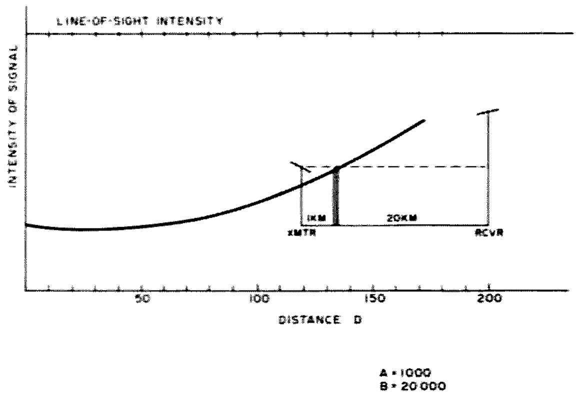

Fig. 5.

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Wear Your Halo with Style

—Mork would love it

If you haven't tried 2-meter SSB from a mobile, you haven't experienced the latest in mobiling. The new multi-mode rigs allow you to operate through the repeaters and simplex on FM, then switch over to SSB for distances impossible to communicate over on FM. Forty miles mobile-to-mobile and eighty to one hundred twenty from mobile to base are common. Two-meter SSB is on the increase due to the availability of the multi-mode rigs and the efforts of SWOT (Side-Winders On Two). Listen on 144.200 for calling and local QSOs and on 144.250 for the SWOT nets. Remember: If the band is in good shape, move off the calling frequency for rag chewing.

On a recent vacation, I wanted to take my KLM Echo II along. I had a Hi-Par halo antenna, but no means of mounting it on the XYL's car. The luggage rack seemed like a likely place to start, perhaps by clamping a piece of plywood to the luggage rack and mounting a floor flange on it, but there should have been an easier way.

The final realization was much simpler than I could have hoped for. A piece of electrical conduit with two bends and four worm-gear hose clamps were all of the materials required (except for the coax, halo, and connectors, of course). An electrician's tubing-bender was used to put two bends in the conduit at approximately two-foot intervals. Note that the bends are not exactly 90 degrees, but are such that the mast is vertical. Minor adjustments are possible if you don't bend the tubing too far. The hose clamps were used to clamp the mast to the luggage rack, the antenna was mounted on the mast, and the coax was attached. When you try it yourself, mount the antenna on the mast, attach the coax, *then* clamp the mast to the luggage rack, and save yourself a lot of stretching and straining. Do as I say, not as I do.

The station wagon with the 5/8-wavelength antenna and halo, plus the broadcast antenna, was dubbed the "Mork-to-Ork Radio Link" by my sister-in-law, Sarah, upon seeing it for the first time. I will admit that it probably looks better to me than to a non-ham, but it is solid, rattle-free, and clear of the rear door, which a bumper mount would not be. ■

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Curtain Raiser

—simple Sterba curtain antennas

The mere mention of the Sterba curtain antenna evokes visions, or memories, of huge multi-element, broadside antenna arrays once used by the Voice of America, Radio Free Europe, RCA, Mackay Radio, and Press Wireless too many years ago. The objective of these antennas was to concentrate the radiated power in a specific, desired direction. In other words, to get "gain."

For amateur radio use, the directivity and gain objectives need some definition, which, naturally, will be different for different amateurs. For amateur radio use on 20 meters, the bi-directional Sterba curtain does not need to be huge and complicated, nor does it need to be erected at unreasonable heights. W2EEY made the point that because the curtain's vertical radiation pattern is low and the horizontal pattern is broad, the result is a more effective antenna, with gain, that can be erected in a limited space using simple supports, like trees.[1]

For both 20 and 10 meters, the objective at W2JTP was primarily broad directivity to the west coast (not DX), reduced pickup for receiving from W4-land, and reasonable gain. (Another existing antenna, a fixed wire triangle beam, is used to work Florida.) Simplicity and low cost also were important considerations.

The first Sterba curtain at W2JTP was put up for 20 meters, 12 years ago, and is still in operation. As shown in Fig. 1, it is only one wavelength long (about 68 feet) and is one-half wavelength high (about 34 feet). The bottom wires are only 10 to 12 feet above the ground although W2EEY recommends a 1/4- to 5/8-wavelength height. The height at W2JTP was governed by two trees available more or less in the right places for both directivity and height.

Construction

A Sterba curtain is easily constructed using #18 or #17 electric fence wire. This is a copper-clad steel wire, unbelievably strong for its size. It is readily available from Montgomery Ward or Sears Roebuck. A 5,000-foot reel is quite small and not too expensive. Don't try to build the transposed phasing sections with this wire, however, unless you want an experience in frustration. (It is impossible to make them hang straight.) Prefabricated open wire, 450-Ohm transmission line was used instead. This is made of #18 solid copper wire spaced 1-1/8", with the plastic spreaders about 10 inches apart. It is made by Saxton Products of Congers, New York (catalog #C4-100-12), and was purchased from Lafayette Radio in a 100-foot roll. The eight insulators were made from pieces of oak, each 4 inches long and about ¾" square, boiled in paraffin. The feedpoint insulator was made from a scrap piece of printed circuit board, without foil. All connections are soldered, by the way.

A plastic clothesline pulley was installed on each tree about 45 feet above the ground. Halyards were made from ¼" nylon rope. The halyards are continuous loops, handy should a wire break. (It isn't necessary to re-thread the pulley then.) The main reason behind the use of nylon rope is that it stretches. This effectively puts a very necessary "spring" on the antenna to keep it taut and to keep it from breaking when those trees sway

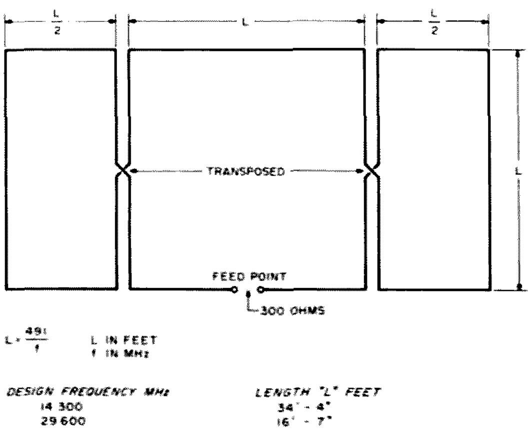

Fig. 1. Sterba curtain schematic diagram.

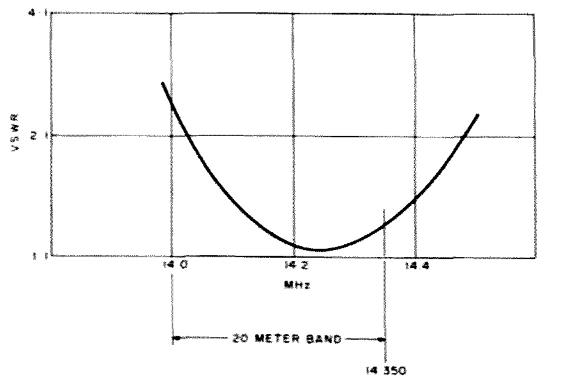

Fig. 2. Measured vswr of 20-meter Sterba curtain.

in the wind.

The antenna is fed with 300-Ohm TV twin-lead, a short length, because it is very light—it won't weigh down the antenna at the feedpoint. About 25 feet from the antenna, a coaxial balun, ½-wavelength long, made from RG-59/U, transforms the 300 Ohms to the desired 75-Ohm coax connection to the rig.

Performance

The antenna element lengths were adjusted until the array resonated at 14,300 kHz. From this the formula was derived. The vswr curve of Fig. 2 was measured with the usual standing wave ratio bridge. The input impedance, at the feedpoint, was measured with an rf impedance bridge, the Antennascope of W2AEF,[2] a grid-dip oscillator, and a digital frequency counter to read the gdo frequency.

The horizontal pattern is quite broad, as predicted by W2EEY, and the pickup off the ends is not significant. Coax relays are used to switch the rig between the Sterba curtain, the Florida triangle beam, and a reference dipole. The gain is apparently about 6 dB, also as predicted by W2EEY.

Now that 10 meters has come alive again, the national FM simplex frequency of 29.60 MHz[3] also has come alive, with cross-country contacts commonplace. Using the formula and the configuration of Fig. 1, a Sterba curtain for 29.60 MHz was put together in one evening. Stretched (again with nylon rope) between a convenient tree and the house, the 10-meter Sterba curtain was erected. The bottom wires vary from about 7 to 12 feet above the ground. A short length of TV 300-Ohm twin-lead runs from the antenna feedpoint to a 4-foot stake where a ½-wavelength coax balun transforms the 300 Ohms to 75 Ohms. RG-59/U is then run underground to the house and rig. Performance? Great! The gain makes my 150-Watts output look like 600. Stations called now come back.

Modifications

How can we improve our 2-section Sterba curtain? Again, "improve" must be defined. If we want more gain, more sections can be added, making a longer array.[4] This will increase the gain at the expense of beamwidth—the beam gets sharper[5] with more sections, which is fine if we are building it for a point-to-point operation. The feed impedance goes down, too, with added sections. (That 300-Ohm feedpoint is darn convenient!)

One possibility yet to be investigated, on 10 meters, is the addition of a reflector array, about 0.2 to 0.25 wavelength behind. (The bidirectional feature of the array described is not important at this station.) Of course, this complicates construction, as 0.2 wavelength at 10 meters is about 6 feet. Gone would be the simplicity and ease of erection of the antenna described. Would it be worth the additional effort to get a few more dB forward? This must be decided, first.■

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2. Scherer, W. M., "Antennascope-54," *CQ Magazine*, June, 1954, p. 23, July, 1954, p. 17.
3. Herman, S., "Try FM on 29.6 MHz," *73 Magazine*, November, 1978, p. 184.
4. Cousins, G., "A Sterba Curtain for the Low Bands," *CQ Magazine*, November, 1962, p. 47.
5. Staff, "A 'Super DX Antenna' for FM Reception," *Radio Magazine*, February, 1942, p. 11.

Who Needs a Rotator?

—how to do without

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A quad makes a fine DX antenna and, like most beams, it requires a rotator if you want to find DX. But there is a good way to eliminate the rotator and still get many of the DX stations. This is especially good for a 40 meter or 20 meter monoband quad.

Cut one element for a driven element and the second element as a director. Run a length of coax to the driven element, either RG-8/U or RG-58/U as you prefer.

Then run another length of coax to the director; RG-58/U will do, but make it a multiple of a half wave at the design frequency. Bring it into the shack and connect a coil across it to tune it as a reflector. Across the coil connect an SPDT toggle switch, so the coil can be shorted out.

A half wavelength of transmission line will repeat the impedance at the end in the shack to the end in the quad. In fact, you can use 300-Ohm twin-lead for the switching line, as long as you remember to correct for the velocity factor.

When you throw the switch, it will short the coil and, at the same time, close the director loop and make it a director, thus instantly reversing the directivity of the quad.

Face it southwest and it will reverse to northeast, covering most of the DX world.■

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A Tribander for the Attic

—work 10, 20, and 40 with this compact antenna

This three-band, small-attic antenna is put together much like Gypsy chicken pot pie. Instead of first stealing a chicken, you first steal the XYL's broom handle which will be used for the trap coil forms. The rest of the materials are equally exotic: a few feet of no. 18 zip cord for the trap capacitors, some scrap plastic for insulators, and about 100 feet of no. 16 copper wire. For purists, a 1:1 balun such as the Van Gorden Engineering unit,[1] at $9.95 ppd., reduces possible TVI by providing a good balanced match from 50- or 75-Ohm coax. Including balun, this multi-band antenna may be built for less than $13.00. Typical maximum swr on all three bands (28.5-29.0 MHz on 10 meters) is less than 1.5:1, except with snow on the roof, and then does not exceed 3:1 even after a heavy snowfall.

Fig. 1 illustrates the layout for a small 21'-long attic. If you are fortunate enough to have a longer attic, by all means install segments C, D, and E horizontally in the same plane as A and B for a slight, but measurable, gain of approximately 1 dB on 40 meters. Test equipment required to optimize this antenna on your favorite frequencies on each band consists of a grid-dip oscillator and swr bridge. If you do not have a GDO, just follow directions, as both the first and second traps are high inductance/low capacitance units with resultant wide bandwidths.

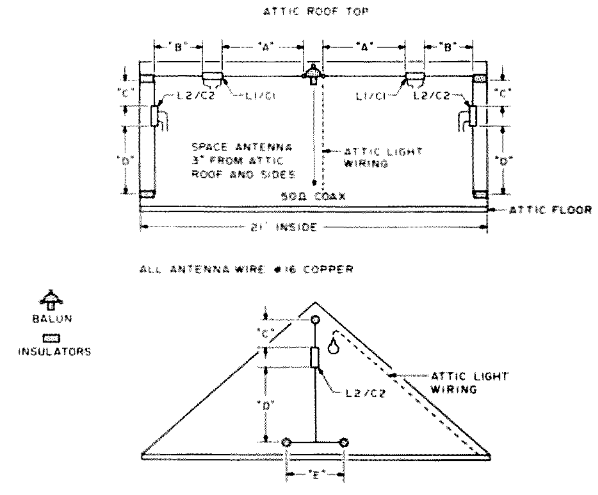


Fig. 1.

The antenna segments with traps are resonant as follows: Segment A is resonant on 10 meters, segment A+B+C on 20 meters, and segment A+B+C+D+E on 40 meters.

Trap L1/C1 is parallel resonant at 28.7 MHz, offering a high impedance and thus isolating the rest of the antenna at 10 meters and providing a loading inductance for shortening the 20-and 40-meter segments. Trap L2/C2 is parallel resonant at 14.2 MHz and presents a high impedance, thus isolating the rest of the antenna at 20 meters and providing a loading inductance for shortening the 40-meter segments, D and E.

Construction Detail

L1 is a 3-inch length of 7/8" diameter broomstick using 5 feet of no. 16 double cotton-covered (DCC) copper wire space-wound with 19½ turns as shown in Fig. 2. No. 16 DCC copper wire should be used if available, but ordinary bare bus bar wire may be used if you carefully wind and space the turns on L1 and L2 to ensure that there are no shorts. C1 is a 10½-inch length of no. 18 zip cord. Grid-dip L1/C1 and adjust to 28.7 MHz. L2 is a 6-inch length of 7/8" diameter broomstick using 12 feet of no. 16 DCC copper wire, slightly closer than space-wound with 46 turns, as shown in Fig. 3. C2 is a 17¾-inch length of no. 18 zip cord with one end trimmed 6½" short and attached to L2 as shown in Fig. 3. Lengths of each antenna segment illustrated in Fig. 1 are:

Segment	Length
A	96"
B	24"
C	22"
D	46"
E	20"

Tuning

As the lengths of all loaded segments interact with each other, this multi-band antenna should be tuned exactly as follows or you will surely come to grief! Using your GDO, tune traps L1/C1 and L2/C2 individually, unconnected to anything, while they are balanced on a glass mayonnaise jar (empty) at least 8" above your wood workbench or desk. This is to avoid obtaining misleading GDO readings due to stray capacitance. Start with both C1 and C2 an inch longer than specified and trim off ¼" between GDO readings until the GDO null (max dip) is exactly at the desired frequency. Also, use your station receiver to check your GDO frequency reading, as all GDO readouts are only approximate and may be as much as 1 or 2 MHz off actual frequency when coupled to the trap under test.

After the traps are tuned with the GDO, leave them alone. Install the entire antenna system as illustrated in Fig. 1. Using *very low power* from the station transmitter, with the swr bridge in the coax line, check swr at 28.5 MHz, 28.7 MHz, and 29.0 MHz. Swr should be less than 2:1 if the antenna is installed correctly. There must be *no* electrical power/lighting wiring parallel to or close to any of the antenna segments if you wish top performance. An overhead attic light is OK if installed close to the balun at the center of the antenna and the light's wiring is run down the inside of the roof, 90 degrees to the plane of the antenna, as shown in Fig. 1.

If you wish to change the center frequency on 10 meters, add or subtract approximately 3/8" per 100 kHz. After 10 meters is satisfactory, check the 20-meter swr at 14.0 and 14.3 MHz, and, if necessary, shorten or lengthen segment C for minimum swr at the desired frequency. After 20 meters, adjust the width of segment E for minimum swr on your favorite 40-meter frequency. A few inches either way will make a considerable difference as segment E is, in effect, a capacity hat for the 40-meter dipole.

Harmonics

Being a multi-band antenna, this system is an extremely efficient harmonic radiator. If there is any question in your mind about your transmitter's harmonic output, you would do well to include a coax antenna tuner between the transmitter and coax for your own sake, your fellow amateurs, your neighbors, and the FCC. The MFJ Enterprises model 900 coax antenna tuner, at $49.95, will resolve any problem in this line you might otherwise have.

15-Meter Option

Although I do not operate 15 meters, the second method described here was satisfactorily developed for a young friend who does operate on that band. There are two obvious ways to include 15-meter coverage in this antenna system, if desired. The first method uses a separate 10-meter trap with ½ the turns of L1 and double the length of zip cord C1. The 15-meter trap, placed about 14" out from the new L1, is tuned by additional capacity across the old L1 (now the 15-meter trap). Both segments B and C are shortened accordingly. The second method, and surely the simplest, is another dipole from the balun in parallel with the original antenna system. It should be slanted so that the outside ends are drooped 2' below segment B, and, most importantly, not less than 12" away from segments C and D to avoid disastrous interaction/detuning of the original system. Ordinary plastic clothesline can be used to support the drooped 15-meter dipole at point X. See Fig. 4 for details.

Conclusion

Squeezing a normally 66'-long 40-meter dipole/three-band antenna into your 21'-long attic is not really difficult, expensive, or very time-consuming if logically pursued. It can be built and tuned in a short

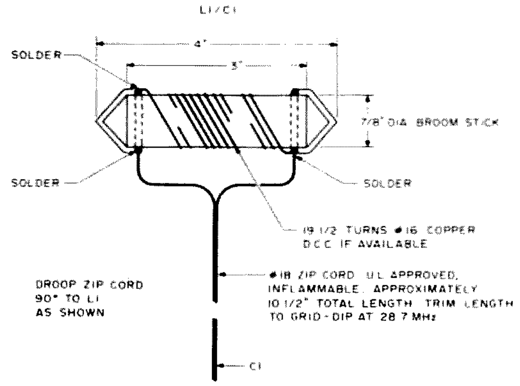


Fig. 2.

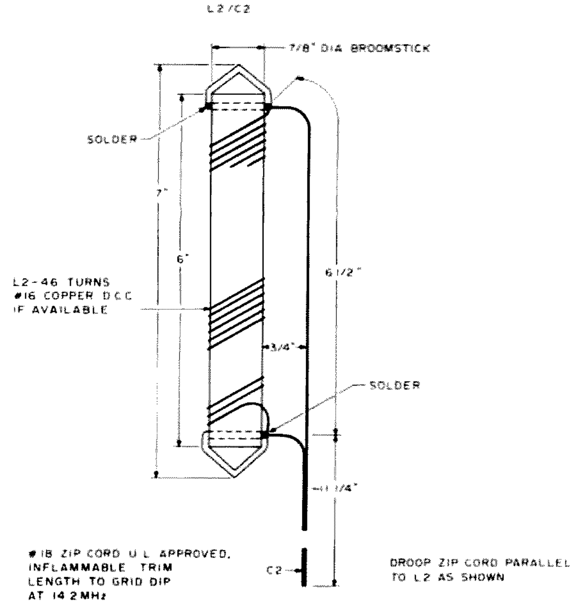


Fig. 3.

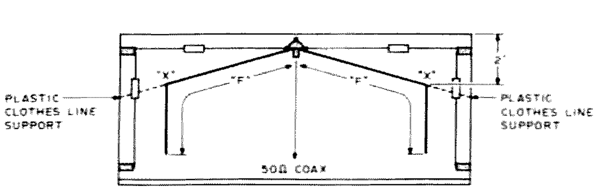


Fig. 4. 15-meter dipole option. Start with each segment "F" at 11'6". Trim one inch at a time for minimum swr at your favorite 15m operating frequency. Do not allow drooped ends of "F" closer than 12" to either L2/C2 or segment D, to avoid detuning other bands.

weekend. When a given band is open for F2 propagation, it will serve you nearly as well as any triband beam, being only about 6 dB down. The difficult part is when you wish to turn the antenna 90 degrees from the direction your attic is pointing. Let's save that solution for a future article!

One point of caution. The no. 18 zip cord capacitors are safe up to about 100 Watts PEP output. Also, use only Underwriters Laboratories (UL) approved inflammable zip cord. Be sure to test a short piece with a match. If it burns, get a refund and try again. Beyond the 100-Watt PEP output level, you would do well to substitute pieces of RG-8/U coax as the C1 and C2 tuning capacitors. Surely you do not wish to mimic the Chinese roast pork recipe: "First put a porker in the house; then burn the house down."

Most every antenna article usually ends with a typical cliche: "How I worked the High Lama of Tibet with one Watt to my gamma-matched W4UCH coat hanger." I will not disappoint you. While tuning up this little 21-foot multiband miracle, using a nearly 20-year-old 100-Watt Hallicrafters HT-37 at reduced power, my first two contacts were: Tony CT2CP in the Azores on SSB and Mario I5CZP in Siena, Italy, on CW.[2] This is not remarkable unless one knows that we had over a foot of snow on the roof and Mario was running only 5 Watts.■

References

1. Van Gorden Engineering, P.O. Box 21305, South Euclid OH 44121—"Hi-Q Balun," 1:1 ratio, $9.95 postpaid.
2. Richcraft Engineering, Box 1065, Chautauqua NY 14722. TRS-80 Morse Transmit/Receive Program, $15 ppd.

John L. Webster 8P6KX/9Y4JW
Maxwell Coast Road
Christ Church
Barbados, West Indies

Hurricane!

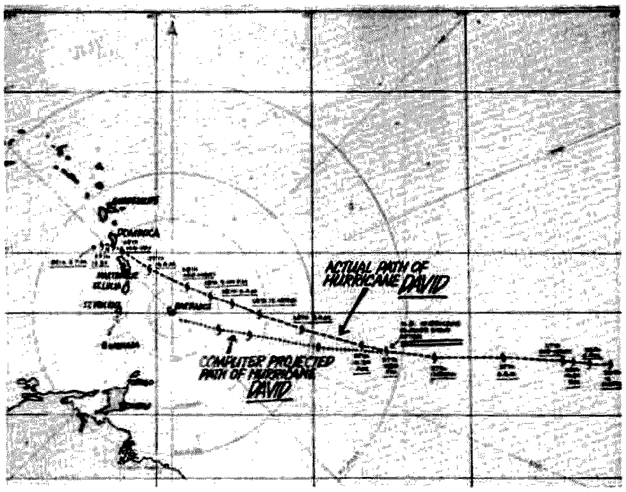
—when David ravaged Dominica, hams were at their best

Every year at the onset of the hurricane season, the Barbados Central Relief Organisation (CERO) has an emergency practice session. The Amateur Radio Society of Barbados (ARSB) is one of the groups which has been requested by CERO to participate in these emergency exercises. The ARSB has been given the responsibility of providing and maintaining communications links between CERO HQ at Central Police Headquarters and various strategic government locations, and external communications, if necessary.

One Sunday morning early in June, 1979, the annual practice was held with the hams taking up their positions as requested. Few people thought that in two and a half months they would be repeating the exercise not as a practice, but this time for real!

On Sunday, August 26, 1979, the Barbados hams on their net frequency of 7.185 MHz were advised by John Schilsky 8P6JH of the existence of a tropical depression located at 12° N, 44° W, moving west at 20 knots. At that speed and direction it was predicted that it would reach Barbados by the morning of Tuesday, August 28th. This information had been received from WSL, which broadcasts weather information to maritime stations on CW on 8.514 and 13.025 MHz.

Photos by the author.



Continued monitoring of WSL by Chris Law 8P6LI revealed that the tropical depression had reached hurricane intensity and had been named David. At 6:00 am on Monday, August 27th, it was located at 11.8° N, 49.0° W and was moving west at 14 knots.

As Monday wore on and further reports became available, it was apparent that David would not reach Barbados before sometime on Tuesday night, as it continued to reduce its forward speed.

Shortly after 7:00 am on Tuesday, August 28th, the Barbados net frequency of 7.185 MHz became essentially an emergency frequency, as Barbados was then in the direct path of the hurricane according to strong indications from the computer analysis of the storm's movements so far. Photo A shows both the actual path and the computer-predicted path of David.

Stations from across the Caribbean area checked into 7.185 MHz to advise that they were standing by to offer any assistance they could. The net continued throughout the day until propagation made it imperative to switch to the 80-meter band—3.805 MHz. Internal communications in Barbados were maintained on 2 meters—146.94 MHz simplex.

Needless to say, everyone was rushing around securing property and household effects and making last-minute purchases in anticipation of what appeared to be a very grueling time ahead—David had been described as the worst hurricane of the century to come in this direction.

Shortly after 12:00 noon, Charlie Briggs 8P6GB advised the net that David had been centered at 13.1° N, 56.7° W, or 200 miles east of Barbados. This report indicated that at last David had started the slight northward drift in its forward movement for which the people of Barbados had been praying.

By 7:00 pm on the night of Tuesday, August 28th, the Barbadian hams had either moved into their locations or were prepared to move to them as soon as possible after the passage of the hurricane. These locations included the Bridgetown Deep Water Harbour, Red Cross Headquarters, Government House, Police Headquarters, Ministry of Agriculture, Ministry of Communications and Works, the hospitals, Grantley

Photo B. Radar photograph of David taken by the Caribbean Meteorological Institute in Barbados at 3:04 am on the morning of August 29, 1979. Each circle on the photograph represents 40 km, and Barbados is at the center. It can be seen that the majority of rainfall associated with David was confined to the southern semicircle in an area extending approximately 80 km. The eye is clearly visible and is about 25-30 km in diameter. The photograph confirms that Barbados was barely missed by David, with the fringes passing only about 20 km to the north.

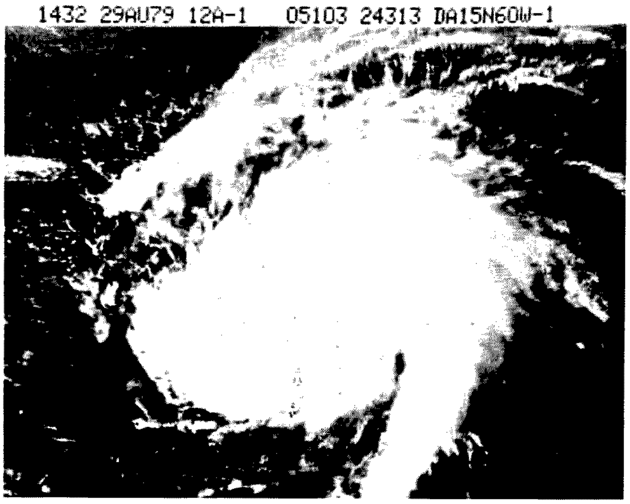


Photo C. Satellite photograph, 1-km resolution, taken at 10:30 am on August 29, 1979, by a US geostationary weather satellite. The photograph has been computer processed so that dotted outlines of the islands are superimposed on hurricane David. David's eye can be seen clearly NE of Martinique and SE of Dominica, both of which were experiencing winds in excess of 150 km/hr at this time.

Adams International Airport, Cable & Wireless, Government Headquarters, and the Caribbean Meteorological Institute (CMI). Hams also were standing by on the nighttime emergency net frequency of 3.805 MHz across the Caribbean area from Venezuela in the south to the Virgin Islands in the north.

Later that night as further meteorological reports and advisories were received, it became apparent that Barbados was going to be spared, and by midnight the "all clear" was given for Barbados.

Radar photographs taken by the CMI in Barbados confirmed that David was due north of Barbados at about 3:00 am, Wednesday, August 29th (see Photo B). These photographs, which are formed by reflections of the radar signal from moisture (rainfall) associated with the hurricane, show the eye to have been approximately 25-30 kilometers in diameter, and verify that the fringe of the main rain band and rough weather missed Barbados by only about 20 kilometers.

Damage to Barbados was negligible, with only the odd tree having been uprooted and one or two electricity supply poles blown over in the north of the island. At my QTH in the south of Barbados, the lowest barometric pressure recorded was 29.65 inches, at approximately 3:00 am. This coincides with the radar photograph showing that David was due north of Barbados and closest to it at that time. There was little rainfall, and this was invariably associated with squalls when the winds gusted to 40-50 km/hr. These squalls continued for several hours after dawn broke in Barbados on Wednesday. Barbados had been very fortunate, but for Dominica trouble was only just beginning.

Amateur radio operators from Martinique reported strong winds and a falling barometer at 6:40 am that morning. Pete Brand J7DP advised at 7:30 am that strong winds already were being experienced in Dominica. Martinique reported at 8:50 am that the center had been located half an hour earlier to be about 75 km northeast of Lementine airport, which itself was experiencing winds of 85 km/hr, but that winds of 170 km/hr had been experienced in northeast Martinique.

This type of information continued to be passed on 7.185 MHz until 9:10 am when the first word of damage was received from Margaret Harris J7DE. She reported from Dominica that winds were very strong, trees were falling, and galvanized sheets from house roofs were flying through the air. This was confirmed shortly afterward by her husband, Austin J7DAJ, who estimated the windspeed at 130 km/hr. (See Photo C.)

Fred White J7DAY also reported very high winds around 10:00 am and kept giving reports to the net about the tremendous destruction being wrought around him as everything worsened. Fred abruptly disappeared from the net about 11:15 am when his antenna was finally blown away.

In an interview with Fred several days later, he was able to give his story. (See Photo D.)

"I did not make much preparation for the hurricane; I had never experienced one before and did not expect it was going to be like it was. We just put some bags on the doors and so on, took down my antenna tower, and put away most things that could fly around, hoping that it would just be some wind that would pass. Electricity was cut off at about 8:00 am [Wednesday, August 29] around the time that the winds started to blow strongly. However, my equipment has a power supply to allow it to operate on battery power, so I removed the battery from my Land Rover and used it to power the equipment.

"I continued to give a step-by-step description of what I saw around me as the winds got higher, until they reached about 100 mph

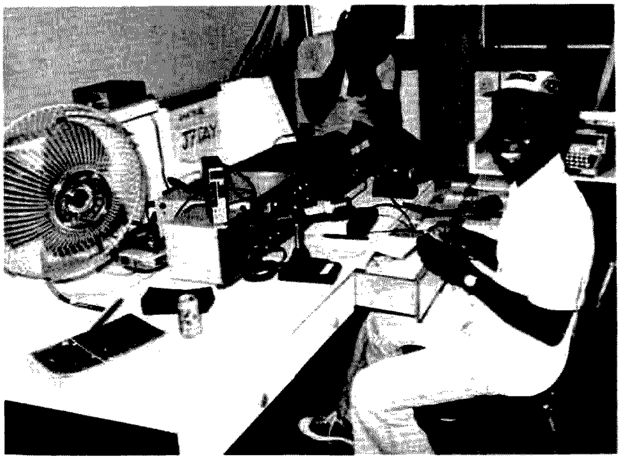


Photo D. Fred White J7DAY takes a break from the emergency traffic to flash a smile. Fred operated out of Police HQ, Roseau (Dominica), for over two weeks, handling all types of emergency and relief traffic for the Government and people of the island. Standby generators located in the basement of the building supplied power for his equipment.

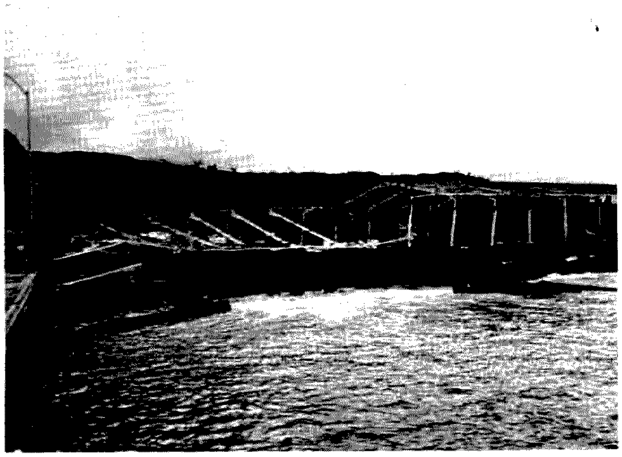


Photo E. A twisted pile of junk is all that remains of one of the main warehouses at the deep-water port.

around 11:15 am and my antenna was blown away. I then put my equipment into cases to try to protect it from the rain. Shortly after, I heard the top of my house breaking away and my cousin—who was on the top floor—was calling for help. He was not hurt but afraid, and I told him to come down below, which he did. Things were flying all about outside by this time, and it was dangerous to be outside. We put some boards and things on a bed so that in case of debris falling from the top of the house we might hopefully survive. After the roof ripped off, some of the floorboards which were covering the downstairs also ripped off, and water flooded inside the house. We then took refuge under the bed, where we remained lying in a pool of water two inches deep for three to four hours.

"As soon as the wind eased up a little later, I thought that the first thing to do was to get into the cellar of a neighboring wall house where we could be safer, and maybe from there I could get my equipment back on the air, as it was still safe in the cases. Carrying my equipment, I jumped through a window, along with my wife and cousin, and ran under that house, where I tried to set up the rig. However, when I looked outside for trees to which to tie the antenna, I could not find any—all around was totally flat.

"I located whatever wire I could find and twisted the bits together to make an antenna 70-80 feet long, using sticks to support it about one foot above the ground. This makeshift antenna allowed me to get on the air at about 5:00 pm Wednesday. I managed to contact Allan 9Y4LG in Trinidad and spoke with him for about three minutes, just long enough to let them know that I still had my equipment but that as far as my eyes could see everything was flattened, and I would be back on later when the winds had fully subsided and I was able to make a better antenna.

"It was around 7:00 pm when I completed a better antenna and got the center about 10 feet high with a piece of stick off one of the broken-down houses. This antenna allowed me to communicate without as much danger to my rig as the first one. A message was relayed to Radio Antilles by one of the hams in Montserrat that contact had been made with me, and my address was given so that I could be contacted. This information was broadcast over Radio Antilles—which is very well received in Dominica and to which most Dominicans were usually tuned, unlike Radio Barbados which can hardly be heard.

"Around 10:30 pm, a reporter from Radio Antilles and some other guys came to me and said that they and the Prime Minister had heard the broadcast and he had sent them to me to broadcast the following message: *The Prime Minister has declared a state of emergency in Dominica. A general state of disaster has been declared for the entire island. The Prime Minister is requesting all islands to supply medical and any type of assistance which they are able to provide to the island. It is feared that there are 60,000 people homeless. Two persons are so far known to have perished. Hospital has been partly demolished.*

"After sending this message, I went off the air to conserve my battery power and spent the night in the same cellar with 30-40 other people, two of whom were hurt, although not seriously.

"Next morning around 6:00 am [Thursday, August 30], some policemen came to move me to Police Headquarters in Roseau, so I sent my equipment with them while I went to try and find some coaxial cable so that I could put up a proper antenna. I arrived at Police Headquarters at 8:00 and managed to get my equipment operating from about 12:00 noon. From this point on, I worked for 24-48 hours continuously passing information relating to requirements for aid, speeches by the Prime Minister and other ministers, and reports by newsmen in the island. The speeches and news reports were relayed to Radio Antilles via other hams, who then broadcast them for reception by Dominicans. Radio DBS, which normally operated out of Roseau, was very severely damaged and was not functional. I had to operate almost continuously until I got some help from outside. I think it was from 8P6GB from Barbados, late on Friday evening."

Hurricane David battered Dominica for about five to six hours, with the eye passing over the southern part of the island during a twenty minute period be-

Photo F. Aerial photograph taken on Friday, August 31st, showing severely damaged warehouses on the outskirts of Roseau.

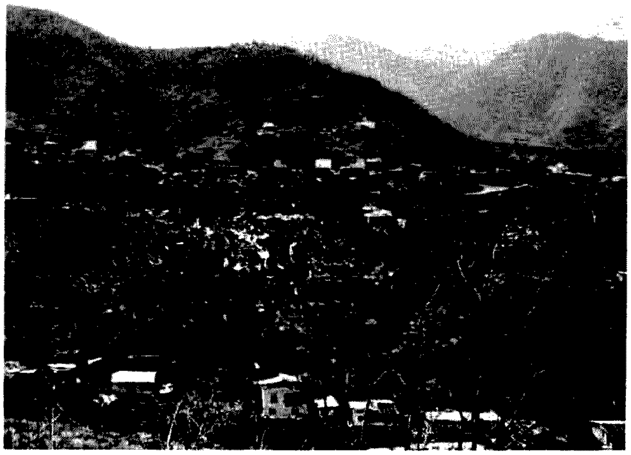


Photo G. View overlooking the Kingshill area, in the vicinity of J7DAY's QTH. There was nearly complete and total destruction of the houses in this area and to the south of Roseau.

ginning Wednesday at about 12:30 pm. After the passage of the eye, the winds, which have been reliably estimated in excess of 240 km/hr, returned suddenly with renewed vengeance from the opposite direction—from a westerly direction. This whipped up waves 9 to 15 meters high, and these waves pounded the west coast, causing extensive damage both to properties and to the roadway which runs at water's edge in most places.

Around 5:00 pm on Wednesday, most people began to emerge from the wreckage of their homes to be confronted with an utterly depressing scene. In five to six hours, the island had been completely devastated. It was estimated that out of a population of 85,000 souls, 60,000 were made homeless; miraculously, only 40 deaths were recorded.

Damage to property was extremely severe, resembling photographs that I have seen of severely bombed-out areas in Vietnam. Large steel-framed buildings had been reduced to twisted heaps of junk. (See Photos E and F.) The entire power distribution grid was destroyed, with hardly an electricity supply pole still standing, and the water supply had been disrupted. Roadways were impassable almost everywhere, being blocked either by debris, fallen trees and poles, or swept away by the sea. The island, which largely is covered by dense tropical rain forest, appeared as though swept by fire. Almost the entire forest was completely stripped of foliage, leaving just broken and uprooted stumps of the trees (photos G through J).

I have always found it to be a beautiful green island, but on arrival there two days after David, I was overcome by a wave of great sorrow. The forest was quite brown and denuded, and wherever you went the picture was the same—total destruction of everything around—and you kept wondering how this newly-independent nation could ever pick up the pieces and make a new start.

However, that was our reason for being involved—to help them begin to pick up the pieces and make that new start. Over the following days, Barbados, due to its geographical position, good airport and seaport, infrastructure, excellent communications links with the rest of the world, and, most

Photo H. Ruins of the Roseau Anglican Church; miraculously, the stained-glass windows survived the wrath of David.

importantly, its well-organized and prepared Central Emergency Relief Organisation, became the center of all relief operations for Dominica.

The ARSB, because of the emergency situation, obtained permission at 7:45 pm on Wednesday, August 29th, to handle third-party traffic and phone patches relating to Dominica. This set the stage for several weeks of really serious relief work by the hams. That night, acting on the information relayed by J7DAY from the Prime Minister of Dominica, the hams in Barbados contacted the Barbados Government and all embassies stationed in Barbados. These included those for the US, Canada, the UK, and some European countries.

The British High Commission advised later that night that the British Frigate *HMS Fife*, which was in the area and had a helicopter on board, had been instructed to change course for Dominica, where her men would render what assistance they could. The hams were advised that they should make radio contact with the *Fife*; calls were made throughout the night and next morning but she never came up on the ham bands—this remains a mys-

Photo I. Typical post-David view of the now denuded but once lush rain forest that once covered most of Dominica and flanked the roadway between the airport and Roseau, the capital.

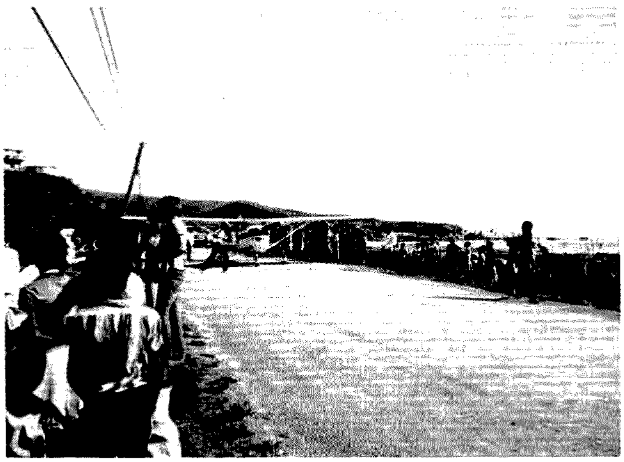


Photo K. The Cessna 182 preparing to take off from the Massacre Bypass. The hams from Barbados used this method of transportation to get into Roseau while the road across the island was still blocked. The opening of the canefield airstrip, located in the right background, brought an end to this hazardous exercise. Fortunately, the only damage resulting to aircraft using this roadway was a burst tire on the Cessna at touchdown, which grounded it for two days until spares arrived, and some wing damage to another aircraft on takeoff. The latter was probably caused by a pole like the one seen overhanging the roadway in this photo, but the pilot was able to make a successful landing in nearby Martinique even though the flaps on his right wing were torn away and flapping in the wind.

Photo J. Decapitated coconut trees at a coconut estate on the west coast of Dominica. Official estimates indicate that 4,500 acres of coconuts were left in this condition by David and that it will take six to seven years to bring this crop back into production.

tery to the hams to this day.

The *Fife* arrived in Dominica by noon the following day—Thursday—but was unable to berth due to heavy seas. Men and equipment were ferried ashore by the helicopter, where they immediately assisted Dominicans with cleaning of the main streets in Roseau and in the repair of the hospital buildings and equipment, all of which had been badly damaged. Actually, the *Fife* provided through her distillation plants the only source of potable water available in Dominica for two or three days, until other methods of purification could be established. This was necessary since the normal water supply had been disrupted and the rivers—of which there are 365 in Dominica—had become polluted from the death of many animals. It took about a week before water was again flowing in pipes to the main housing areas, and much longer before it was in those to the rural areas.

Throughout Thursday, all types of emergency and priority traffic flowed on 7.185 MHz into and out of Dominica. Most of this traffic was for Barbados or Montserrat. Montserrat became very important to Dominicans, because on that island is located a commercial broadcasting station—Radio Antilles—which broadcasts on the AM band. Radio Antilles became a vital link in making information available to the Dominican public. This was especially so since damage to Radio DBS kept it off the air. In addition to the emergency traffic, journalists in Dominica were allowed to pass their reports to the news services via ham radio.

However, it was impossible at this stage for health and welfare traffic to be handled, and Fred J7DAY was working continuously, unassisted. There are not many hams in Dominica and, unfortunately, of the few that exist only Fred (apparently) was able to carefully pack away his equipment and make it and himself available to his country in this time of need. Most of the other hams either had their equipment damaged, had no power, or were so shocked at the disaster that they were unable to assist.

It was at this stage, after midday on Thursday, that I decided to volunteer to go to Dominica. Charlie Briggs 8P6GB did so also. Our offer was accepted by J7DAY that night, and we then had to find a way into Dominica. Enquiries revealed that Barclays Bank, which maintains a twin-engined aircraft for use in the Caribbean area, had made a landing that morning at Melville Hall Airport. This was the first aircraft to land in Dominica after the disaster; it took a rather heroic effort by the pilot, Mike Littlepage, as the winds were still very unpredictable, there

was no air traffic control, and there was little indication of what the landing strip was like. Nevertheless, Mike made a successful landing, and through his efforts the world was made aware that the airport was serviceable.

There was still, however, a serious problem in that the airport is in the north of the island and Roseau, the capital, is in the south, separated by a distance of some 36 miles. Most of the road is a rough, narrow road in dense tropical rain forest (see Photo I). This meant that most of the roadway was blocked by landslides and fallen trees, and supplies and personnel arriving at the airport could not be taken by ground transportation into the capital until the roads were cleared. This clearing process took some five days, with crews working around the clock using bulldozers and chain saws from both the Roseau and airport ends.

Barclays Bank agreed to fly us into Dominica and on Friday, the 31st, at 1:45 pm, we departed from Grantley Adams International Airport and headed for Dominica, along with an aging Heathkit SB-100 transceiver.

On arrival at Melville Hall Airport three quarters of an hour later, we expected to be flown in to Roseau by the helicopter from *HMS Fife*. This was not possible, however, as the helicopter was otherwise occupied shuttling injured persons and medical supplies to and from the airport.

Following some discussions with officials at the airport, we were introduced to an American missionary who had been living in Dominica prior to David. He had a small single-engined Cessna aircraft in which he had already made several flights that morning to the other side of the island, landing on a roadway known as the "Massacre Bypass," some three miles from Roseau. On these flights, he had shuttled people back and forth—mainly journalists and their camera crews. He offered to take two of us and our equipment across. However, as darkness was fast approaching and I was not very familiar with Dominica, it was decided that Charlie and another guy, a Dominican who had come down with us from Barbados, would be taken with the equipment. In this way, Charlie should be able to find the QTH from which we would operate, and I would return to Barbados that night to make another attempt for Roseau next morning.

As we left Dominica for Barbados, we flew along the west coast and were really shocked at the extent of the damage. Our pilot made several approaches on the Massacre Bypass, and it was decided to bring in a Cessna 182 the following day in addition to the twin-engined aircraft. This small plane could be used to shuttle the wives and children of Barclays Bank staff from the Bypass to Melville Hall, from whence they would be flown to Barbados in the larger aircraft.

Later that night, after Charlie had made his way to one of the Barclays Bank manager's houses which had largely survived the onslaught of David, he passed the following information concerning the landing strip on the Bypass: "[it is] 350 paces long, 7 paces wide, with a slight left-hand bend on landing from the north—several potholes. Bridge on the southern end; road severely eroded by the sea on northern end. Telephone poles hanging over the road slightly at southern end."

I was flown in to the Bypass next afternoon on the second landing of the Cessna 182, after a very long delay at Melville Hall caused by severe congestion. I counted over twenty aircraft ranging from small Cessnas to large C-130 transports, all jammed together on the small park-

Photo L. There was never any problem in finding wires for antennas or running emergency power lines. One just walked into the street and cut off what was needed. Here the author can be seen obtaining wire from a fallen pole with which to erect his antennas.

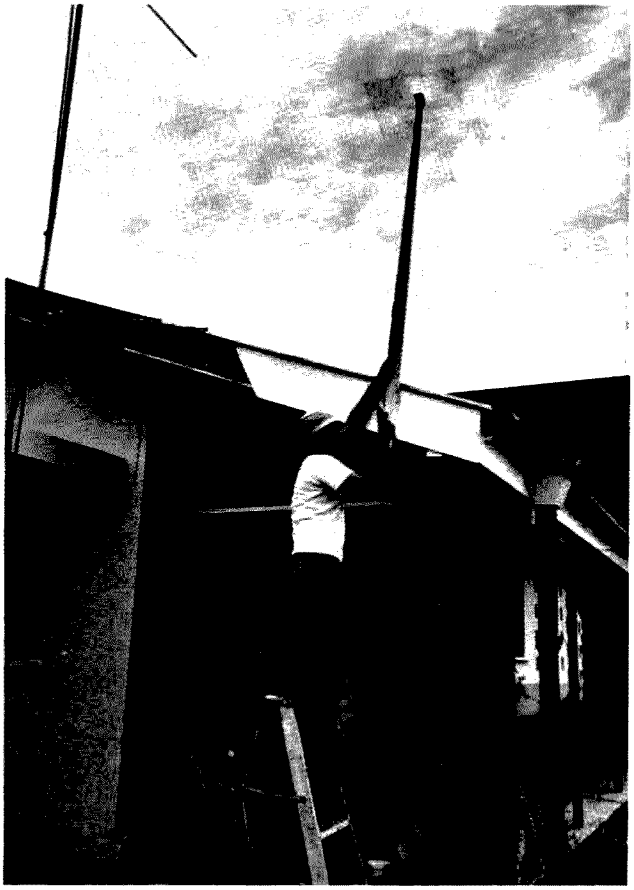


Photo M. Erection of a 2-meter quarter-wave vertical with a chicken-wire ground plane.

Photo N. John L. Webster 8P6KX/9Y4JW operating J73N (formerly 8P6GB/J7). He spent two weeks in Dominica from the 1st to the 14th of September.

Photo P. Operating QTH of 8P6GB/J7 (J73N). The CB half-wave ground-plane vertical, which was very successfully used on 20 meters unaltered, and the 20-, 40-, and 80-meter dipoles may be seen.

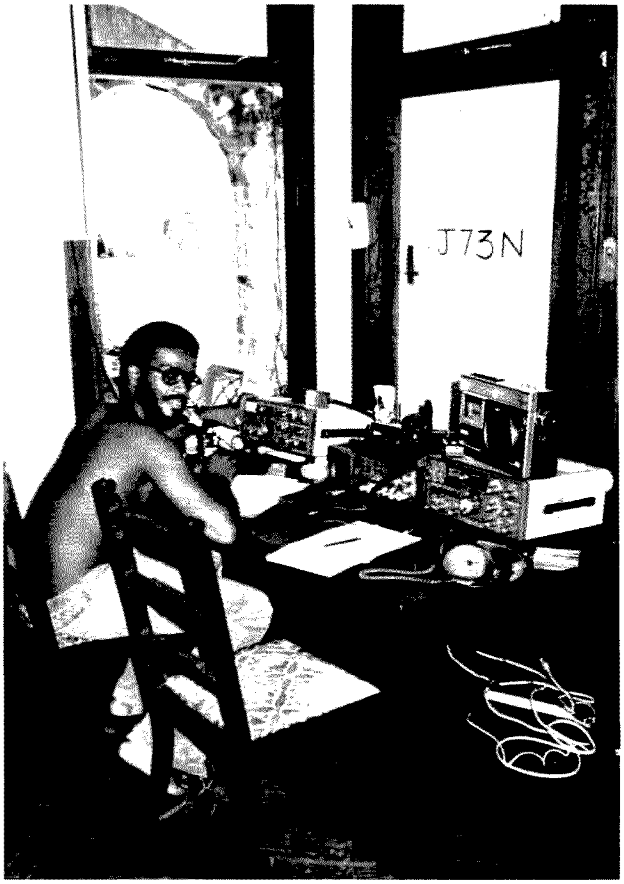


Photo O. Charlie Briggs 8P6GB/9Y4CEB, the third operator of J73N.

ing apron. This naturally created a traffic jam, and the passengers on one commercial flight which landed during this time had to disembark in the center of the runway.

The landing on the Bypass was one of the most frightening moments of my life, and I've never felt so relieved as when I was able to step out of that aircraft on to firm ground! (See Photo K.)

After consultation with Fred, it was decided that we would handle health and welfare traffic mainly, on frequencies of 3.835 MHz at night and 7.220 MHz during the day. Fred would continue to operate on the main emergency frequencies of 3.805 MHz and 7.185 MHz. We would shift to these frequencies if and when Fred required a break. Internal communications between Fred and us were maintained via CB equipment on channel 9 for the first four or five days until we were able to obtain some VHF equipment. At this stage, we switched to 2m—146.52 simplex—for internal communications.

Charlie and I arranged a program so that we could operate 24 hours a day in shifts. (See Photos L and M.) We operated as 8P6GB/J7, but this was changed after a week of operation to J73N, as all emergency stations assumed Dominican callsigns. (See Photos N, O, and P.) Our 24-hour operation continued until early in the morning of Monday, September 2nd, when we suddenly realized that our receiver had lost all sensitivity and our transmitter also had developed some problems. Apparently, our aging SB-100 decided that 72 hours of continuous operation was the final straw and had packed up on us.

What does one do in such a situation to get spares? We were really at a loose end, but word was passed to the engineers on board the *HMS Fife* who were able to supply us with most of the required components. However, before we could install them, John Ackley KP2A offered us, and we accepted, the loan of a Kenwood TS-820S. John, of the American Virgin Islands, is a pilot and owns a light aircraft; he arrived in Dominica about September 1st and brought with him a considerable amount of radio equipment. John actually ended up outfitting the three main amateur radio stations—Fred, himself, and us. KP2A was set up in Red Cross HQ and handled mainly health and welfare and other Red Cross traffic. John was often on 20 meters working into the US. (See Photo Q.)

Our health and welfare traffic was disseminated in the following manner. *HMS Fife*, by September 1st, had started regular broadcasts to Dominica on the frequency normally used by Radio DBS—595 kHz—us-

Photo Q. John Ackley KP2A of the US Virgin Islands set up as J73A in Red Cross HQ.

Photo R. Elsa Webster 8P6MH/9Y4LL operating the station 8P6GB/J7. Elsa was the only female operator to come into Dominica during the early relief effort, and she spent five days there.

ing the ship's transmitters. As these transmitters were not designed for continuous usage, the broadcasts were unconventional. Transmissions began every hour on the hour, and for the first 10-20 minutes, health and welfare enquiries, including those we had received and passed to them by a runner, and other messages, were broadcast. This was followed by music until twenty-five past the hour, at which time the same transmissions were made in *patois*—a corruption of the French language spoken in Dominica.

After 50 minutes of transmission, the station would go off the air for ten minutes to allow the transmitters to cool and to make any necessary adjustments. Meanwhile, engineers of the *Fife* repaired the station at Radio DBS, permitting it to resume transmissions about one week after David. Even after Radio DBS resumed transmissions from their normal QTH, however, we continued to disseminate our health and welfare traffic in this manner.

Charlie was relieved by my XYL, Elsa (see Photo R), who is also a ham, licensed as 8P6MH, 9Y4LL, and ex-VP2DL. She took over for five days from September 3rd while he had a break in Barbados. During this period, we had one of our finals fail (a 6146B), once again putting us off the air for some time. However, Fred was able to return to the ruins of his home and locate a replacement amongst the rubble and get us back on the air.

During the two weeks that we operated out of Dominica, power for our equipment was supplied for the first week by small portable, 300-Watt Honda gasoline generators—see Photo S. These proved adequate until we tried to provide lighting as well. At this point, we often used to FM somewhat on our transmissions as the light presented too great a load to the generators. During our second week we were provided with a 1.6-kVA diesel generator which, in addition to powering our equipment and lights, was also able to power a refrigerator which allowed us to have cold drinks—quite a luxury under the circumstances.

I should emphasize here that it was largely through the efforts of Barclays Bank that we were able to go into Dominica and render what assistance we could. Barclays took us there and back on their own aircraft, provided us with the power generators, fuel, and food supplies, and even housed us in Dominica.

Photo S. The author refueling a portable standby generator of the type used by the Bajan (Barbadian) hams, in Dominica, to power their equipment. These small 300-Watt Honda generators allowed continuous radio operation for about six hours on a half gallon of gas. They were used for about a week prior to Barclays Bank providing a 1.6-kVA diesel generator, shown in the background. This larger generator allowed the operation of a refrigerator and lights at night, in addition to radio equipment.

As the relief effort progressed, other hams made their way to Dominica, each to make his own contribution. I have already mentioned KP2A and his invaluable contribution to the relief effort.

Bob WØDX from the US was an early-comer who, I believe, walked a considerable distance from the airport to Roseau with his equipment. He operated out of Police HQ, near Fred.

Another outstanding contribution was made by Stanley VP2ABC from Antigua. Stanley maintained a radio link between Fred at Central Control in Roseau and the airport for some time prior to the passage of hurricane Frederic.

Frederic was the hurricane which followed closely on David's heels which threatened Dominica for some time, causing vir-

Photo T. Emergency supplies from the US being unloaded from a US Marine "Jolly Green Giant" helicopter at Windsor Park, the main sports field in the capital. These helicopters ferried supplies from the airport to the capital even after the roadway was reopened, until an adequate stockpile was established. The boxes to the right of the photograph were a shipment of VHF equipment sent by the IARU to assist in internal communications.

tual panic, until it veered northward, missing Dominica but bringing considerable flooding in the north of the island, especially at the airport. This flooding resulted in damage to relief supplies that had arrived at the airport and were being stored there. Also, when the river adjacent to the airport overflowed its banks, one of the large US "Jolly Green Giant" helicopters (like the one shown in Photo T) was swept into the sea and severely damaged.

After the passage of Frederic, Stanley was taken by helicopter to most of the outlying villages in the central and southern parts of the island. On each occasion he radioed back very detailed reports. He also was able to deal with health and welfare enquiries relating to these districts.

The International Amateur Radio Union (IARU) sent a shipment of VHF gear for use in the relief effort (see Photo T). It included a VHF Engineering 2m repeater and about a dozen Genave GTX-2 2m transceivers, some with portable battery packs. These were used to link all the local amateur radio stations, the hospital, and Radio DBS to Central Control at Police HQ. Due to the very rugged and difficult terrain in Dominica, 2 meters does not prove to be very effective over any great distances, but in the absence of telephones it serves a very useful purpose around the city and nearby villages, and will continue to do so for some time (photo U).

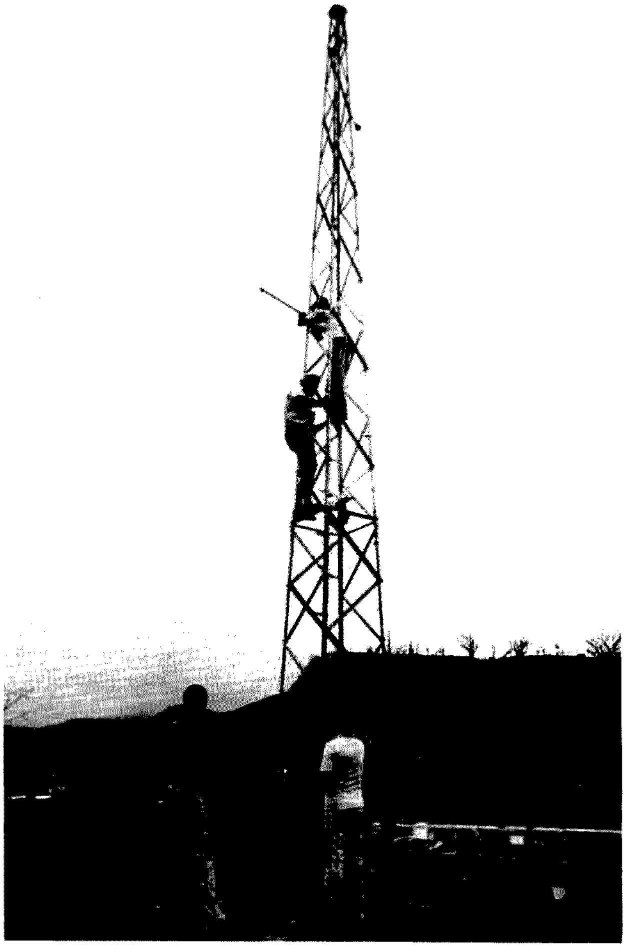


Photo U. J7DAY and KP2A, both up in the tower, erect home-brew antennas for use with the VHF gear sent by the IARU. They are assisted by VP2ABC, to the right, from a safer location. The tower was located on top of the police HQ building. In the background may be seen the devastated botanical gardens and a damaged school.

During the period of relief that followed the devastation of Dominica by hurricane David, hams across the Caribbean area rallied together, passed thousands of messages, and made dozens of phone patches. Although a great many hams participated, I would like to single out a few who made outstanding contributions and greatly assisted with the smooth running of the relief effort.

At the top of the list are Ron 8P6BN (Photo V) and Richard 8P6FW (Photo W), who worked around the clock from the beginning and were together responsible for most of the phone patches made. Arthur 8P6AA as Emergency Coordinator of the ARSB did much of the work behind the scenes, along with Toby 8P6AK who is president of the ARSB. Allan 8P6AH, although away from Barbados for about one week directly following David's ravaging of Dominica, on his return was always around and handled some of the clearest patches we made. Also, Allan's witty character kept the spirits of all high.

Out of Antigua, we had Hya VP2AYL, who was the only YL operator, other than my XYL, participating in the emergency. Hya was noted for her relay of detailed weather forecasts for the Caribbean region from the Antigua Met Station. These weather forecasts were rebroadcast over Radio DBS.

From Montserrat there were VP2MO and VP2MC, both of whom were important links in passing information to Radio Antilles.

However, in spite of all notable efforts by these and many other amateurs both in and outside the Caribbean region, it was most distressing at times to witness interference by unconcerned amateurs. This interference generally took the form of some sort of QRM on the emergency frequencies, but also included those amateurs who, even though advised that only

Photo V. Ron Armstrong 8P6BN, along with 8P6FW (Photo W), did yeoman service during the relief effort.

Photo W. Richard Gale 8P6FW, together with 8P6BN, handled most of the phone patches.

emergency traffic was being handled, persisted in trying to get their health and welfare enquiries through. The exercise has shown that many amateurs are not capable of passing and receiving messages.

A true ham is illustrated in the words of Fred White J7DAY, himself, who, when asked by a fellow ham about his personal situation replied, "The first thing I tried to save was the rig, because I knew if it got damaged, there would be no communication outside. Actually, everything is lost on my side, and hopefully something can be done, sometime, but after I have taken all the emergency traffic here, then I'll start thinking of myself."

Fred's efforts have been acknowledged by the Government of Dominica, and at the island's first Independence Celebrations on November 3, 1979, Fred was presented with his country's highest honor, the Sisserou Award.

I would like to express my gratitude to the Editor of the *Bajan Magazine*, Mr. Trevor Gale, for allowing me to use information presented in an earlier story by me, titled "Unsung Heroes," published in the November, 1979, issue of *Bajan*. ■

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A "Short-Yard" Antenna for 40/75

—fits where others won't

The problem of space in which to erect an antenna is, I suppose, as old as ham radio itself. My first antenna consisted of four wires strung between two sixty-foot telephone poles two hundred feet apart—but that was in 1920, and I just happened to live on a farm with plenty of space.

Few city lots today will accommodate a half-wave horizontal antenna for seventy-five meters, however; some even have trouble with forty meters.

Being in that category myself, I began looking around for some way to operate on seventy-five that didn't include running a wire over to my neighbor's TV tower. The first solution that comes to mind, of course, is a ground-mounted vertical. That's fine and I enthusiastically recommend that method, but a base-insulated tower is not easy to manage and an aluminum tube sticking up in the air sixty-odd feet is not the easiest thing in the world to keep up there.

Having a forty-meter vertical already in operation, I came up with the following idea, requiring only about thirty feet of horizontal space. Fig. 1 is self-explanatory, perhaps, but here is a simple verbal explanation.

I ran a copper wire up alongside the forty-meter aluminum tubing, insulated from the tubing at both extremities, and tied the bottom point to the inner conductor of the coax cable at the same place it is connected to the aluminum tubing. The coax braid is already strapped to the ground for the forty-meter vertical, of course. The horizontal part can be tied off, with an insulator at the end of the wire, to anything that is available—a house, shed, barn, or favorite tree. Actually, it really does not have to be exactly horizontal. The outer end can be higher or lower than the end fastened to the forty-meter antenna. I tried several different angles, and, except for affecting the resonant length, it didn't seem to make any difference.

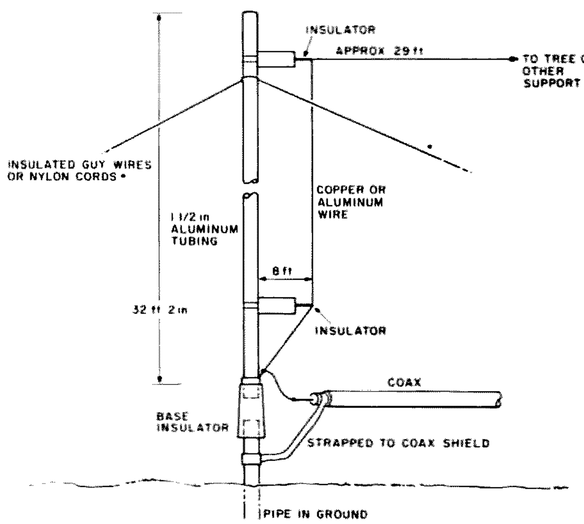

Fig. 1. A "short-yard" 75-meter antenna.

The length of the forty-meter tubing may have to be altered somewhat to bring it back into resonance where you want it, but I found very little difference after I put up the wire alongside. Of course, the horizontal portion will have to be trimmed to the portion of the seventy-five-meter band where you wish to work; you'd want to do that anyway.

I found the performance of the forty-meter vertical unaffected and that of the seventy-five-meter wire as good as any half-wave horizontal I've ever used.

This is an ideal "short-yard," combination forty- and seventy-five-meter antenna, but if you don't operate forty—or perhaps have a forty-meter beam—this same arrangement can still be used for seventy-five meters with slight modification. In that case, the horizontal wire is electrically fastened to the tubing at the top, eliminating the insulators and the wire running down to the bottom of the tubing. The coax remains connected in the same manner as with the two-antenna combination.

Another method might be to use your beam tower to support the seventy-five-meter wire. In this case, the inner conductor of the coax would be connected to the wire only and not to the tower—the vertical portion of the wire would have to be insulated from the tower as it was in the first instance. You would want to fasten the horizontal portion of the wire at about the thirty-foot level of the tower, give or take a few feet, remembering that the higher on the tower you go, the shorter the horizontal portion will have to be (the idea being that from the coax connection to the far end of the wire, the electrical length should be a quarter wave of the operating frequency). Like most antennas, it should be trimmed to the frequency you mean to operate on.■

73 Magazine *Staff*

Antenna Fans: Try the Skeleton Slot

—an improved driven element for VHF/UHF

One of the problems with simple yagi antennas is obtaining wide bandwidth while keeping the swr low over an entire band. Usually, one has to compromise and dimension the antenna for a particular portion of a band.

The main reason that the swr changes across a band is that the lengths and spacings of the elements used in the antenna do not change as the transmitted frequency is changed. These physical arrangements, along with the wavelength change due to frequency alteration, cause changes in the mutual coupling to the driven element, and the feedpoint impedance of the driven element also is changing, and this contributes also to changes in the feedpoint impedance.

One classic approach to solving this problem has been to make the driven element a folded dipole. The inherently wider bandwidth characteristic of the folded dipole element, as compared to a simple dipole, prevents the driven element impedance changing as much as the electrical length of that element changes. However, G2HCG has gone a step further and developed a driven element configuration which not only has broad bandwidth by itself, but when used in a yagi is far less affected by the influence of frequency-dependent electrical length changes of other elements in the yagi. To top it off, the overall gain of the yagi may also be slightly increased by his form of driven element. Although his form of driven element is popular in G-land, it has not yet been used much here. Those amateurs who have simple, multi-element yagis and desire to increase the bandwidth characteristics will find this new form of driven element very applicable.

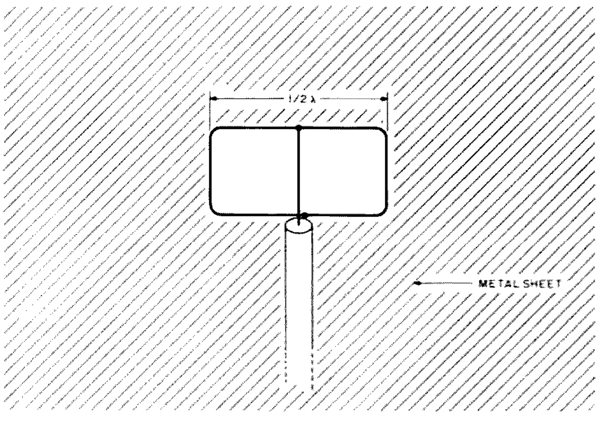

Fig. 1. The true slot antenna doesn't look like an antenna at all. It is a dimensioned slot cut in a large piece of sheet metal.

The skeleton slot-driven element, as it is called, derived from experiments concerning a true slot antenna. A true slot antenna, as shown in Fig. 1, is not what most of us would visualize as being a "real" antenna. It is, as the name indicates, a slot cut out of a sheet of metal. The slot thus formed radiates much like a conventional dipole. If one makes the slot wider, it is similar to making the length-to-diameter ratio of a conventional dipole smaller. In other words, the dipole length remains the same, but the diameter of the elements increases. This will increase the bandwidth. In the case of properly-dimensioned slot antennas, very large bandwidths can be achieved in the UHF range.

The skeleton slot resulted from experiments to determine how small the sheet of metal could be made and still retain the characteristics of a slot antenna. The final result was to demonstrate that a "skeleton" made of tubing, and dimensioned as shown in Fig. 2 (a), acted much like a slot antenna. The antenna of Fig. 2 (a) can be visualized as shown in Fig. 2 (b), i.e., as two ½-λ antennas spaced 5/8 λ where the ends of each ½-λ section are bent.

The final practical form of the antenna is shown in Fig. 2 (c) along with practical dimensioning information for the VHF bands. If the antenna, used as a driven element in a yagi, is constructed of the tubing sizes normally found in VHF beams, the feedpoint impedance is approximately 300 Ohms. So, one can use twinlead as a feedline for low-power installations or use a conventional 4:1 balun at the antenna for a 75-Ohm coaxial cable transmission line.

Further practical experiments with the skeleton slot as a driven

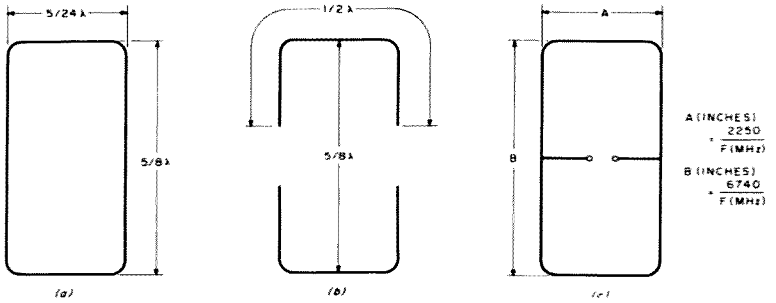

Fig. 2. (a) The original skeleton slot. (b) Showing how it might be visualized as stacked dipoles. (c) Showing practical dimensions.

element showed that it worked best if bent slightly forward, as shown in Fig. 3 (a), at an angle of about 11 degrees from the vertical. Also, when using the skeleton slot as a driven element, the parasitic reflector elements in a yagi should be changed so there are two: each one at the approximate height of each horizontal member of the skeleton slot, as shown in Fig. 3 (b). The reflector and director elements can retain their normal dimensioning. There is some slight increase in forward gain using the skeleton slot as the driven element. This is probably due to the fact that the skeleton slot itself acts as two stacked dipole radiators, and also from the effect of the added reflector elements. The gain increase can be about 2 dB.

It is difficult to say how much the bandwidth of a given VHF antenna will be increased by the use of the skeleton slot as the driven element. Increases in bandwidth of up to twice that using normal dipole elements are possible. Of course, this would be an increase in bandwidth in regard to keeping the swr low. It doesn't mean that the antenna would retain its forward gain characteristics over the entire bandwidth. Nonetheless, the ability to load into this antenna and get some gain at an increased bandwidth may well make the skeleton slot modification worthwhile.

Although the skeleton slot antenna has its main application at VHF frequencies, it also might have some applicability at HF frequencies as a wire antenna. The dimensions might suit some situation where only a small distance is available for the horizontal portion of the antenna on a given band, but height is available. One idea that suggests itself is to try the antenna on a tower using arms extending from the tower to form the horizontal portions of the antenna. Even on 7 MHz, only two approximately 13-foot-long arms would be required. Constructed of wire and used on the HF bands, the feedpoint impedance of the antenna might rise severalfold. This is because the dimensions of the antenna become so much larger than the diameter of the wire that would be used to construct it. Nonetheless, the idea is an interesting one, and such an antenna fed with a resonant transmission line might perform very well. ■

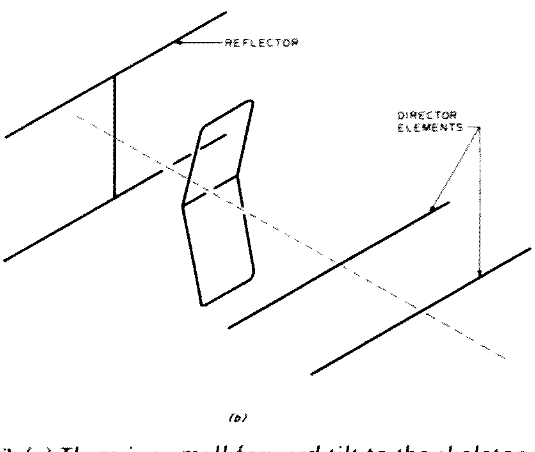

Fig. 3. (a) There is a small forward tilt to the skeleton slot. (b) This is how the skeleton slot would be used in a yagi, with a modified reflector.

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The Capacitive Coaxial Ground Wire

—could this be the end of TVI?

Have you been awarded the WAS or the WAC awards? Now, don't confuse these awards with the Worked All States or Worked All Continents awards. I'm referring to the Worked All Stereos and Worked All Consoles awards. Well, the two awards I am referring to are not the most popular awards being issued these days, especially with your neighbors. I was the unhappy recipient of both of them not too long ago.

An amateur friend of mine found the problem, made a simple modification, and I am happy to say that these two awards will adorn my shack no longer. Want to know what the modification was? Well, I'm about to tell you, and as I do, I'm going to tell you a little bit about my problems.

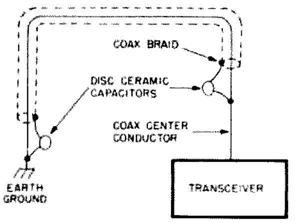

Fig. 1.

I recently had the fantastic experience of setting up my very own shack. Being an American GI stationed in Germany, it took me about two months to get my German call after passing the US General Class test a year ago April. During this two month period, I ordered and received all my equipment and was ready to set up my shack. With the help of some friends, I put up my beam, ran the coax, and was ready to plug in the transceiver.

When we got ready to hook up the ground wire for the transceiver, we discovered that this would necessitate running about 30 feet of wire out the window and down the side of the building to the ground rod. You see, I live on the second floor of a four story apartment building. No problem, though; we had plenty of good copper wire. With the ground wire hooked up, we were all ready to put the station in operation. I plugged in the rig, tuned it up, and started making contacts.

Boy, this amateur radio has got to be the greatest hobby in the world! As fate would have it, however, there came a menacing knock on the door. It was a couple of very irate neighbors who in no uncertain terms informed me that I was completely wiping out their TVs and stereos, including a gunshot scene from "Starsky and Hutch" and the cannon shots at the beginning of the *1812 Overture*.

I was completely shocked and, to say the least, a little discouraged. I pacified the neighbors and went to work immediately to find out the source of the interference. I was using a match box and a low-pass filter, and all the equipment was connected and operating correctly, so what could be causing the problem? I had used up all my electronics expertise just passing the test and setting up my shack, so I shut the rig off and decided I had better get some additional help.

I called my good friend Bill Pardue AA4AG/DA1KV, who holds an Extra Class license, and explained my problem. If anyone could find the source of the interference, he could. He came right over and checked out the entire station. Everything looked good until he came to my ground wire. At about 30 feet, the ground wire was resonant at 10, 15, 20, and 40 meters. He suggested we check it with a field-strength meter. As Bill operated the rig, I went outside with my field-strength meter. I set the sensitivity about half-way as I rounded the corner of the building. I got to about four feet from the ground wire and the needle of the meter was already pegged out. I yelled the results to Bill, who was listening through the window.

"Disconnect the ground wire," he shouted back.

I knew we couldn't run the rig without a ground wire, and I didn't have the slightest idea what Bill had in mind, but I disconnected the ground wire and Bill threw the other end out the window. About five minutes later, I saw some coax coming out of the window. Bill

yelled to hook the center conductor of the coax to the ground rod. As the end of the coax came within reach, I noticed a capacitor had been soldered between the center conductor and the braid. I hooked the center conductor to the ground rod and stood back while Bill started transmitting again. With the sensitivity set where I had had it before, I checked the field strength again. Nothing. I moved closer and closer and still no reading. Finally, with the sensitivity set at full and the antenna of the field-strength meter touching the ground wire, I was able to get the needle to move a little.

Back in the shack, Bill explained the operating principles. The center conductor acts as the ground, but in case some rf is radiated, it is absorbed by the braid and bled back to the center conductor (ground) through the capacitors. Because the path of the least resistance is through the center conductor, no rf will be induced through the capacitor to the braid. Only the rf that is radiated from the center conductor will reach the braid, and thus the braid acts as an extremely effective shield.

The type of coax used is not important, but the capacitors must be 1000-pF disc ceramic rated at 1.4 kV. The illustration will show you exactly how to install the capacitors.

If this story sounds familiar and you have been awarded the WAS and WAC by your neighbors, your ground wire might very well be the culprit. This ground wire worked for me, and it might work for you. ■

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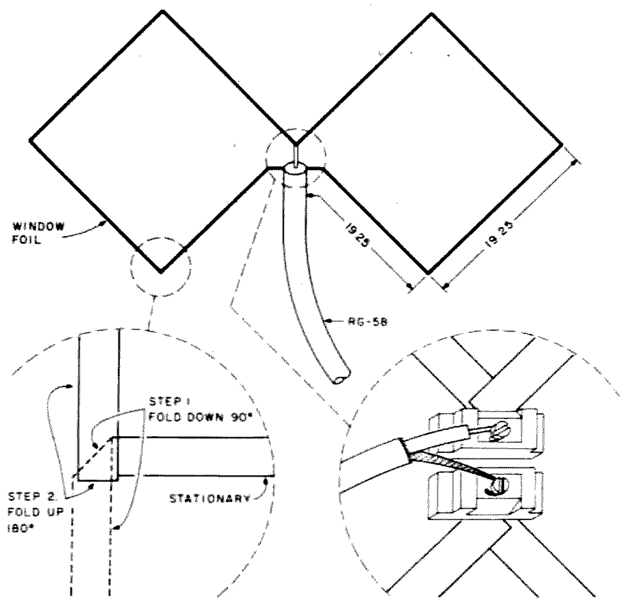
Stick 'Em Up

—install this 2m Bi-Loop anywhere

I needed a simple antenna for 2 FM, one that wouldn't take up to much space or be obvious to the landlord. Remembering the fact that basic antenna designs are fairly independent of frequency, I thought that a traditional HF antenna, scaled down, might just fit my requirements.

The end result is the antenna illustrated here. In essence, it consists of two full-wave loops fed in parallel—an adaptation of W7CJB's Bi-Loop.[1] The radiating elements are made from adhesive-backed burglar alarm window foil. This stuff is easy to get at Radio Shack and is inexpensive. Also, it doesn't pull off big chunks of paint when you want to remove it.



Feedline connection is made with burglar-alarm window foil connectors, of course (see detail). Continuity is ensured by overlapping the foil about one-half inch and puncturing with a needle. You should jab it about a half-dozen times at each splice. Wall (or window) area needed is about 2¼' x 4½', and the antenna can be covered with a large picture or map for camouflage.

With the antenna stuck on an inside wall on the second story of a frame dwelling (aluminum-backed insulation and all), the feedline vswr is 2:1, and I have solid simplex QSOs with my brother eleven miles away (I'm running 1½-Watts output). The antenna in free space, theoretically, has 8 dB of gain when compared to a half-wave dipole and 6.8 dB over my old 5/8-wave-length ground plane.[1,2] The loops seem quite broadband, possibly because of the length/width ratio of the elements. Polarization is vertical with the configuration shown. Comparative signal reports from KA2AFS (my brother Hank's station) indicate superiority to the ground plane.

One final note: Window foil of this type is made primarily from lead. This material seems to have no derogatory effect, in spite of its low conductivity as compared to copper. ■

References

1. Davey, "Try a Bi-Loop Antenna," *73*, April, 1979.
2. Miller, "How to Determine Antenna Gain," *Popular Electronics*, July, 1979.

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Old Fishermen Never Die

—they just learn to raise dipoles

You really don't have to be a lineman for the county to get that dipole strung. Sometimes it helps to be a fisherman, or a man with fishermen for friends.

After years of throwing—and hanging—soft-drink bottles in pine trees, a few of us tried bows and arrows. But a Coke bottle hanging from a limb is better than a pierced heart, especially if it belongs to a neighbor.

The answer is fairly simple, with compensation allowed for Murphy: Throw a small weight over that tall tree with a spinning rod. (That's a fishing stick, for the uninitiated.)

What's that you say, Bippy? Never used one? Take heart; the same five-year-olds who proved code is easy to master regularly throw with a spinning outfit.

With a spinning reel, you don't have to have perfect aim. Using a spinner is simply a matter of coordinating your thumb (which releases the brake) and wrist (which is the lever for tossing the weight).

Here in the south, pine trees are the main "towers" for stringing dipoles. But, obviously, any tall tree will work. Using a spinner and a proper weight, we have had dipoles off the ground in under 15 minutes from scratch.

What weight to use is really a matter of choice, although the beginner will usually put on too much weight. For example, my Zebco One spinning reel with a six-foot rod responds well to a weight from three to six ounces.

Sources of weights are plentiful around most shacks. If all else fails, try three ten-penny nails wrapped in electrician's tape. A better weight might be fishing sinkers with "eyes" or a fishing plug with the barbs removed. Some sporting-goods stores sell practice lures which are barbless and great for throwing.

Now that you have the weight and spinner, it is time to consider the line to use. Usually I carry from 10- to 25-pound test line in my spinner, for bass, and that works well.

Spot your two trees (or one in the case of a sloper), attach the weight, and throw over the crown of the tree from the inside, i.e., between the two trees to be used. With some practice, you can put a weight over the crown with the line lying softly on the branches on the inside but with the line running straight down the trunk on the outside. So much for the aesthetics.

Once the weight is over the tree and within reach, most of the battle is won. Simply remove the weight, attach stronger line, and pull it over by reeling in your line. Chalk line used by plumbers and brickmasons is good, although it ages and weathers rather rapidly. I often use monofilament nylon line, which is very small, yet handles from 200 to 300 pounds of dead weight pull.

If you wish to use larger line to support the antenna, simply snake the smaller line over first and tie the larger line on the end. You can progress through several changes of line size this way in minutes—much like sailors do on large ships when docking.

Yes, there are some drawbacks.

Unless you are an accomplished fisherman, stay away from open-face reels. Use a spinner and lessen the chance of a snarled line.

If the weight goes over the tree but refuses to descend all the way down the other side due to the weight of the paid-out fishing line, resist the temptation to snatch it back. Pay out more line and lay the spinner on the ground. Then go inside and work the bands for an hour. When you return, Mother Nature's gentle wind, with some help from gravity, will have your weight safely on the ground.

There are many advantages to the spinning method. There are no arrows to lose, no heavy weights which reach only halfway to the top, and one big added bonus. Consider what brings down most dipoles in moderate to heavy winds. They are tied to large limbs or trunks, and when the trees sway in different directions, no dipole-support line can withstand such pressure.

Using a spinner and going over the crown of the tree gives you the advantage of this situation. Limbs at or near the crown are small, soft, and pliable. With each end of the dipole supported over the crown of a tree, the crowns will actually bend *toward* the antenna during opposing winds.

It beats trying to climb a tree, for those of us beyond age 20 or 30.■

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Warminster PA 18974

Breakthrough! A Computerized Antenna Rotator!

—KIM-1 can do!

One evening, Rich WB3CTZ and I were discussing various improvements we had made to our ham shacks which had resulted in greater operating convenience. One thing that we felt still could be improved was the operation of Rich's Ham II rotator. There was no simple way to get around the normal system of looking up the bearing, holding the brake release down while operating the motor control, and watching the bearing indicator. Finally, a decision must be made to release the motor control at the correct time. When this scenario is repeated many times during a contest, it consumes a considerable amount of valuable time. A thirty-hour contest might require as much as one hour of time devoted to operating the antenna (an average of 45 seconds per operation and four operations per hour).

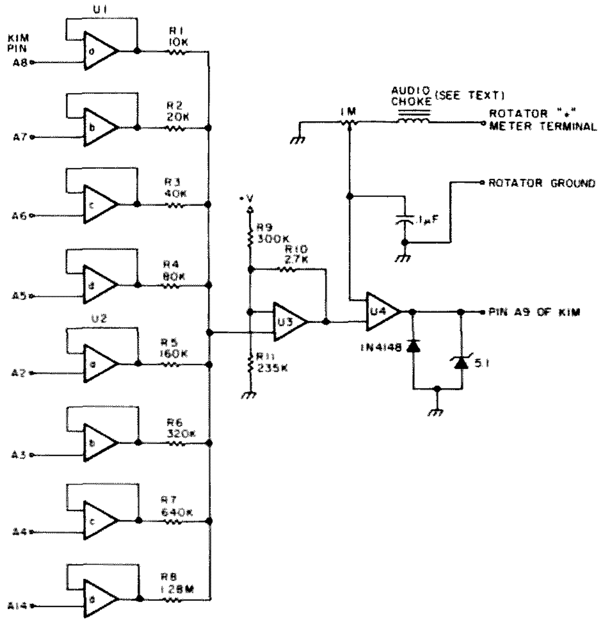


Fig. 1. A/D converter. U1, U2—quad op amp (RS 276-1711); U3, U4—741 op amp.

About this same time, we were trying to come up with a good application for our newly-purchased KIM-1 microprocessor. We had told our wives how great micros were but had not been able to show them much more than the old standby, Lunar Lander. We decided to work out a method of using the KIM to control and operate the Ham II rotator, thereby eliminating two problems at one time, to everyone's delight. The result was so overwhelmingly successful we thought that other hams might benefit from it.

The system we came up with consists of an A/D converter (so that the KIM will be able to read the bearing of the antenna), a relay-operated interface to operate the controls of the rotator, and the software. Operation of the system is very simple. After the program is read into the KIM, a simple calibration is conducted. From then on, the KIM does the work. You punch in the bearing and push the ST (start) key. The KIM will turn on the power to the rotator, operate the brake release, turn on the motor to turn the antenna to the desired heading, turn off the motor at the correct time, wait until the antenna has coasted to a stop, set the brake, and turn off power to the rotator control. At all times the selected bearing is displayed digitally on the KIM display.

There are many error checks and fail-safe devices built into the program to prevent the operator from doing something wrong. All switches in the rotator control unit have been paralleled so that manual operation can be used at any time. The system has been found to be reliable and very accurate. Our initial design goal was an accuracy of two degrees, but as far as we can determine, the antenna stops at the exact bearing punched into the KIM (as indicated by the meter on the Ham II).

The I/O Device

The I/O device is two separate circuits. One is nothing more than a home-brew A/D converter and the other is a number of relays and relay drivers to operate the various controls of the rotator.

The A/D converter in Fig. 1 probably could be replaced with a commercial unit. I took the home-brew route to maintain my image of doing things the hard way. Besides, I thought it would be instructive and rewarding.

Operation of the A/D converter is not difficult. U1, U2, and U3 generate a voltage determined by the digital word at the output of the KIM. The higher the digital word, the higher the voltage generated. U4 compares this voltage to the voltage to be measured from the rotator. When the two voltages are equal, the comparator sends a signal to the KIM (U4 output changes state). The voltage from the rotator is directly proportional to the bearing of the antenna. For the KIM to determine where the antenna is pointing, all it has to do is keep changing the digital word at the input of U1 and U2 until it gets the highsign from the comparator. In our system, what actually happens is that the KIM calculates what the digital word would be for a desired heading and then turns the antenna until the rotator voltage is equal to the voltage generated by the digital word.

U1 and U2 are quad op amps set up as voltage followers. The outputs will follow the digital word at the inputs (0 or 5 volts) and act as a current source. R1 through R8 make up a voltage divider whose output will be somewhere between 0 volts and 5 volts. Since there are eight inputs to the voltage divider, there are 256 different voltages possible which may be generated. Our unit generates voltages with a resolution of 18.35 millivolts between 0 volts and 4.7 volts.

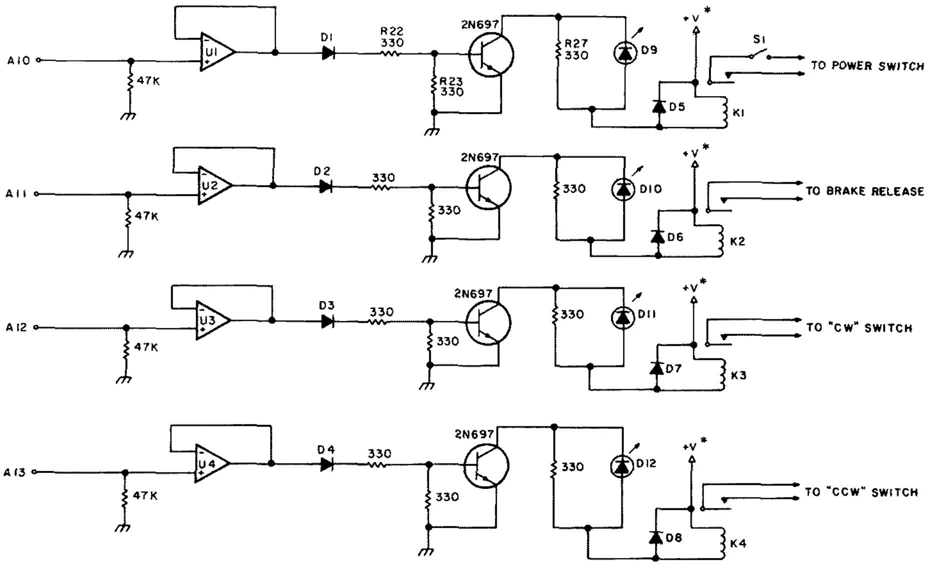


*Fig. 2. Relays and relay driver. U1-U4—741 op amps or equivalent; D1-D8—1N4148; K1-K4—12-V dc relays (see text). *Install on/off switch on V+ line to disable relays.*

U3 is a summing amplifier for the voltage and also is used to "zero" the system. We found that our KIM produced about 40 millivolts when its outputs were low. This was equivalent to about 3 degrees of antenna rotation. We found that we could compensate for this slight offset using U3 and resistors R9, R10, and R11. The values of these resistors were found experimentally by using potentiometers and adjusting them until the output of U3 was exactly 0 volts when all inputs to U1 and U2 were held low by the KIM. The values shown should work very well with most machines.

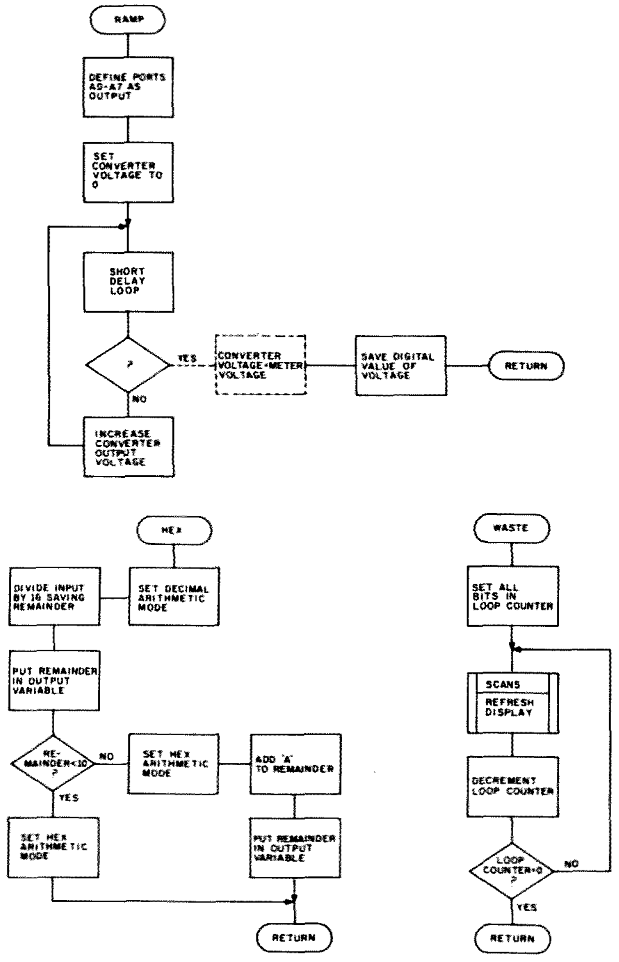
The output of the summing amp is fed to the noninverting input of the comparator, U4. The voltage from the rotator, which is directly proportional to the antenna bearing, is fed to the inverting input of the comparator. Whenever the voltage from the rotator is higher than the voltage generated by the KIM, the output from the comparator will be low. The diode on the output of the comparator prevents the output from going to V−, which it will try to do when it is in the low output state. Similarly, the zener prevents the output from going over 5 volts in the high state. This protection is important since the output of the comparator is connected to the KIM to tell it when the antenna voltage is equal to the voltage generated by the A/D converter.

I recommend checking out the operation of the comparator carefully before hooking it to the KIM to be sure that the voltage does not go above 5 volts or to some negative value. This is the only place in the system where a voltage is fed into the KIM. All other connections are outputs from the KIM.

All connections to the KIM are as shown in Figs. 1 and 2, with the exception of the power supply. The connection to the antenna rotator control is made through the 1-megohm pot wired as a voltage divider and a filter choke to filter 60-cycle hum. We found that the voltage across the meter in the Ham II was about 22 volts at full scale, decreasing to 0 volts in a linear fashion. By wiring the 1-megohm pot as shown in Fig. 1, we could set the full-scale voltage to the desired value of 4.7 volts which would take full advantage of our A/D converter.

We also found several volts of ripple which was averaged out by the meter. To eliminate this ripple, we used the choke-capacitor filter shown in Fig. 1. The choke came from a "boat anchor" in the basement and probably any audio-type choke will be sufficient. A slight amount of hum at the input to the comparator will cause the KIM to turn off the rotator motor early regardless of the direction in which the antenna is turning. Each 13 millivolts of ripple is equivalent to one degree of rotation. In our unit, the ripple is small enough that the antenna comes to rest at just the right place. Murphy must have been out to lunch the day we chose our choke!

The four relay driver circuits shown in Fig. 2 are identical. One is for the on/off switch, one for the brake switch, and one each for the two motor switches.



Subroutine flowcharts.

As the relay drivers operate similarly, I will describe only the one used for the power switch. The output from the KIM is hooked to the non-inverting input of buffer amplifier U1, a 741 op amp, wired as a voltage follower. The 47k-Ohm resistor from the input of the buffer to ground will keep stray signals and noise from activating the relays. Without these resistors, we found that a 2-microamp signal would operate the circuit and trigger the relays. The output of the buffer amp is fed through diode D1 to the transistor, which operates as a switch. D1 will not conduct until it is forward biased to .7 volts. This is necessary to prevent relay activation from the 40-millivolt potential at the output of the KIM when it is in the low state.

Resistors R22 and R23 limit the current drawn from the buffer amp and bias the transistor to operate as a switch. I used 330-Ohm resistors since I had quite a few on hand, although other values would work just as well. The transistors are junk-box specials. Any NPN transistor with a gain of 30 or more which can handle the current for your relays will work very well. The relays must be able to handle the current drawn by the rotator motor and brake. The Ham II required 5-Amp relays. We got a very good deal on relays from Poly Paks. They are 5-Amp relays and require 10 volts at 100 milliamps to operate.

Delay	Location
Power on to brake release	02C6
Brake release to rotation	02D6
Stop rotation to apply brake	0322
Apply brake to power off	0332

Table 1. Rotator timing delays.

Diode D5 protects the transistor from any spikes developed in the relay coil when the transistor is turned off. It effectively shunts any voltage greater than Vcc to the V+ line. I guarantee that you will zap any transistor that is not protected by such a diode.

LED D9 and resistor R27 may be omitted and the relay hooked directly to the collector of the transistor. We had it set up without these two parts at first, but found it very unnerving to hear the relays clicking and not know which ones or exactly what was happening. The LED will turn on when the relay is energized, indicating which relay is operating. This is particularly helpful in system checkout and troubleshooting.

The final item I want to mention is the switch, S1. It is used to disable the on/off relay during calibration, initialization, and troubleshooting. Remember that this switch and relay are switching 120 V ac, so *extreme caution should be exercised*. The entire on/off power switch relay can be eliminated from the system if you so wish, but you will have to leave the power turned on to the rotator control all the time. Another switch should be provided in the V+ which goes to the relay transistors so that all relays can be disabled for calibration. This switch should be left open until calibration is complete.

The Software

With the hardware under way, we began work on the computer program. The first step was to determine how to tell the computer how far the antenna could be turned in either direction. To do this, we came up with the following method. We first turned the antenna as far as possible in a counterclockwise direction, entered the number 1000 into the computer, and pressed the ST key. (The 1000 should appear on the address LEDs of the KIM.) The computer interpreted this action and read the bearing on the rotator. This number became the extreme for counterclockwise rotation.

The extreme for clockwise rotation was indicated to the computer by swinging the beam as far as possible in the clockwise direction, entering the number 2000, and pressing the ST key. (These two actions can be done in either order.) Once the extremes of rotation are determined, the operator enters the number 3000 and presses the ST key, thus telling the computer to set all its internal math calculations based on the two extremes of rotation. If you get clockwise and counterclockwise mixed up, the computer will tell you by displaying Es when the 3000 command is entered. We call these steps calibration, and they must be done before the computer can recognize properly any commands to turn to a certain bearing.

After the calibration stage, the operator may enter any bearing, followed by ST, and the computer will do its job. It will—

1) Turn on ac power to the rotator

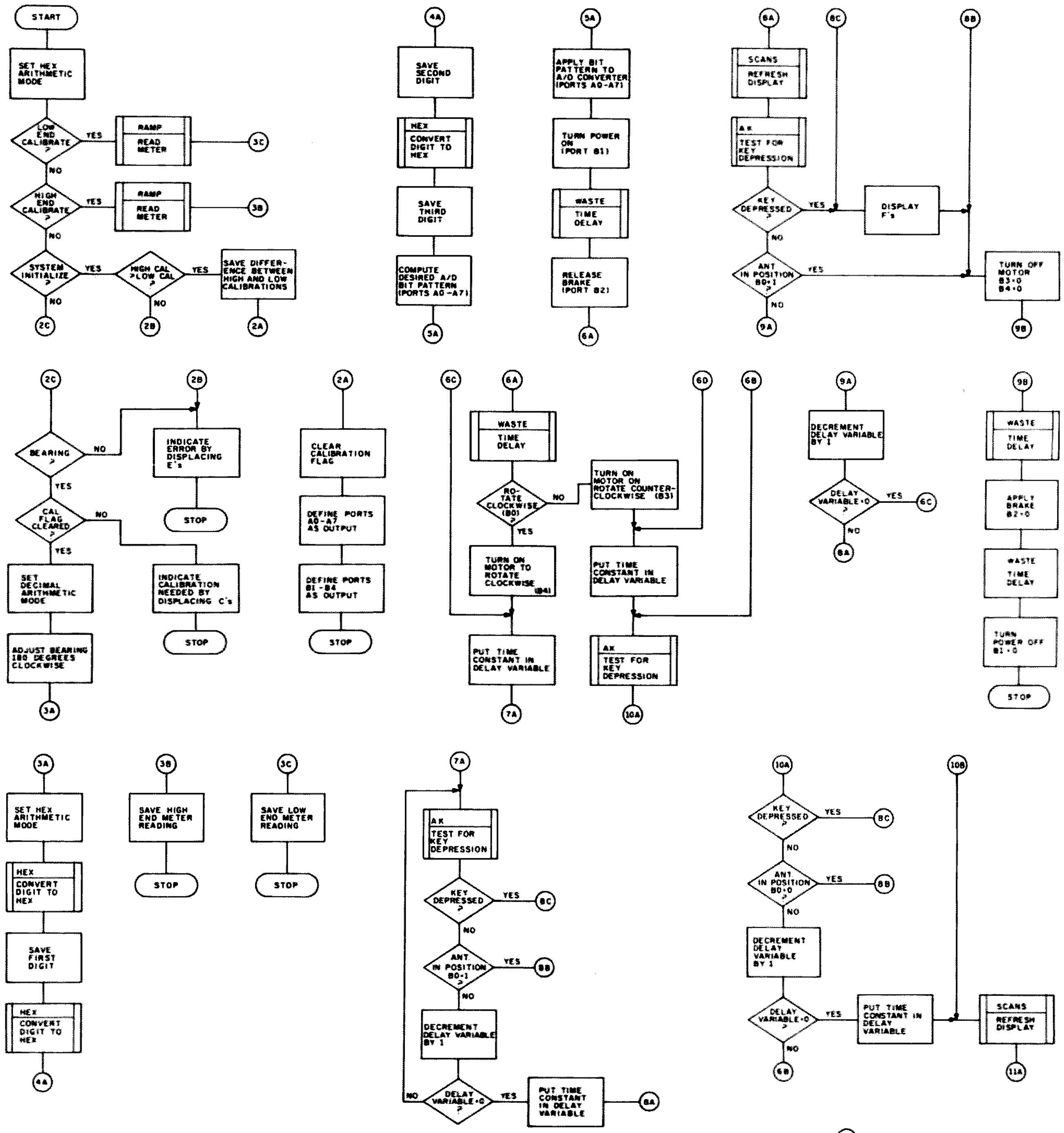
2) Release the brake

3) Turn the antenna to the desired bearing

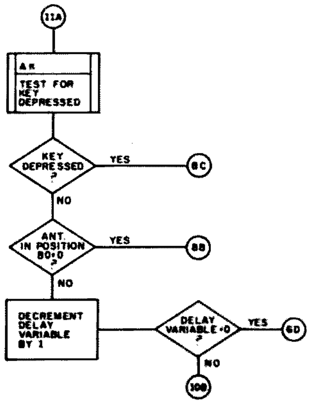
4) Reapply the brake

5) Turn off ac power to the control box

During the time that the antenna is in motion, the



Flowchart.



bearing which was entered by the operator will flash. When the flashing stops, the antenna is in position. A side benefit of this system is that a digital readout of the current antenna position will be shown whenever the antenna is not in motion.

Although the computer is always right, there are some errors which we humans may make. One is attempting to enter a bearing before performing the calibration steps. If we do this, the computer displays Cs, telling us that it will not respond because no calibration has been done. Another is entering a bearing which is not really the one we want and noticing it after the computer begins moving the antenna. We can either wait for the antenna to reach the wrong position and then enter the one we really wanted, or we can touch any key on the keyboard. When any key is touched during rotation, the computer assumes that we entered the wrong bearing and stops the antenna where it is so that we can

Program listing.

```
0020 A9      RAMP     LDA FF
0021 FF
0022 8D               STA 1701      define A0 thru A7 as output
0023 01
0024 17
0025 A9               LDA 00
0026 00
0027 8D               STA 1700      clear output
0028 00
0029 17
002A A0      LTRYAGN  LDY 10
002B 10
002C 88      LOOP10   DEY
002D D0               BNE LOOP10
002E FB
002F A9               LDA 01        test bit
0030 01
0031 2C               BIT 1702
0032 02
0033 17
0034 D0               BNE LGOTIT
0035 06
0036 EE               INC 1700
0037 00
0038 17
0039 4C               JMP LTRYAGN
003A 2A
003B 00
003C AD      LGOTIT   LDA 1700
003D 00
003E 17
003F 85               STA VRAMP
0040 09
0041 60               RTS
0050 A5               LDA VBSVH
0051 08
0052 E9               SBC 00
0053 00
0054 85               STA VBSVH
0055 08
0056 4C               JMP 3A1
0057 A1
0058 03
0059 85               STA VWORK1
005A 0C
005B A5               LDA VWORK2
005C 0D
005D E9               SBC 00
005E 00
005F 85               STA VWORK2
0060 0D
0061 4C               JMP 233
0062 33
0063 02
0064 A2               LDX FF
0065 FF
0066 CA      AGN      DEX
0067 D0               BNE AGN
0068 FD
0069 A9               LDA 01
006A 01
006B 2D               AND 1702
006C 02
006D 17
006E 4C               JMP 2FB
006F FB
0070 02
0071 A2               LDX FF
0072 FF
0073 CA               DEX
0074 D0               BNE AGN1
0075 FD
0076 A9               LDA 01
0077 01
0078 D2               AND 1702
0079 02
007A 17
007B 4C               JMP 363
007C 63
007D 03
0200 D8               CLD           set hex mode
0201 A5               LDA POINTH    high order characters
0202 FB
0203 C9               CMP 10        test for low end calibration
0204 10
0205 F0               BEQ LCALLOW   branch if so
0206 17
0207 CA               CMP 20        test for high end calibration
0208 20
0209 F0               BEQ LCALHI    branch if so
020A 1D
020B C9               CMP 30        test for set calibration
020C 30
020D F0               BEQ LSETCAL   branch if so
020E 23
020F C9               CMP 04        test for bearing
0210 04
0211 90               BCC LBEAR     branch if so
0212 39
0213 A9      LERROR   LDA EE        error code
0214 EE
0215 85      DISP     STA POINT
0216 F9
0217 85               STA POINTL
0218 FA
0219 85               STA POINTH
021A FB
021B 4C               JMP START     display error
021C 4F
021D 1C
021E 20      LCALLOW  JSR RAMP      get I/O value
021F 20
0220 00
0221 A5               LDA VRAMP     low end I/O value
```

enter the correct one. To show that it has stopped without reaching its goal, it displays Fs (failure to reach goal). Another possible error of major concern is that of entering a bearing which is greater than 360 degrees. If this happens, the computer displays Es and waits for a proper entry. The Es also will be displayed if we try to enter a command which it does not recognize (e.g., 5000 instead of 3000).

After the program is read into the computer, the following steps must be taken before the ST key will function. Place the values 00 and 02 in core locations 17FA and 17FB respectively. *This should be done immediately after the program is loaded into the computer.*

Most of the program is straightforward. However, some complexity was involved in determining when the antenna had reached the desired bearing. The approach taken to this problem was to have the microprocessor calculate and generate through the A/D converter a voltage corresponding to the desired bearing. The antenna is then rotated until the voltage from the rotator equals

```
0222 09
0223 85              STA VLOWEND     save it
0224 00
0225 4C              JMP START       exit
0226 4F
0227 1C
0228 20    LCALHI    JSR RAMP        get I/O value for high end
0229 20
022A 00
022B A5              LDA VRAMP
022C 09
022D 85              STA VHIEND      save it
022E 01
022F 4C              JMP START       exit
0230 4F
0231 1C
0232 A5    LSETCAL   LDA VHIEND      high calibration value
0233 01
0234 38              SEC             set for subtract
0235 E5              SBC VLOWEND     subtract low calibration value
0236 00
0237 90              BCC LERROR      error if values reversed
0238 DA
0239 85              STA VCALCONST   save difference
023A 02
023B A9              LDA 00          clear A
023C 00
023D 85              STA VCALFLAG    indicate calibration completed
023E 03
023F A9              LDA FF
0240 FF
0241 8D              STA 1701        set A0 thru A7 as output
0242 01
0243 17
0244 A9              LDA 1E
0245 1E
0246 8D              STA 1703        set B1 thru B4 as output
0247 03
0248 17
0249 4C              JMP START       exit
024A 4F
024B 1C
024C A5    LBEAR     LDA POINTL      low order bearing
024D FA
024E 38              SEC             prepare for subtract
024F F8              SED             set decimal mode
0250 E9              SBC 61          check for illegal bearing
0251 61
0252 A5              LDA POINTH
0253 FB
0254 E9              SBC 03
0255 03
0256 B0              BCS LERROR      report if bearing bad
0257 BE
0258 A5              LDA VCALFLAG    check for calibration performed
0259 03
025A F0              BEQ LCALDNE
025B 05
025C A9    LCAL      LDA CC
025D CC
025E 4C              JMP DISP
025F 15
0260 02
0261 4C              JMP 3C3
0262 C3
0263 03
0267 85              STA VBSVL
0268 07
0269 20              JSR HEX         convert to hex
026A 93
026B 03
026C A5              LDA VREM
026D 0A
026E 85              STA VHEXBRL     first digit
026F 0B
0270 20              JSR HEX
0271 93
0272 03
0273 06              ASL VREM        position second digit
0274 0A
0275 06              ASL VREM
0276 0A
0277 06              ASL VREM
0278 0A
0279 06              ASL VREM
027A 0A
027B 18              CLC
027C A5              LDA VHEXBRL
027D 0B
027E 65              ADC VREM
027F 0A
0280 85              STA VHEXBRL     place second digit
0281 0B
0282 20              JSR HEX         third digit
0283 93
0284 03
0285 66              ROR VREM
0286 0A
0287 66              ROR VHEXBRL     this is input in hex
0288 0B                              divided by 2
0289 A5              LDA VHEXBRL     compute A/D bit pattern
028A 0B
028B 85              STA VWORK1
028C 0C
028D A9              LDA 00
028E 00
028F 85              STA VWORK2
0290 0D
0291 A6              LDX VCALCONST
0292 02
0293 F0              BEQ LCAL        calibrate if constant equals zero
0294 C7
0295 CA    LOOP3     DEX
0296 F0              BEQ LDIV        branch if multiply complete
0297 10
0298 18              CLC             set for add
```

the voltage generated by the A/D converter. At this point, the antenna is pointing in the desired direction.

The first step in this process was to find an algorithm for computing the correct voltage for a given bearing. My rotator is set so that zero degrees is exactly mid-scale, with 180 degrees found at either extreme. To develop a linear correspondence between the bearing and the rotator voltage, it was first necessary to add 180 degrees to the input bearing. This calculation causes the lowest voltage to correspond to the smallest bearing figure after the addition. Since the A/D converter works in 256 steps across its range, we theoretically could find the proper bit pattern for generation of the bearing's voltage by using this formula: 255/360 × input bearing = bit pattern.

The only problem with this approach is that the lowest voltage generated by the A/D converter might not equal the lowest voltage from the rotator. Likewise, the highest voltages might not be equal. Compensation for this factor is included in the calculation. When the value 1000 is en-

```
0299 A5                 LDA VWORK1
029A 0C
029B 65                 ADC VHEXBRL
029C 03
029D 85                 STA VWORK1
029E 0C
029F A5                 LDA VWORK2
02A0 0D
02A1 69                 ADC 00
02A2 00
02A3 85                 STA VWORK2
02A4 0D
02A5 4C                 JMP LOOP3
02A6 95
02A7 02
02A8 A2      LDIV       LDX 00        clear for divide
02A9 00
02AA 38      LOOP4      SEC
02AB A5                 LDA VWORK1
02AC 0C
02AD E9                 SBC B4
02AE B4
02AF'4C                 JMP 59
02B0 59
02B1 00
02B3 90                 BCC LBDONE
02B4 04
02B5 E8                 INX
02B6 4C                 JMP LOOP4
02B7 AA
02B8 02
02B9 8A      LBDONE     TXA
02BA 18                 CLC
02BB 65                 ADC VLOWEND
02BC 00
02BD 8D                 STA 1700      desired voltage
02BE 00
02BF 17
02C0 A9                 LDA 02        power on
02C1 02
02C2 8D                 STA 1702      turn on box
02C3 02
02C4 17
02C5 A9                 LDA 08
02C6 08
02C7 85                 STA VTIME     waste time
02C8 0E
02C9 20      LWASTE1    JSR WASTE
02CA 84
02CB 03
02CC C6                 DEC VTIMER
02CD 0E
02CE D0                 BNE LWASTE1
02CF F9
02D0 A9                 LDA 06
02D1 06
02D2 8D                 STA 1702      release brake
```

```
02D3 02
02D4 17
02D5 A9                 LDA 04
02D6 04
02D7 85                 STA VTIMER    waste time
02D8 0E
02D9 20      LWASTE2    JSR WASTE
02DA 84
02DB 03
02DC C6                 DEC VTIMER
02DD 0E
02DE D0                 BNE LWASTE2
02DF F9
02E0 A9                 LDA 01        test bit
02E1 01
02E2 2D                 AND 1702      check for left or right
02E3 02
02E4 17
02E5 F0                 BEQ LRIGHT    rotate right
02E6 68
02E7 A9                 LDA 0E        left motor
02E8 02
02E9 8D                 STA 1702      turn on motor
02EA 02
02EB 17
02EC A9      LMOTOR1    LDA FF
02ED FF
02EE 85                 STA VWASTE1
02EF 0F
02F0 20      LOOP5      JSR AK
02F1 FE
02F2 1E
02F3 AA                 TAX
02F4 D0                 BNE LFAIL
02F5 4E
02F6 4C                 JMP 64        test bit
02F7 64
02F8 00
02FB F0                 BEQ LOFF
02FC 1F
02FD C6                 DEO VWASTE1
02FE 0F
02FF D0                 BNE LOOP5
0300 EF      you have now punched in about half of the program!!!
0301 A9                 LDA 50
0302 50
0303 85                 STA VWASTE1
0304 0F
0305 20      LOOP6      JSR SCANS     refresh display
0306 1F
0307 1F
0308 20                 JSR AK
0309 FE
030A 1E
030B AA                 TAX
030C D0                 BNE LFAIL
030D 36
```

tered into the computer, it generates a series of voltages, beginning with the least possible voltage and stopping when the generated voltage is equal to the rotator voltage. Since at this time the meter should be at its lowest point, as set by the operator, we have the bit pattern representing this position. The same is true for the high end of the meter operation. When the value 2000 is entered, the same series of voltages is generated by the computer, stopping when the generated value is equal to the sample from the rotator. We then have a bit pattern representing the highest point of meter movement. By subtracting these two values, we find a value, K, which we can use in the following formula: K/360 × input bearing = X.

When the value X from this formula is added to the bit pattern representing the lowest point of meter movement, a bit pattern representing the desired bearing results. This pattern can then be applied to the A/D converter and the rotator stopped when the sample voltage from the meter becomes equal to the voltage generated by the converter. Since I/O port B0 is connected to the output of a comparator which com-

```
030E A9            LDA 01       test bit
030F 01
0310 2D            AND 1702
0311 02
0312 17
0313 F0            BEQ LOFF     shut off if voltage OK
0314 07
0315 C6            DEC VWASTE1
0316 0F
0317 D0            BNE LOOP6
0318 EC
0319 4C            JMP LMOTOR1
031A EC
031B 02
031C A9  LOFF      LDA 06
031D 06
031E 8D            STA 1702     shut off motor
031F 02
0320 17
0321 A9            LDA 10
0322 10
0323 85            STA VTIMER
0324 0E
0325 20  LWASTE3   JSR WASTE    waste time
0326 84
0327 03
0328 C6            DEC VTIMER
0329 0E
032A D0            BNE LWASTE3
032B F9
032C A9            LDA 02
032D 02
032E 8D            STA 1702     apply brake
032F 02
0330 17
0331 A9            LDA 04
0332 04
0333 85            STA VTIMER
0334 0E
0335 20  LWASTE4   JSR WASTE    waste time
0336 84
0337 03
0338 C6            DEC VTIMER
0339 0E
033A D0            BNE LWASTE4
033B F9
033C A9            LDA 00
033D 00
033E 8D            STA 1702     power down box
033F 02
0340 17
0341 4C            JMP START    exit
0342 4F
0343 1C
0344 A9  LFAIL     LDA FF       fail code
0345 FF
0346 85            STA F9
```

```
0347 F9
0348 85            STA FA
0349 FA
034A 85            STA FB
034B FB
034C 4C            JMP DISP     display fail code
034D 1C
034E 03
034F A9  LRIGHT    LDA 16       right motor
0350 16
0351 8D            STA 1702
0352 02
0353 17
0354 A9  LMOTOR2   LDA FF
0355 FF
0356 85            STA VWASTE1
0357 0F
0358 20  LOOP7     JSR AK
0359 FE
035A 1E
035B AA            TAX
035C D0            BNE LFAIL
035D E6
035E 4C            JMP 71       test bit
035F 71
0360 00
0363 D0            BNE LOFF
0364 B7
0365 C6            DEC VWASTE1
0366 0F
0367 D0            BNE LOOP7
0368 EF
0369 A9            LDA 50
036A 50
036B 85            STA VWASTE1
036C 0F
036D 20  LOOP8     JSR SCANS    refresh display
036E 1F
036F 1F
0370 20            JSR AK
0371 FE
0372 1E
0373 AA            TAX
0374 D0            BNE LFAIL
0375 CE
0376 A9            LDA 01       test bit
0377 01
0378 2D            AND 1702
0379 02
037A 17
037B D0            BNE LOFF     shut off if voltage OK
037C 9F
037D C6            DEC VWASTE1
037E 0F
037F D0            BNE LOOP8
0380 EC
0381 4C            JMP LMOTOR2
```

pares the sample voltage from the rotator with the voltage generated by the A/D converter, examination of the port determines the direction of rotation. In this case, a value of 0 indicates that counterclockwise rotation is needed until that port becomes a 1. If 1 is the original value, then clockwise rotation is needed until that port changes to a value of 0.

Another problem to be considered is that the KIM is much faster at issuing requests to the electronic devices than those devices are at accepting the commands. For example, the computer could issue I/O to release the brake and then issue I/O to turn on the motor long before the mechanical action of removing the brake was completed. To adjust for this type of situation, we placed various delay loops in the program. Some of these may be of interest because the length of each delay was arbitrarily selected. Table 1 lists the addresses which can be modified to change the various time delays which apply to the rotator controls. Placing a higher value in any of these locations will increase the time delay, while a smaller value will decrease the delay.

```
0382 54
0383 03
0384 A9     WASTE    LDA FF        waste time
0385 FF
0386 85              STA VWASTE 3
0387 11
0388 85     LOOP10   STA VWASTE2
0389 10
038A 20     LOOP9    JSR SCANS
038B 1F
038C 1F
038D C6              DEC VWASTE3
038E 11
038F D0              BNE LOOP9
0390 F9
0391 60              RTS
0393 F8     HEX      SED           compute one hex digit
0394 A2              LDX 00
0395 00
0396 38     LSUB     SEC
0397 A5              LDA VBSVL
0398 07
0399 E9              SBC 16
039A 16
039B 85              STA VBSVL
039C 07
039D 4C              JMP 50
039E 50
039F 00
03A1 90              BCC LADD
03A2 08
03A3 8A              TXA
03A4 18              CLC
03A5 69              ADC 01
03A6 01
03A7 AA              TAX
03A8 4C              JMP LSUB
03A9 96
03AA 03
03AB 4C     LADD     JMP 3EE
03AC EE
03AD 03
03AE 86              STX VBSVL
03AF 07
03B0 85              STA VREM
03B1 0A
03B2 38              SEC
03B3 E9              SBC 10
03B4 10
03B5 30              BMI LRET
03B6 06
03B7 D8              CLD
03B8 18              CLC
03B9 69              ADC 0A
03BA 0A
03BB 85              STA VREM
03BC 0A
```

```
03BD D8     LRET     CLD
03BE A9              LDA 00
03BF 00
03C0 85              STA VBSVH
03C1 08
03C2 60              RTS
03C3 A5              LDA POINTL
03C4 FA
03C5 18              CLC
03C6 F8              SED
03C7 69              ADC 80
03C8 80
03C9 85              STA VPTL
03CA 12
03CB A5              LDA POINTH
03CC FB
03CD 69              ADC 01
03CE 01
03CF 85              STA VPTH
03D0 13
03D1 38              SEC
03D2 A5              LDA VPTL
03D3 12
03D4 E9              SBC 60
03D5 60
03D6 85              STA VWORK1
03D7 0C
03D8 A5              LDA VPTH
03D9 13
03DA E9              SBC 03
03DB 03
03DC 90              BCC LRDY
03DD 06
03DE 85              STA VPTH
03DF 13
03E0 A5              LDA VWORK1
03E1 0C
03E2 85              STA VPTL
03E3 12
03E4 D8     LRDY     CLD
03E5 A5              LDA VPTH
03E6 13
03E7 85              STA VBSVH
03E8 08
03E9 A5              LDA VPTL
03EA 12
03EB 4C              JMP 267
03EC 67
03ED 02
03EE A5              LDA VBSVL
03EF 07
03F0 18              CLC
03F1 69              ADC 16
03F2 16
03F3 4C              JMP 3AE
03F4 AE
03F5 03
```

Power Supply

The power supply we used for the KIM was the same one that was supplied with the unit when we purchased it. For the I/O devices, we used a dual-polarity adjustable bench supply that I normally use to operate the various projects in the ham shack. We set the supply to plus and minus 9 volts. A more permanent supply can be constructed but it must be regulated and must be dual polarity. This can be done easily with two 9-volt regulator chips. The minus regulator needs to supply about 50 milliamps, but the positive regulator must be able to operate the relays, and about 250 milliamps was satisfactory in our unit.

Although this unit was sufficient for our purposes, an ASCII keyboard and 4K of memory could be added to the system. A bearing table for DX calls could be placed in the additional memory. By entering the call prefix, the computer could be directed to look up the proper bearing and automatically rotate the antenna. By including more data in the bearing table, the computer could even display the approximate distance to the DX station. ■

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Antenna Engineer

—predict performance of phased arrays with a TRS-80

This article is intended for use with a TRS-80 Level II 16K. The program listing is for the amateur who is interested in designing his own array of antennas and predicting the polar plot ahead of time. This ability to predict and create graphic displays on the TRS-80 saves me many hours which previously were spent in building antenna arrays—many of which never quite worked as I had hoped.

The program is set up for an array of up to 10 elements to be plotted, but with only a few program changes, it can calculate and plot any number of elements. All inputs to the program are prompted.

The program needs only five pieces of input information as described below.

1) The number of elements in the array.

2) The relative phase of each element. This is the phasing that each element in the array receives compared to the reference element. The reference element can be any element in the array, and is chosen by the user; all measurements of phase are referenced against it. The phase of the reference element is automatically made zero (0) degrees. The phase of each element in the rest of the array is then the difference in phasing in degrees from the chosen reference element. The examples will make this clear.

3) The angles of elements. The angle of the element is the angle which is made from the user's view of the antenna placement (See Fig. 1).

4) The relative amplitudes of elements. This is how much power each of the elements is getting compared to the reference element. If element #2 is getting the same amount of power as the reference, then the response to the program would be (1). If the element in question were getting twice as much power as the reference, then the reply to the program when asked this question would be (2), and so on.

5) Spacing to an element. This is the spacing, in degrees, from the reference element located at the center of the X-Y coordinate system to the element in question. If you are used to thinking in terms of spacing as parts of a wavelength then remember this: Spacing in degrees = 360° times spacing in parts of wavelength: 360 x .2λ = 72°.

To help clarify any of the above programming steps, refer to Fig. 2 and also to photo A which is the polar plot of the well-known two-element beam, with (1) 90-degree lagging phase, (2) equal power division, and (3) placed at 45 degrees in direction and .25λ, or 90°, from the reference element. The photo shows the cardioid pattern that accompanies the two-element beam. Fig. 2. shows also that the beaming action is at 45 degrees on our coordinate system, with the second element being placed in that direction and having a phase difference of 90

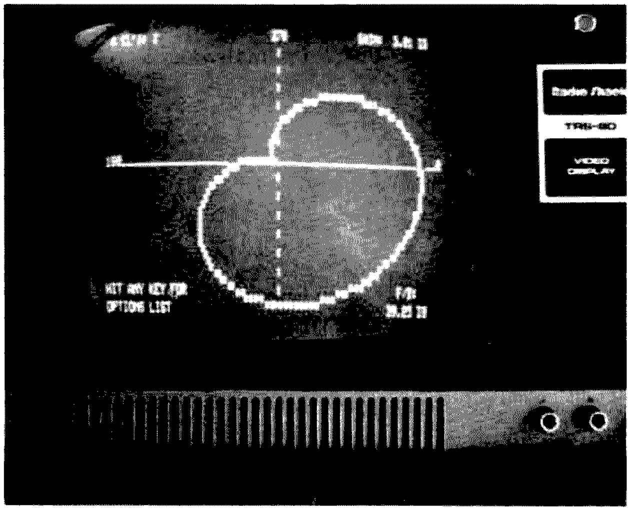

Photo A. Polar plot of two-element array.

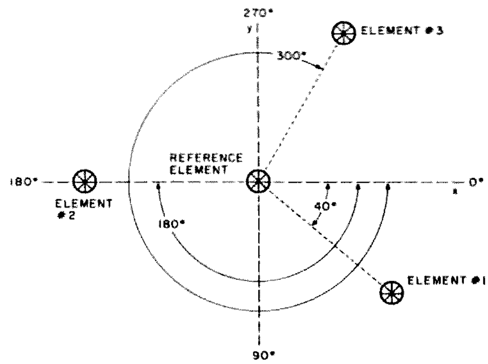

Fig. 1. The reference element is always centered on the X-Y coordinate system. All other element placements are measured as shown here.

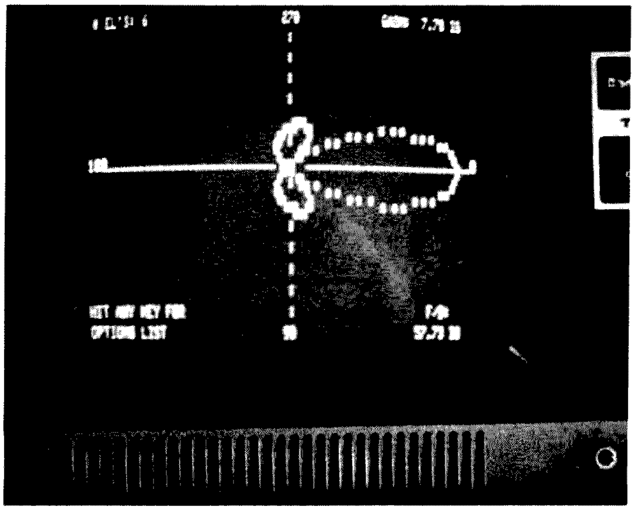

Photo B. Bobtail curtain with equal power division.

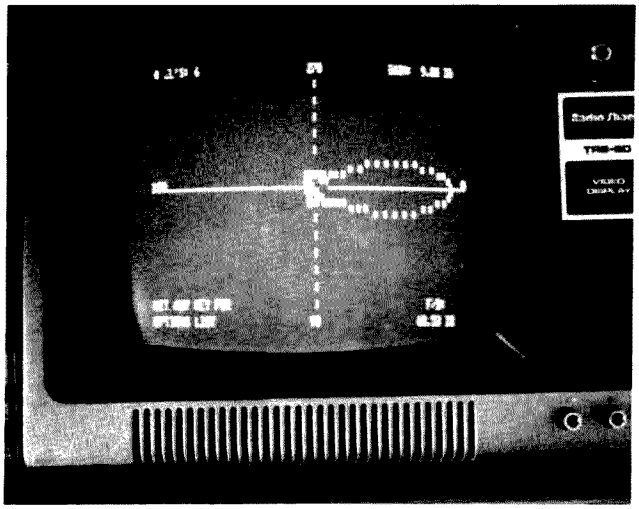

Photo C. Bobtail curtain with unequal power division.

degrees (−90 from reference).

The correct response to the program for a design of this two-element beam would be as follows:

- Relative phase of element #2? −90
- Angle to element #2? 45
- Relative amplitude to element #2? 1
- Spacing to element #2? 90
- Number of elements? 2

The program is very easy to use once the input parameter definitions as just outlined are known.

Lines 20 to 540 are simply inputs and their various formatting. Lines 560 to 780 compute the partials from each element to the total pattern of the array. Lines 820 to 920 are format to start the graphics plot routine. Lines 920 to 1060 scale the pattern to be plotted to fit into the TRS-80 picture format and then start the plot to the screen. The rest of the program consists of various formatting to display the different output routines from the program.

The program will give the

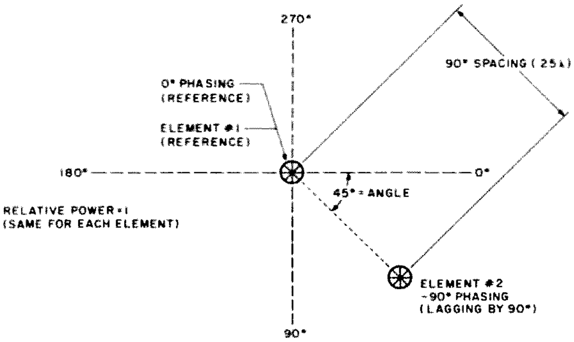

Fig. 2.

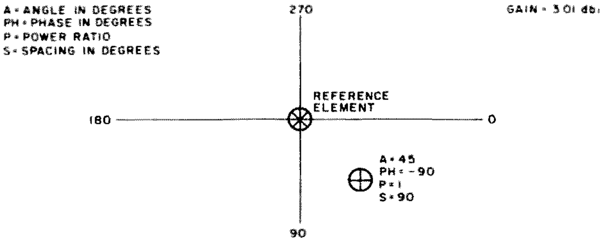

Fig. 3. Bird's-eye view of two-element antenna array placement.

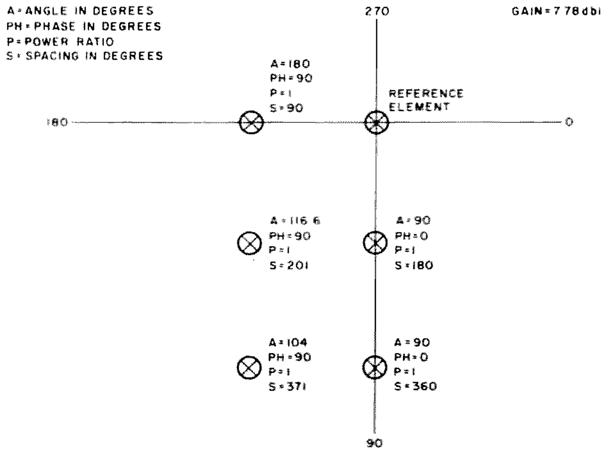

Fig. 4. Bird's-eye view of vertical element placement of Bobtail curtain, equal power division.

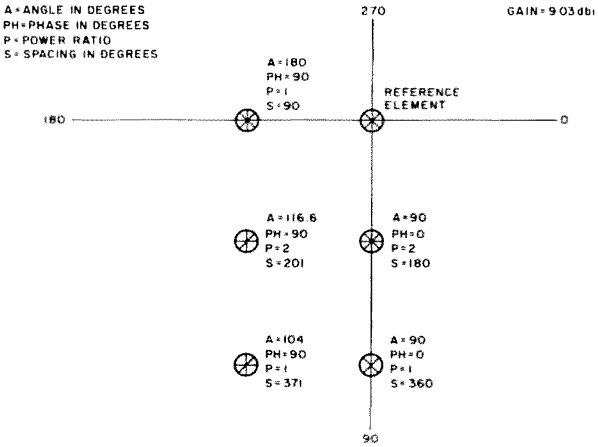

Fig. 5. Same as Fig. 4, with unequal power division.

following outputs at any time during the program once the initial plotting has been done:

- Plot pattern.
- Give gain data every 30 degrees.
- Give gain data every 2 degrees.
- Restart another array design.
- Give graphic element placement of the designed array.
- Give element parameter recap.

Fig. 4 and Fig. 5 and Photos B and C show the variations obtained with the Bobtail curtain antenna, changing only the power division (holding every other parameter constant). It can be seen readily that the correct division for best pattern and gain is in Fig. 5 and Photo C.

The Antenna Designer program can save many hours of field work by computer-designing an antenna idea. With this and imagination, some helpful inputs to one's antenna intuition should come.

There are some assumptions made when using this program that should be mentioned, however. The first is that all elements are assumed to be point sources (isotropic) and the actual pattern developed by most real-life elements is not isotropic. A vertical antenna at ground level can closely compare to an isotropic source better than most and has been my major line of study with this program. Second, the added beaming effect introduced by radiation outside of the plane in which the array lies, is not considered. And third, the problems of mutual coupling among the elements in the array are not considered.

Even with these assumptions, the program closely describes the field-strength patterns from every comparison made to date, and their being neglected should not alter much the pattern or gain of any amateur antenna attempted.

I have cataloged over 200 polar plots using a similar program written in Fortran, for variations of 2 to 10 elements. In all cases, they are essentially identical to other published patterns.

If the reader does not cherish the thought of retyping the listed program, a cassette on quality tape is available from me for $8.00.■

Bibliography

1. "HP-67/97 Plots Antenna's Polar Pattern," *Electronics Magazine*, September 13, 1979.
2. W. L. Weeks, *Antenna Engineering*, McGraw-Hill, 1968.
3. J. Kraus, *Antennas*, McGraw-Hill, 1950.
4. *ARRL Antenna Handbook*.


```
20 CLS
30 GOSUB1780
100 CLEAR 500
200 DIM GN(360),GM(360):AA=1:BB=2:RD=.0174533:CV=58:CH=95
220 VI=15360:ZL=10:F$="###.##":FI=0
240 G$="##.#####":HY$=STRING$(64,"-"):BL$=STRING$(64," "):B$=LEF
T$(BL$,15)
260 PRINT"INPUT NUMBER OF ELEMENTS  (MAX. 10)";:INPUT NI
280 IF NI=0 OR NI>10 THEN 260
300 CU=(NI+3)*64:GOSUB1440
320 FOR N=2 TO NI
340   PRINT@CU,"INPUT RELATIVE PHASE OF ELEMENT#";N;
360   INPUT A(N):GOSUB 1500:PRINT@(N+1)*64+14,A(N);
380   PRINT@CU,"INPUT ANGLE OF ELEMENT #";N;
400  INPUT O(N):GOSUB 1500:PRINT@(N+1)*64+28,O(N);
420  PRINT@CU,"INPUT RELATIVE AMPLITUDE OF ELEMENT #";N;
440  INPUT K(N):GOSUB 1500:PRINT@(N+1)*64+42,K(N);
460  PRINT@CU,"INPUT SPACING OF ELEMENT #";N;
480  INPUT B(N):GOSUB 1500:PRINT@(N+1)*64+56,B(N);
500  AN$="":PRINT@CU,"";:INPUT"IS THIS DATA CORRECT";AN$
520 IF AN$=""OR LEFT$(AN$,1)="Y",NEXT ELSE 340
540 GOSUB 1520:GOSUB1680
560 ZM=0:PRINT@896,"NOW CALCULATING FOR";
580 PRINT@965,"DEGREE BEARING";
600 FOR J=0 TO 360STEP2
620  PRINT@960,J;
640  FOR N=2 TO NI
660    C=(B(N)*COS((O(N)-J)*RD)+A(N))*RD
680    HO=COS(C)*K(N)+HO:VT=SIN(C)+VT
700    GN(J)=SQR((AA+HO)[BB+(VT[BB))
720    IFGN(J)>ZM,ZM=GN(J):P1=J
740    IFGN(J)<ZL,ZL=GN(J):P2=J
760  NEXT
780  VT=0:HO=0
800 NEXT
820 IFP1>=180THENP3=P1-180ELSEP3=P1+180
840 CLS:FORI=0TO15:POKE15392+(I*64),CV:NEXT
860 FORI=15808TO15871:POKEI,CH:NEXT
880 PRINT@511,"0";:PRINT@991,"90";:PRINT@448,"180";:
    PRINT@31,"270";
900 PRINT@962,"PLOTTING:";
920 FOR M=0 TO 360 STEP2
940 IF FI=0 THEN GM(M)=GN(M)
960   GN(M)=(23/ZM)*GN(M)
980   PRINT@968,M;
1000   X=COS(M*RD)*GN(M)*2.5:IFX<-64,X=-64:IFX>64,X=64
1020   Y=SIN(M*RD)*GN(M):IFY<-23,Y=-23:IFY>23,Y=23
1040   SET(64+X,23+Y)
1060 NEXT
1080 DB=10*(LOG(ZM)/LOG(10)):FB=10*(LOG(GM(P1)/GM(P3))/LOG(10))
1100 IF FI=0 THEN DC=DB
1120 PRINT@0,"# EL'S:";NI;:PRINT@48,"GAIN:";:PRINTUSINGF$;DC;:PR
INT" DB";:PRINT@951,"F/B:";:PRINT@1012,USINGF$;FB;:PRINT" DB";
1140 FI=1
1160 PRINT@896,"HIT ANY KEY FOR";:PRINT@960,"OPTIONS LIST";
1180 IF INKEY$=""THEN GOTO 1180
1200 CLS:PRINT@4,"ENTER";:PRINT@64,"1) PLOT PATTERN";:PRINT@128,
"2) GAIN EVERY 30 DEG.";:PRINT@192,"3) GAIN EVERY 2 DEG.";:PRINT@
256,"4) NEW START";:PRINT@320,"5) ELEMENT PLACEMENT";:PRINT@384,"
6) ELEMENT DATA"
1220 X=0:Y=0:INPUTLL:IFLL=1,ZM=23ELSE IFLL=3,J=2
1240 ON LL GOTO 840,1280,1340,1540,1560
1260 GOSUB 1440:GOTO1160
1280 CLS:PRINTTAB(20)"SYNOPSIS OF GAIN DATA":PRINTHY$;
1300 J=30:REM DEGREE STEP
1320 PRINT,"DEGREE","PWR. GAIN.","DB(I) GAIN"
1340 FORI=0TO360 STEP J
1360   PRINTTAB(16);I,:PRINTUSINGG$;GM(I),:IFGM(I)>=0PRINT,10*(L
OG(GM(I)) /LOG(10))
1380 NEXT
1400 GOTO 1160
1420 END
1440 CLS:PRINTHY$;:PRINT"EL.#";TAB(14);"PHASE";TAB(28);"ANGLE";
     TAB(42);"AMPL.";TAB(56);"SPACING":PRINTHY$;
1460 FOR I=2TONI:PRINTI;TAB(14);A(I);TAB(28);O(I);TAB(42);K(I);
     TAB(56);B(I):NEXT:PRINTHY$;
1480 RETURN
1500 PRINT@CU,BL$;:RETURN
1520 FOR I=CU TO 869 STEP64:PRINT@I,BL$;:NEXT:RETURN
1540 CLS:CLEAR: RUN100
1560 FOR PL=2 TO NI+1:IF B(PL)>BG,BG=B(PL):NEXT
1580 CLS:PRINT@511,"0";:PRINT@991,"90";:PRINT@448,"180";:PRINT@3
1,"270";:FOR RL=2 TO NI:XX=COS(O(RL)*RD)
1600 XX=XX*B(RL)/BG*56+64
1620 YY=SIN(O(RL)*RD)*B(RL)/BG*18+22:SET(XX,YY):SET(XX+1,YY+1):S
ET(XX-1,YY-1):SET(XX+1,YY-1):SET(XX-1,YY+1)
1640 NEXT RL
1660 FOR V=1TO20: SET(64,22):SET(65,23):SET(63,21):SET(65,21):SE
T(63,23):NEXT:FOR VV=1TO20:RESET(65,23):RESET(63,21):RESET(65,21)
:RESET(63,23):NEXT:IF INKEY$="",PRINT@896,"HIT ANY KEY TO";:PRINT
@960,"CONTINUE";:GOTO1660ELSE1160
1680 FOR PL=2TONI+1:IF B(PL)>BG,BG=B(PL):NEXT
1700 PRINT@896,"HIT ANY KEY TO";:PRINT@960,"CONTINUE";:IF INKEY$
=""THEN GOTO1700
1720 CLS:PRINT@511,"0";:PRINT@991,"90";:PRINT@448,"180";:PRINT@3
1,"270";
1740 FOR RL=2TONI:XX=COS(O(RL)*RD):XX=XX*B(RL)/BG*56+64:YY=SIN(O
(RL)*RD)*B(RL)/BG*18+22:SET(XX,YY):SET(XX+1,YY+1):SET(XX-1,YY-1):
SET(XX+1,YY-1):SET(XX-1,YY+1):SET(64,22):NEXT
1760 RETURN
1780 CLS:PRINTCHR$(23):PRINT@532,"HAM-";:FORI=1TO600:NEXT:PRINT@
532,B$:PRINT@538,"-TENNA":FORI=1TO600:NEXT:PRINT@538,B$:PRINT@532
,"HAM-";:FORI=1TO300:NEXT:PRINT@542,"TENNA";:PRINT@960,"";:FORJ=1
TO8:PRINT:FORI=1TO300:NEXT:NEXT:GOTO1800
1800 PRINT@518,"POLAR PLOTTING PROGRAM":PRINT@586,"FOR DRIVEN AR
RAYS":GOTO1820
1820 PRINT@960," 1979 - D.C.MITCHELL - K8UR";:FORI=1TO1500:NEXT:
CLS:PRINTCHR$(28)
1830 PRINT"     THIS PROGRAM LETS THE USER DESIGN HIS OWN PHASED
 ANTENNA  ARRAYS UP TO 10 ELEMENTS.  MORE ELEMENTS MAY BE USED B
Y CHANGING THE '10' IN LINE 280 TO THE DESIRED NUMBER OF ELEMENTS
."
1840 PRINT"     TO DESIGN AN ARRAY, PLACE THE ELEMENTS OUT AS DE
SIRED USING A 'BIRDS EYE' VIEW OF THE ARRAY AND AN X-Y  COORDINAT
E  SYSTEM WITH 0-DEGREES AT THE RIGHT,270 AT TOP,180 AT LEFT AND
90 DEGREEAT BOTTOM."
1850 PRINT"     THE PROGRAM WILL ASK YOU PHASE,ANGLE,AMPLITUDE A
ND SPACING.PHASE IS (-) FOR LAGGING PHASE AND (+) FOR LEADING  PH
ASE.PHASE IS IN DEGREES FROM THE REFERENCE ELEMENT. CHOOSE ONE  E
LEMENT OF THE ARRAY AS A REFERENCE."
1855 PRINT@960,"HIT ENTER TO CONTINUE";:INPUTUU$:CLS
1860 PRINT"     (ALL MEASUREMENTS FOR THE OTHER ELEMENTS WILL BE
 TAKEN FROM THE REFERENCE ELEMENT CHOSEN).ANY ELEMENT WILL DO. TH
E ANGLE IS THE ANGLE BETWEEN THE (0)DEGREE HEADING OF YOUR X-Y CO
ORDINATE, ";
1861 PRINT" THE REFERENCE ELEMENT WHICH IS ALWAYS AT THE CENTER
OF THE X-Y COORDINATE, AND THE ELEMENT IN QUESTION."
1870 PRINT"     THE AMPLITUDE IS THE AMOUNT OF POWER WHICH THE
ELEMENT IN QUESTION RECEIVES COMPARED TO YOUR REFERENCE.  IT IS E
XPRESSED  AS A RATIO.  THE REFERENCE ELEMENT ALWAYS GETS 1:1 POWE
R SO IF"
1875 PRINT" ELEMENT 2 WERE TO GET TWICE AS MUCH POWER, YOUR INPU
T WOULD BE (2) FOR AMPLITUDE.THE SPACING IS HOW FAR THE ELEMENT I
N QUESTION IS FROM THE REFERENCE IN DEGREES."
1880 PRINT"     SEE POOP-SHEET FOR ANY LAYOUT PROBLEMS.

1890 PRINT@960,"HIT ENTER TO CONTINUE";:INPUTUU$:CLS
1900 RETURN
```

Program listing.

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SWTP/H14 Get-Together

—a driver routine for the Heathkit line printer

Not too long ago, I purchased a Heathkit printer, Model H14. Anyone familiar with Heathkit's excellent documentation and instructions knows how easily he can become spoiled. This certainly affected my programming. I became careless. You might say that this is natural, but we programmers all know that this means sloppy programs. This came to light when I told my trustworthy SWTP 6800 computer to start sending data to my new printer.

```
                *** PRINTER DRIVER***
                *THIS SUBROUTINE WAS DEVELOPED TO SUPPORT
                *THE "HEATHKIT" LINE PRINTER.
                *AUTHOR:
                *ROBERT RIENSTRA
                *5877 PARLIAMENT DR.
                *COLUMBUS - OHIO 43213
                *
                *
                *STORAGE
A010            TEMPXR EQU   $A010    TEMPSTORAGE FOR "X" REGISTER
A062            BYTCNT EQU   $A062    BYTE COUNT (16)
801C            PORT07 EQU   $801C    PORT ADDR. FOR PRINTER
A060            PRTTST EQU   $A060    TEST PORT TO SEE IF INITIALIZED
                *
                *
                *PRINT DRIVER SUBROUTINE
                *
C4A8                   ORG   $C4A8    PROM ADDRESS.
                       OPT   LIS,SYM
C4A8 37                PSH B          SAVE B ACCUM.
C4A9 FF A0 10          STX   TEMPXR   SAVE "X" REGISTER
C4AC 8D 35             BSR   JMP1     JUMP TO DEVICE CLEARED AND INIT. LINK
C4AE E6 00      LOOP   LDA B 0,X      SEE IF DEVICE IS READY FOR DATA
C4B0 57                ASR B
C4B1 57                ASR B
C4B2 24 FA             BCC   LOOP     TEST AGAIN
C4B4 A7 01             STA A 1,X      OUTPUT ONE CHARACTER TO PRINTER
C4B6 8D 05             BSR   INTRPT   SEE IF PRINTER SENT INTERRUPT SIGNAL
C4B8 33                PUL B          RESTORE B ACCUM.
C4B9 FE A0 10          LDX   TEMPXR   RESTORE "X" REGISTER
C4BC 39         EXIT00 RTS            EXIT DRIVER ROUTINE
                *
                *
                *THIS SUBROUTINE EXAMINES THE PRINTER'S
                *INTERRUPT SIGNALS.
                *
                *
C4BD 7D A0 62   INTRPT TST   BYTCNT   IS BYTE COUNTER = ZERO
C4C0 26 17             BNE   ADD1
C4C2 A6 00      LOOP1  LDA A 0,X      TEST  IF HANDSHAKE SIGNAL IS PRESENT
C4C4 47                ASR A
C4C5 24 18             BCC   TIME1
C4C7 A6 01      CKINTR LDA A 1,X
C4C9 81 13             CMP A #$13      PRINTER BUFFER IS FULL
C4CB 27 05             BEQ   BYTE16
C4CD 81 11             CMP A #$11      PRINTER NEEDS MORE DATA
C4CF 26 F1             BNE   LOOP1
C4D1 39         EXIT01 RTS            EXIT INTERRUPT TEST
C4D2 86 0F      BYTE16 LDA A #$0F     LOAD "A" WITH 16 COUNT
C4D4 B7 A0 62          STA A BYTCNT    STORE IN COUNTER
C4D7 20 EE             BRA   CKINTR
C4D9 7A A0 62   ADD1   DEC   BYTCNT
C4DC 27 DF             BEQ   INTRPT
C4DE 39         EXIT02 RTS            EXIT
                *
                *
                *THIS IS THE LINK TO THE TIMING ADJUST ROUTINE
                *
C4DF 8D 00      TIME1  BSR   NEXT1    JUST TO STRETCH THE TIME
C4E1 20 74      NEXT1  BRA   BITDLY   GO TO BIT DELAY
C4E3 20 5B      JMP1   BRA   CLRDEV   CLEAR DEVICE AND INITIALIZE
                *
                *
                *THIS SUBROUTINE CLEARS AND INITIALIZES THE ACIA
                *
                *
C540                   ORG   $C540
```

Program listing.

I made sure that all the required paraphernalia were present: RS232C line, handshake line, serial I/O interface. I even came up with a program of sorts.

The Heathkit printer contains:

1. One 256 byte line buffer.
2. Handshake control signals. Hex 13 = Buffer full. Hex 11 = Send more data (16 bytes only). More about these control signals later.
3. Three different characters/inch print modes.
4. Print action started by either a "CR" or when any of the selected number of characters/inch modes are satisfied.

The handshake signals were giving me the most problems, as I did not know what actually took place. Hex 13 = buffer full means what it says and the program must stop sending data until hex 11 is received after which only 16 characters can be sent until another hex 11 is received. I found out by hooking up my scope that hex 11 is transmitted by the printer right after the matrix printhead has reached the end of the printline and starts its return trip. So, programmers be aware.

After many experiments and reprogramming sessions, I came up with a program which seemed to answer my problem. See the program listing.

The program was compiled with an EPROM starting address. The PORT address is the SWTP's printer port by convention. The X register and the B accumulator have been saved at the beginning and are restored at the end. The serial device ACIA is always initialized and cleared. This subroutine starts at location 'C540'. The 92-position opening between LOC. 'C4E5' and LOC. 'C540' is because of another printer-oriented subroutine residing there.

This program is by no means the ultimate answer, and I am sure that somewhere in this country somebody else may also have tackled the same program problems, but all I can say is that Heathkit's line printer runs smoothly and flawlessly at 4800

baud without missing one character. If you have to take the printer off line (out of paper, etc.), the computer will loop in the program and never lose one character.

Relocating the program to another location should be easy, as the program is completely relocatable. This program is a subroutine, so all you have to do is load the A accumulator with the ASCII character to be printed and execute this program using the BSR instruction (BSR #$C4A8).

Program Description

The program's main line starts at LOC. 'C4A8'; it ends at LOC. 'C4BC'. After the ACIA device has been tested to see if it is free to receive more data, accumulator A is stored in the device's data register '801D'. The program then performs a subroutine that tests the interrupt (handshake) codes (LOC. C4BD through C4DE).

This interrupt subroutine not only takes care of the interrupt codes, but also deals with an inherent timing problem automatically created by the moving printhead and data transmission. TAG "TIME1" and "NEXT1" will adjust this delay I mentioned. Did I say delay? I mean timing. TAG "BITDLY" adjusts the timing problem. Decreasing or increasing the 04 count may cause the interrupt subroutine to miss the handshake signals (hex 11 or hex 13) and, therefore, cause garbage to be printed.

TAG "CLRDEV" really does not need any explanation, as it initially clears and programs the ACIA device.

Now I'm looking for a way to use the SWTP CT-64 at a higher baud rate, say 4800.■

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Hustler Minibeam: the Mobileer's Secret Weapon

—two-el beam fits in your trunk

One of the most useful and convenient accessories of interest to many amateurs is a fold-down minibeam antenna. A portable and efficient gain antenna solves numerous signal radiation problems for traveling amateurs, weekend vacation enthusiasts, or amateurs with limited space. Most minibeam antennas suffer two distinct problems which limit their use by today's "on-the-go" radio amateurs. Either they are too large to be easily transported and quickly erected by one man or they require a large number of parts to be assembled before each period of use. Consequently, many amateurs merely use simple dipoles or mobile whips for their portable activities. The Hustler Minibeam was devised to provide a solution to this dilemma.

This antenna described in this article provides up to 5 dB forward gain, may be operated on the 20-, 15-, or 10-meter bands, and will fit comfortably in one corner of an auto trunk. The vacationing amateur can unpack, assemble, and erect the antenna in less than fifteen minutes, and the approximate cost of this array can be under forty dollars. This two-element beam also may be operated as a rotary dipole for the 40- or 80-meter amateur bands, if desired.

Photo A. The knock-down Hustler minibeam can be removed from the trunk of a compact auto and be in use on a moment's notice.

Theory of Operation

Basically, this antenna is a two-element yagi of reduced proportions. Center loading of each element is provided through the use of Hustler mobile resonators, and most of the beam's aluminum tubing is salvaged from an old CB beam antenna. While this small array may be fed directly with 50-Ohm coaxial cable, a 50-Ohm unbalanced-to-balanced balun transformer will substantially improve overall performance.

The requirements for a two-element yagi are relatively simple: The driven element must be ½ wavelength long, and the parasitic element must be either 5% longer if it is used as a reflector or 4% shorter if it is used as a director. The close-spacing distance between driven and parasitic elements should be approximately .15 wavelengths for a reflector and .1 wavelengths for a director. As we have learned through the use of triband minibeams, however, less-than-optimum element spacing is often quite acceptable.

New-Tronics mobile antennas have proven their outstanding ability through numerous years of service, and this minibeam antenna performs with almost the class of its full-sized counterparts. Band changing is accomplished by exchanging resonators as necessary. Additionally, 40-meter or 80-meter resonators may be used with the driven element proper to afford the rotary dipole option. Resonators used with this antenna are not subjected to the stress of mobile activities, so damaged and electrically restored resonators should work very well in this array.

Rather than adjusting element length for resonance at the desired frequency, the beam's resonators are tuned by moving their tip rods and monitoring resonant frequency with an antenna noise bridge or indicator. Once these positions are located, a notch is filed in the resonator's tip rod for future reference. The antenna's driven element may be adjusted for operation by merely tuning for a 1-to-1 swr at the desired frequency. Assuming 20-meter resonators are employed, the driven element should be tuned to approximately 14,250 kHz. As shown in Fig. 1(a), this equals an approximate length of 32.84 feet. A comparable reflector element will be approximately 5% longer, or 34.48 feet in length. In Fig. 1(b), we find that this length equals a resonant frequency of 468/34.48, or 13,570 kHz. Since this frequency is below the resonator's range, each side of the reflector's elements must be extended slightly. This is accomplished by varying the screw-stock length for

$$\text{1/2 wavelength (ft.)} = \frac{468}{F_Q\text{ (MHz)}}$$

Fig. 1(a). Determining element length.

$$F_Q\text{ (MHz)} = \frac{468}{\text{1/2 wavelength (ft.)}}$$

Fig. 1(b). Determining resonant frequency.

coarse adjustments and adjusting resonator tip rods for fine tuning. While the parasitic element may be adjusted to act as a reflector (lower resonant frequency) or as a director (higher resonant frequency), a slightly higher forward gain will be produced when using a reflector element.

Concept of Construction

Rather than presenting a step-by-step-duplication procedure here, I will describe this antenna in a manner which will allow personal ingenuity and available parts to be used to maximum benefit. You can "mix and match" ideas as you like.

The dipole (driven) element should be constructed first, since it may be used independently or as a reference to ensure that the other element is properly adjusted to its respective frequency.

As shown in Fig. 2, the driven element should be insulated from the boom by whatever means you find convenient. If you can't salvage these parts from a damaged CB beam, a short length of PCV plastic pipe may be used. An old boom-to-mast plate may be incorporated for element mounting, and it will serve double duty should you also desire a rotary dipole arrangement for 80 or 40 meters. A section, or sections, of aluminum tubing totaling 53.75 inches (the length of the New-Tronics Mobile Mast, M01 or M02) can then be inserted and secured to the PCV plastic pipe.

Each end of these aluminum sections is fitted with screw stock (from any hardware store) which mates with Hustler resonators for the desired band of operation. Holes may be drilled through the PCV pipe and aluminum tubing, and sheet metal screws with balun or feedline connection lugs inserted. In order to ensure portability, my driven element is broken into three sections, each slightly less than 3 feet in length. Each section is marked at its insertion length, and screw-type compression clamps are used to secure the element when assembled.

The parasitic element, complete with boom mounting assembly, may be secured from an old CB beam. Many of these arrays employ swaged elements which mate perfectly with the screw stock which is inserted in their outer ends. Since these element sections are not insulated from the boom, they may be removed at that point for transportation and rapid reassembly. Each end of the screw stock-fitted sections should be slotted with a hacksaw and fitted with screw-type compression clamps. Approximately 12- to 16-inch lengths of screw stock should then be inserted and the clamps tightened only enough to hold them securely. A final tightening will be accomplished after the element is tuned to frequency and its position marked with a laundry marker pen. A construction procedure similiar to the above is satisfactory for conventional aluminum tubing assemblies, also.

The boom may be salvaged from a CB beam, or a piece of aluminum shower curtain rod may be utilized. As I have learned from a variety of minibeams marketed in recent years, several variations of boom lengths may be acceptable. I, however, have realized good results using a 6.5-foot

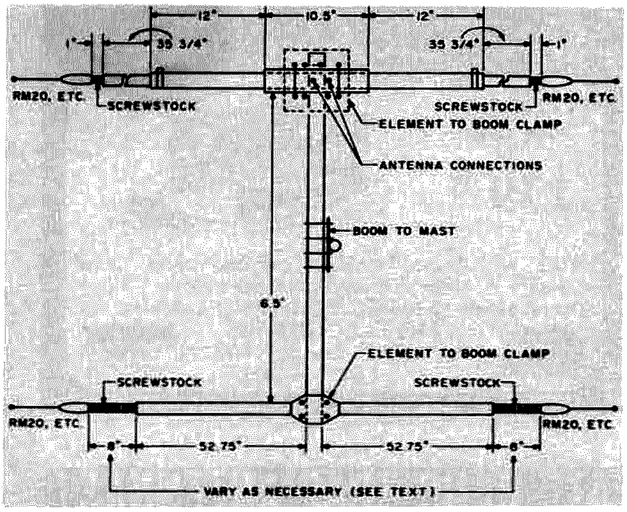

Fig. 2. Electrical/mechanical details of the Hustler minibeam.

boom. This length is approximately .15 wavelengths at 21,300 kHz: a reasonable compromise for 20-, 15-, or 10-meter operations. The boom may be cut in the middle and fitted with a connecting sleeve and mast-mount assembly for portability. (Due to lack of time, I haven't yet added this feature to my minibeam.)

Tuning and Adjustment

Once the antenna is constructed, it may be tuned and marked for later reassembly and use as needed. Each end of the driven element should be adjusted to measure 53.75 inches from center to tips of screw stock. Resonators for the desired band should be fitted and tuned for minimum swr. Next, resonators and screw stocks for the parasitic element should replace those on the driven element, and they, too, should be tuned to their respective frequencies—about 5% lower than the chosen operating frequency. Since the Hustler resonators may not quite reach the parasitic frequency, screw-stock length should be varied in 2-inch increments until tip-rod adjustment range is acquired.

After parasitic resonators are tuned to the calculated frequency, they are marked and inserted into their respective parasitic element sections. The driven element is then reassembled with its pretuned resonators, and the basic tuning is complete. A final tweaking may be accomplished with the aid of a field-strength meter. The parasitic resonators are then carefully adjusted while monitoring forward gain. This procedure is identical to any beam antenna adjustments, so it need not be repeated here.

Additional Notes

The easiest and quickest way to tune all elements of

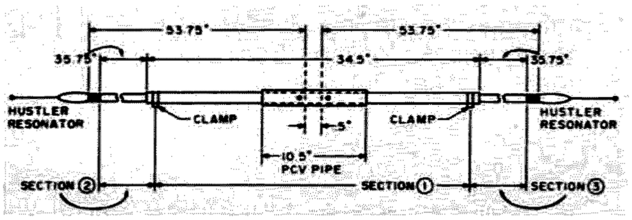

Fig. 3. The three-section breakdown of the driven element (see text).

this antenna involves using an antenna noise bridge and general-coverage receiver. The noise bridges manufactured by MFJ Enterprises and Palomar Engineering are ideal for this operation. Complete antenna tuning procedures are included in the MFJ and Palomar instruction manuals.

Assuming band-to-band color coding is used to mark element positions and resonator tip rods, the collapsed beam can be reconstructed within a matter of minutes. Mobiling amateurs carrying an antenna similiar to this array in their autos are thus ready for hilltop DXing.

While I haven't (yet!) investigated the possibility of using an extended boom and trying a 40-meter beam, the concept looks very promising.

Sections of aluminum tubing salvaged from a 6-meter or CB antenna may replace parasitic element resonators when this array is used on the upper part of 10 meters. Merely calculate their approximate lengths and install tubing in the place of the resonators.

Conclusion

The pint-size beam antenna described in this article is an outstanding performer for any amateur setup. This little gem can be stored and used as required, with minimum assembly and tuning time required. The beam will substantially outperform a dipole or vertical, and its cost is quite reasonable.

I would like to thank Erskine Jackson W4CEC for his clever ideas in the construction of the beam's driven element. Jack operates mobile and portable quite often, and this fold-up concept was his ideal solution. ■

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The Pope Comes to the Cornfields

—and Iowa amateurs provide the communications

Photo A. Charles Corcoran WB0URB consults with one of the 3,000 emergency health teams while Pope John Paul II (background) celebrates mass at Living History Farms. Red hearts and flags were used to help the public identify health teams. (Photo by the official papal visit photographer, Ed Mulvin WB0IFF)

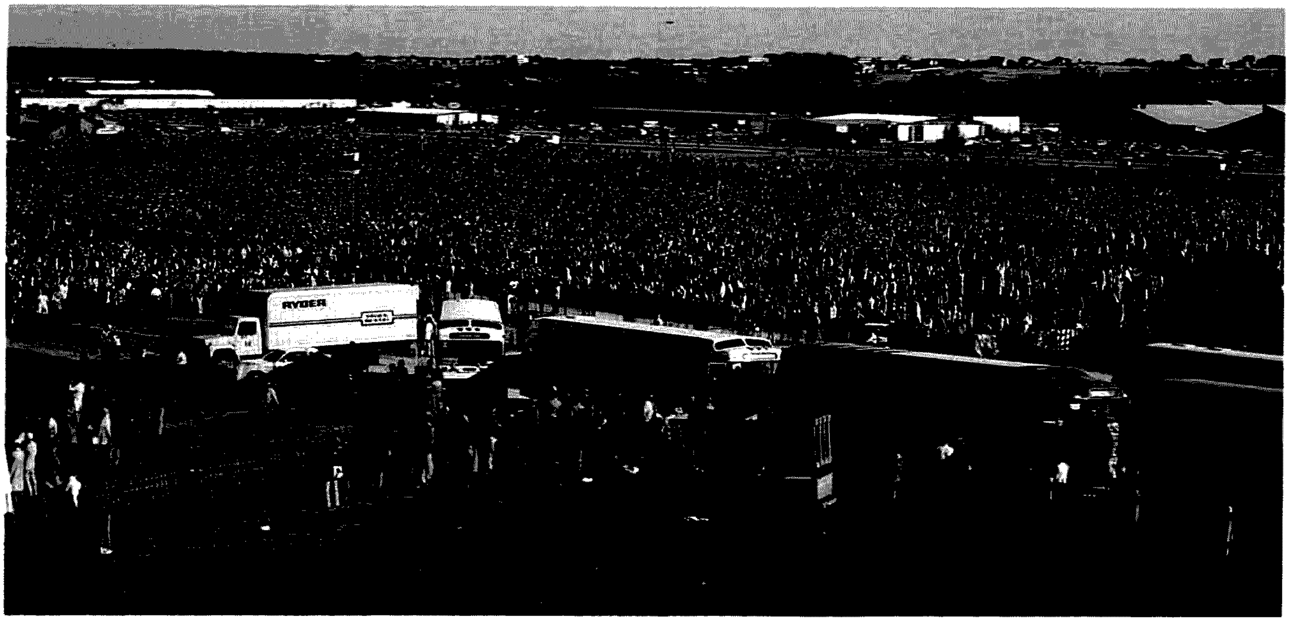

Photo B. A portion of the crowd which came to Living History Farms to see Pope John Paul II. Preliminary estimates indicated that in this group there could be as many as 50 coronary heart attacks, six births, 10 deaths, and 10,000 faintings, depending upon the weather. (Photo by WBØIFF)

Usually, when hams hear the word "disaster," they think immediately of tornadoes, hurricanes, earthquakes, and other displays of the power of Mother Nature. The Amateur Radio Emergency Service is well known to the public for its activities during dire emergencies of that kind.

But large crowds of people also can pose a life-threatening emergency under certain circumstances. The prospect of such an emergency seemed very real to the planners of Pope John Paul II's visit to Des Moines, Iowa, on October 4, 1979. To amateur radio operators in Iowa, the Pope's visit provided an unusual opportunity to help avert a potential disaster.

For two weeks prior to the Pope's official announcement that his tour of Ireland and the United States would include a stop at Living History Farms in Des Moines, city and church officials considered the visit to be a strong possibility. Their initial elation was tempered by the first official estimates of the expected crowd—between 200,000 and 400,000 persons.

A crowd of such magnitude in a large city such as Boston or Chicago, other stops on the Pope's tour, would be no greater cause for concern than the turnout for a tickertape parade or other public spectacle. But in Des Moines, with a total population of only some 236,000, the prospect of doubling or tripling its size for even a few hours caused city and state officials to become very concerned that facilities in the area would not be able to handle the huge crowds expected.

It was immediately clear that the cooperation of many volunteer groups would be necessary to avert potential disaster. Amateur radio services were offered to the Papal Visit Coordi-

Operators Participating in the Papal Visit Operation
Ralph Wallio WØRPK, Chairman
Bob McCaffrey KØCY, Manpower
Keith Greiner AKØQ, Manpower
Mike Colvin WDØAKB, Public Relations
Gary Liljegren WØSH, Control Manager
Charles Stover WØZZM, Control Manager
Tom Hildreth KØHTC, Control Manager

Operators in the field during the visit included the following, plus others from the Des Moines RAA, the Southwest Iowa ARC, the Midlands ARES, the Northeast Iowa RAA, and groups in Story, Boone, and Jasper counties.

NØAJI	WBØDQN	AIØK	WAØTBG
N8AKD	WDØEBS	WBØKXJ	WBØTEY
KØAL	WØEDQ	WAØKZB	WBØTIY
KØALD	WDØEGR	KØLHW	WBØTOT
NØALX	WDØENV	KØLKH	WBØTWW
WDØAMA	WAØEYG	WØLMP	KØUAB
NØANP	WAØFFZ	WAØLTX	WBØUCK
WAØAOR	WAØFOG	WBØMBZ	WBØUIU
WAØAUX	WDØFRE	WØMHC	WBØUOZ
WAØAWA	KAØFRW	WAØMIT	WBØURB
NØAZ	WAØGAZ	WBØMMS	WBØUUL
WB7BCI	WDØGDO	WBØMTZ	KØVEB
KØBGJ	KØGID	WBØMUB	WBØVLL
WDØBKO	WBØGIL	WAØMUG	WBØVUI
WBØBLR	WBØGHK	WAØNAA	WB4VWV
WBØBOR	WBØGXD	WØNKV	WBØWOE
WBØBQV	KØHFU	NØNL	WAØWYW
WAØBRU	KØHHF	WBØNSH	WØWL
WDØBVC	WDØHII	WBØNVL	KØXD
WDØBVG	WAØHKT	WØOIC	WBØYOD
KAØCHK	WDØHRC	WØOMV	WBØYTI
WBØCMC	KØICM	WBØOUL	WAØYXM
WDØCPD	WBØIFF	KØPCG	KØZAL
WBØCPR	WØIYW	WBØPDX	WBØZKU
WDØCSH	WØIZK	WØPKW	WB9ZMV
WBØDEB	WD9JCX	WØPZN	WBØZQC
WAØDEI	WBØJFF	WBØQAM	KØZQ
WØDLN	WBØJGJ	WBØRMN	WAØZUR
WDØDOK	KØJRQ	WAØRVD	WBØZWE
WØDQ	WBØJTQ	WBØUFL	

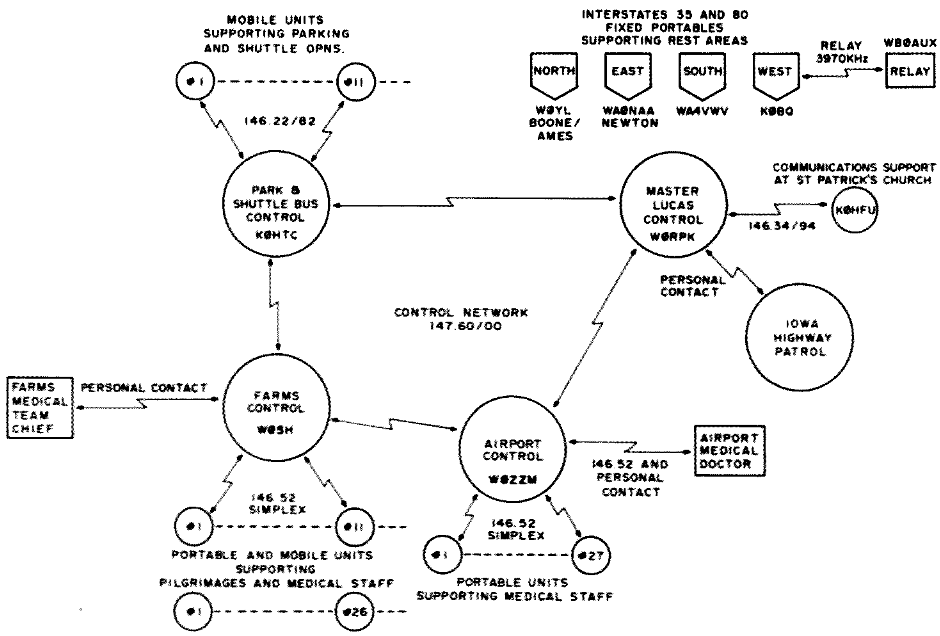

Fig. 1. The Amateur Radio Communications Network shows the control network with three sub-control stations and five distant stations (top right) reporting into it. While both the Farms Control and Airport Control stations communicated with their teams on 146.52, no interference was experienced because the two teams were across town and used less than one Watt of power.

Photo C. Committee chairman, Ralph Wallio WØRPK, coordinates with state officials from the communications center in the basement of the Lucas State Office Building, five miles east of Living History Farms.

nating Team, a group of city, state, and church officials, by the Des Moines Radio Amateur Association soon after news of the papal visit was made public. Shortly thereafter, but only four weeks before the day of the Pope's arrival, Ralph Wallio WØRPK was contacted by the Iowa State Government requesting a preliminary meeting to discuss potential services.

The first meeting held with state and city officials included WØRPK, WØSH, WØZZM, and KØCY. It was obvious from the start, when the state requested 1,500 radio-equipped operators, that local amateur organizational and communicating capacity would be tested beyond the usual! Fortunately, the DMRAA was not starting from scratch. Local hams provide communications for many annual events and maintain two wide-area coverage 2-meter FM repeaters. However, by the time this first meeting was over, it was apparent that hams from all over the state and beyond would be needed to meet the manpower requirements of the visit.

Organization was the first order of business. A special committee was formed with WØRPK as chairman, and duties were delegated. Manpower recruiting was the biggest initial job, and the task of calling hundreds of amateurs locally and in nearby states was begun immediately by KØCY and AKØQ. Emergency coordinators and club presidents from all over Iowa were contacted. A detailed request for volunteers was released through the wire services. W1AW was asked to broadcast bulletins requesting assistance. In addition to contacting Des Moines club members individually, announcements were made on the weekly nets and in the DMRAA newsletter, *Static Sheet*.

Simultaneously, details of the communications system were worked out. Amateur communications were assigned to meet several critical needs. Roving emergency medical teams from the local Heart Association and Red Cross would need communications from their positions in the crowds at the Farms and the Des Moines airport, back to five fully-equipped field hospitals at those locations. Further, a number of walking pilgrimages from parking areas three to four miles away from the Farms were planned, and communications checkpoints along each route were needed to deal with crowd control and medical problems. Communications also were needed at each parking area so that shuttle buses could be dispatched efficiently to pick up new arrivals. Finally, the Iowa Development Commission, which is responsible for providing tourist information,

requested on-site communications facilities at interstate rest areas to give the inbound driving public the latest information on traffic conditions and available parking.

Through subsequent weekly meetings of the committee, myriads of operational details were coordinated. Command station locations, equipment and antennas, operating frequencies, portable and mobile location assignments, base-station managers and crews, and security clearances were all confirmed. Throughout the remaining weeks, cooperation from state and local officials was exemplary. There was no doubt that amateur communications were to be an integral part of the public safety plans for the Pope's visit.

On Monday, October 1, just three days before the Pope's arrival, a final public services briefing was held which included top officials of the Iowa State Highway Patrol, the National Guard, several county and local law enforcement agencies, the FBI, the Secret Service, the Red Cross, the Heart Association, and other organizations charged with crowd responsibilities. It was with some pride that WØRPK provided details of the communications plan that amateurs had put into operation.

Final plans for the visit called for the Pope to arrive at the Des Moines airport at 1300 hours. He was to be shuttled by helicopter to a tiny rural church nine miles south of Des Moines where he would meet with the church's parishioners. From there he would be flown to Living History Farms on the western outskirts of Des Moines to say mass for some 350,000 people. His departure was scheduled for approximately 1630 hours.

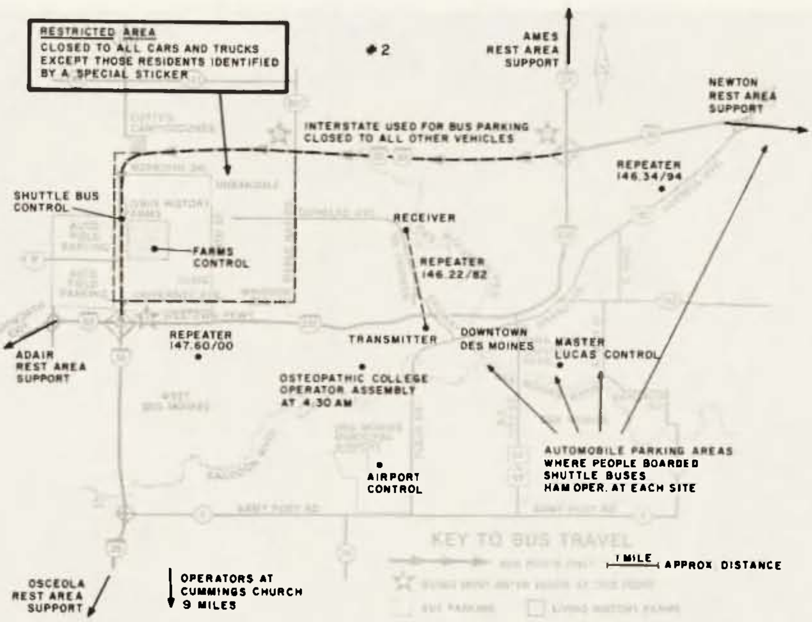

Fig. 2. This official map of the city of Des Moines shows the various elements of the amateur radio operation in perspective with some of the other activities of the day.

The communications plan worked out by the Amateur Radio Planning Committee established five communications networks including a command network with control at a downtown state office building where the Iowa Highway Patrol and other law enforcement agencies were headquartered. Two satellite control stations operating on 2-meter sim-

Photo D. An estimated 350,000 people gathered at Living History Farms. The altar for the papal mass is located in the center of the photograph. The buildings at the upper right contained the amateur radio "Farms Control" and the main hospital facility. Three other hospital facilities were located in tents along the perimeter, just outside the border of this photograph by Bill Dennis KØUKN. Bill took the picture from 7,000 feet as he piloted one of the very few aircraft allowed over the site.

Photo E. After the papal visit, the public walked a quarter of a mile to Interstate 80 where some 2,000 charter buses and hundreds of shuttle buses were parked. (Photo by KØUKN)

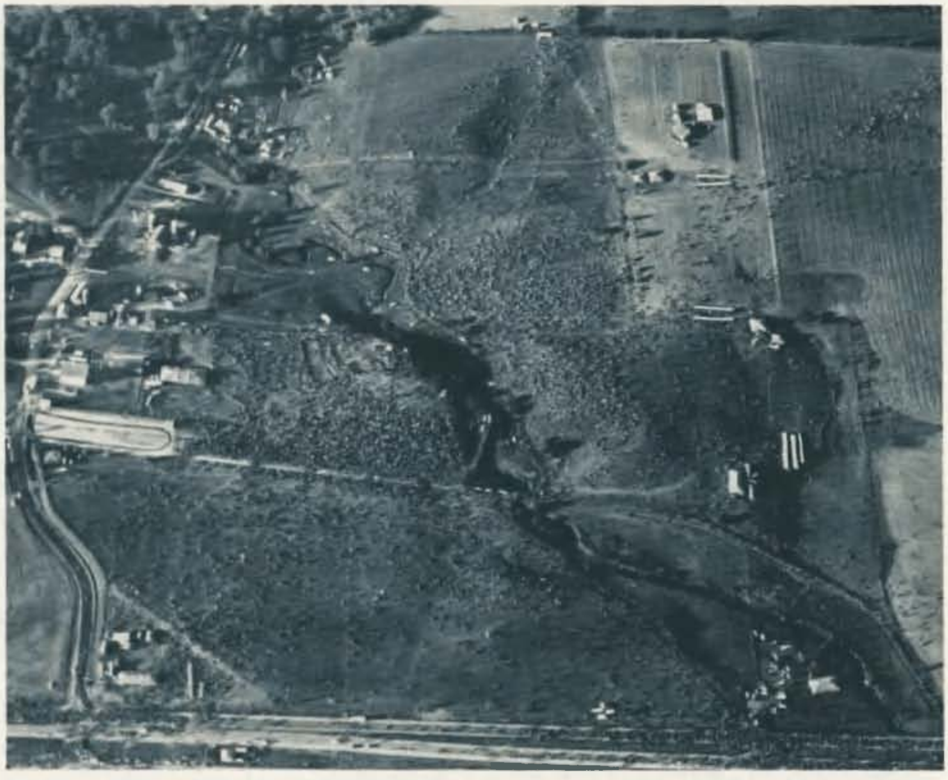

Photo F. Members of the public are shown leaving the Living History Farms site after the Pope departed. (Photo by KØUKN)

plex were set up at Living History Farms and the airport to assist the field hospitals in those locations. Another satellite control station was to be put into operation on 22/82 to assist the shuttle busing plan. Fixed portable stations at strategically located rest areas on the interstate highways were to communicate with the command post via 34/94 or 75 meters. Command post communications with the airport, the Farms, and shuttle bus stations were to use 60/00.

Two operators were assigned to assist in emergency communications at the country church about nine miles south of Des Moines.

To complicate matters, both of the local repeaters were struck by lightning about three weeks before the expected visit. This is a most unusual occurrence, since the repeaters are located about five miles apart. The result was a flurry of activity in which the 34/94 repeater was rebuilt from the circuit boards on up. In addition, WBØMBZ assembled a backup repeater, and the Iowa Department of Public Safety provided a modified commercial repeater as a second backup.

On the day of the papal visit, everything was ready. The command post and satellite control stations had been set up two days earlier. Commitments from approximately 150 operators had been received, including 30 operators from the Omaha/Council Bluffs area. This large block of people was assigned as a group to assist with the airport operation.

At 0430 hours on Thursday, October 4, the communications system commenced operations. The early work of the Planning Committee was now over,

and everyone anxiously waited to see how well the advance preparations would pay off.

Some pilgrims had arrived at Living History Farms on Wednesday evening to beat the expected throngs. They spent the night huddled together in small groups as temperatures dipped into the mid-thirties. By the time the communication system went on the air at 0430, 1,000 to 2,000 people per hour already were walking past some of the checkpoints. The field operators assisting the medical teams at Living History Farms and the airport reported in the chilly early morning hours to the Des Moines College of Osteopathic Medicine and were greeted with hot coffee supplied by KØCY. They were loaded aboard buses and taken to the airport and various pilgrimage staging areas. From there they walked with the marchers to the Farms, alerting medical teams of any medical emergencies en route.

Crowds at both the Farms and airport were greeted by a very chilly dawn. Shortly after sun-up, a cold breeze began to blow, chilling the gathering spectators who were clad for temperatures in the mid-sixties. The winds continued throughout the day. While thermometers rose to 48 degrees, the wind chill dropped the temperature to an apparent, frigid 25 degrees.

As the crowds gathered, the cold wind took its toll. Field hospitals began treating people suffering from various degrees of exposure. Spectators at the airport faced directly into the wind while gathering on an embankment at the edge of the runway apron where the Pope was to arrive. Among the 15,000 people who eventually gathered at the airport were over 100 severely handicapped in wheelchairs who were placed at the very front of the crowd so that they could be sure to be greeted by the Pope.

By mid-morning, operators at field locations at the Farms and airport passed the message back to medical staff that many blankets were desperately needed. A call went out to nearby motels, city hospitals, the Iowa Highway Patrol, and the Air Force Reserve. In response, several thousand paper blankets, blankets, and plastic bags were sent to help cut the wind and keep people warm.

At about 1030 hours, during the peak of the foot traffic at the Farms area, crowds passing some checkpoints were estimated at 4,000 to 6,000 per hour. Official estimates of the total crowd that eventually gathered at the 40-acre field were 340,000.

Ham radio activities during the day included much more than crowd control and calling for blankets. Operators provided valuable assistance to medical teams. Two doctors from the Omaha/Council Bluffs area, NØAZ and WBØZWE, came to help out for the day. Hams handled a wide variety of problems, including 250 reports of missing children and adults which were fed into a specially-designed computer system operated by the Iowa Department of Public Safety. Other emergencies included 14 suspected cardiac cases, 2 concussions, 3 sprained ankles, a laceration, a broken arm, and an impacted wisdom tooth which was dealt with by the staff dentist at the main field hospital. As it turned out, there were no deaths or births despite expectations. Medical emergencies were minimized by the effective presence of ham radio communications.

All systems functioned as planned, and aside from the failure of a few hand-helds due to weak batteries and long hours of operation (most hams brought extra batteries), there were no major equipment problems. It was gratifying to everyone involved that the many hours of intensive planning paid off.

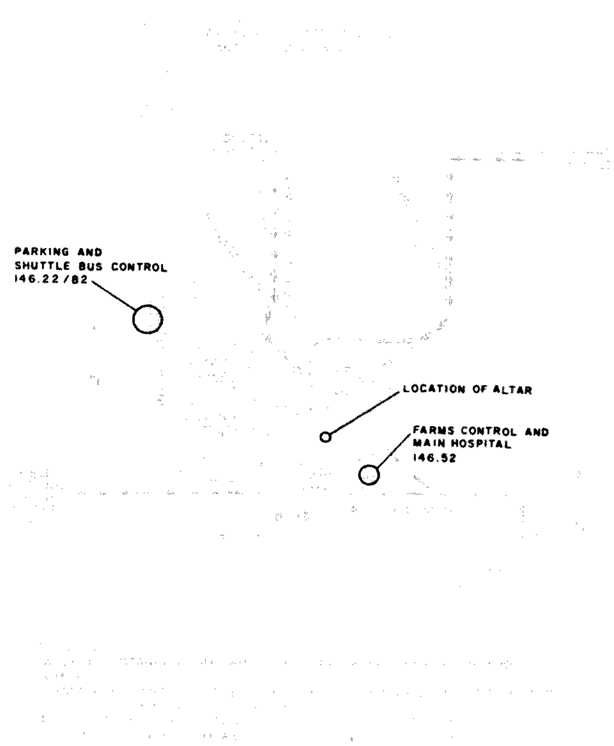

Fig. 3. This official map of the Living History Farms area shows the two control stations in the area plus details of the walking pilgrimages. Ham radio operators assisted with emergency medical communications along the pilgrimage routes.

Photo G. This is the view overlooking the press and broadcast communications tent. Members of the press may be seen just beyond the tent. The vertical antenna in the foreground is for military communications. (Photo by WBØIFF)

Photo H. A few of the airport medical teams take a break just outside the Airport Control van. Each control station had two transceivers. One was used to communicate with medical teams on 146.52 MHz and the other was used to communicate with the Lucas Control station on 147.60/00. (Photo by Charles Stover WØZZM)

Photo I. Some of the airport operators took time out for this group picture at the end of the day. (Photo by WØZZM)

The Des Moines Radio Amateur Association's involvement with the Pope's visit has helped cement much closer ties with Iowa State Government and law enforcement agencies and will ensure more effective use of amateur communications in unplanned emergencies. It also has given amateurs involved an opportunity to establish in the future an effective communications system that can be utilized in many kinds of public service situations. In short, the Pope's visit was much more than a religious experience for Des Moines residents. It was an opportunity to establish and field-test a lifesaving communications system that will benefit the public for many years.

Ham radio operators involved in the Des Moines operation can certainly take part of the credit for a comment which came from the coordinator of the Pope's US trip. The coordinator commented that the stop in Des Moines was more organized than stops in all other cities combined.■

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Confused About Phased Arrays?

—educate yourself with this simple model

Confused about how phased antenna elements cause a certain radiation pattern? If you're thinking about two vertical elements, each fed with an equal amount of rf power, you can construct a simple model that'll tell you quickly and accurately just how the actual radiation pattern will look.

Here's what you'll need: a large square of cardboard or similar material, two pins, two pieces of string, and two different-colored marking pens—say, red and green. Establish some measure (inch, cm, etc.) to represent a half wavelength in space (not coaxial cable). Retain that unit of measure for all segments of your pattern checks.

Now here's what you do, taking for the first check the exploration of the radiation pattern of two vertical radiators spaced a half wave (180°) apart and fed in phase. See Fig. 1(a) for a suggested configuration. Take two equal-length strings. These should be several wavelengths long and preferably some multiple of a half wave in total length. Fasten a pin at an end of each string. Then color a half-wave portion of the free end of each string one color (say, red), and going back toward the pins, color the adjacent half-wave section the contrasting color (say, green). Continue this sequence for another half wave or two. Now each of the strings will have the same color combinations at their free ends.

Next, select a spot near the center of that large sheet of cardboard and mark two points, one being directly above the other, a half wavelength away. Stick the two pins into these points. These pins simulate the two radiating elements and establish their relative positions. Then stretch out the two strings horizontally, parallel to each other. Arbitrarily designate this direction as 0°.

Now read your results. Note that like colors are together at the ends of the strings. This shows that the

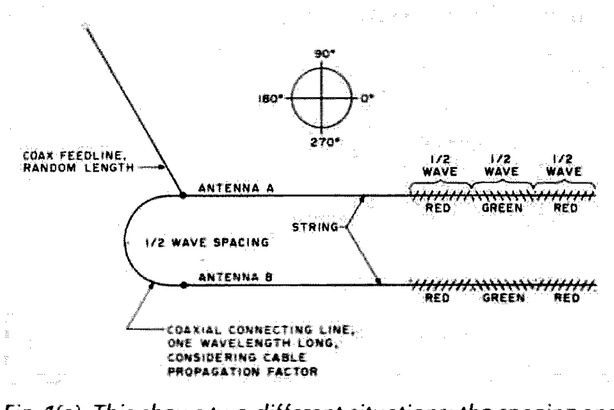

Fig. 1(a). This shows two different situations: the spacing and feed method for actual antennas and the method of simulating the generation of a radiation pattern. This simulation will show the radiation pattern of two antennas spaced a half wave apart and fed in phase with equal power to each antenna. A similar situation will exist at 180°.

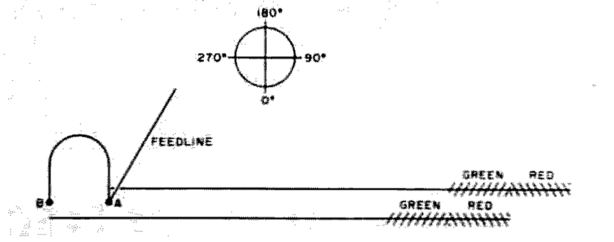

Fig. 1(b). Simulation of the phase relationship of radiation from two antennas spaced one-half wavelength apart and fed in phase with equal power to each antenna. Note the cancellation at 90°. A similar situation will exist at 270°.

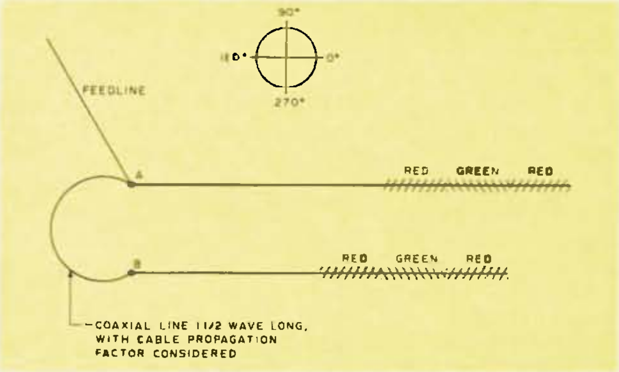

Fig. 2. Simulation of phase relationship at 0° for radiation from two antennas spaced one-half wavelength apart and fed equal power but out of phase. That is, the power fed to antenna B has been delayed 180° by an extra half wavelength of cable. Note the phase cancellation at 0°. A similar situation will exist at 180°. Mentally rotate the lines to 270° and you'll readily see the in-phase relationship. A similar situation exists at 90°.

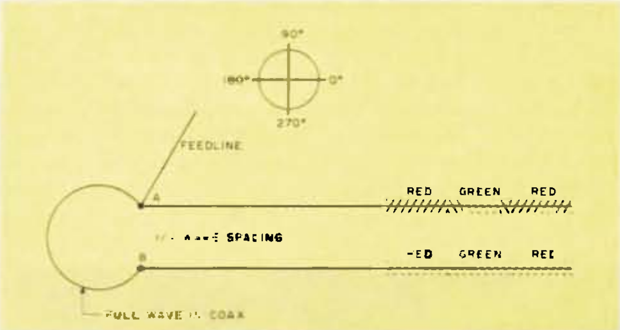

Fig. 3. Simulation for observing the radiation pattern of two antennas spaced a quarter wave apart and fed equal power in phase. Note that the pattern is similar to that of two antennas spaced a half wave apart and fed power in phase, except that the "nulls" are much less deep.

radiation from each antenna element is in phase with that of the other element, and that the total field strength in that direction (0°) is twice that which would be radiated from a single element. Now rotate the two strings (keeping them parallel to each other) a quarter turn (90°) counterclockwise. Observe the colors. Now you'll see that unlike colors are adjacent, showing that the phase of radiation from one element is unlike that from the other, so that the total field strength in that area is being reduced to nearly zero. Continue counterclockwise around 360° and you will have discovered the azimuthal radiation pattern of two vertical antennas spaced a half wave apart and fed in phase with equal rf power to each element.

For the next portion of your tour of discovery, look at Fig. 2, which tells you how to simulate the radiation from two antenna elements spaced a half wave apart but fed equal rf power with that of one element delayed 180° (½ wave) relative to the other. This is another way of saying they're fed out of phase. For this, you'll need to shorten one string (the one fastened to the pin representing the antenna element fed with the delayed rf power) by one half wave so as to duplicate the effect of delaying the phase of the

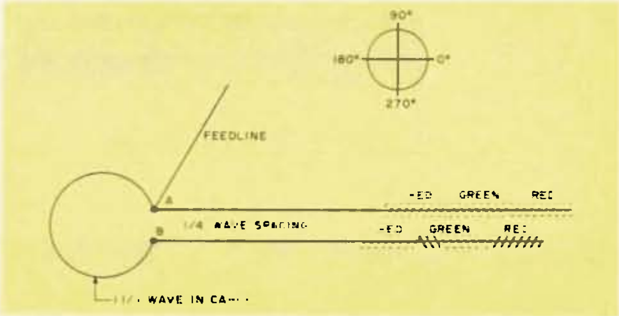

Fig. 4(a). Simulation for observing radiation pattern of two antennas spaced a quarter wave apart and fed equal power but with power fed to antenna B delayed by an extra quarter wavelength of cable. Note partial cancellation, partial enhancement of the pattern at 0°. A similar situation exists at 180°.

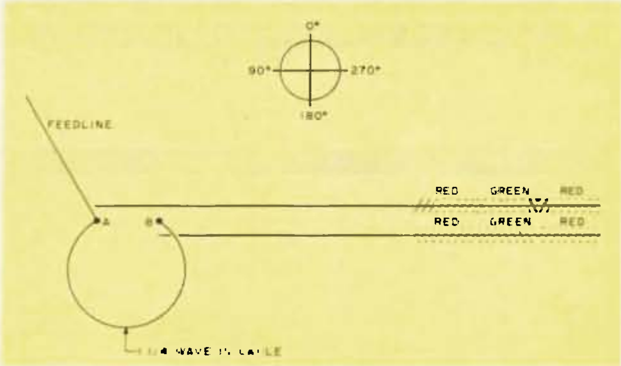

Fig. 4(b). Radiation pattern as observed at 270°. Note full enhancement. A similar situation will not *exist at 90°.*

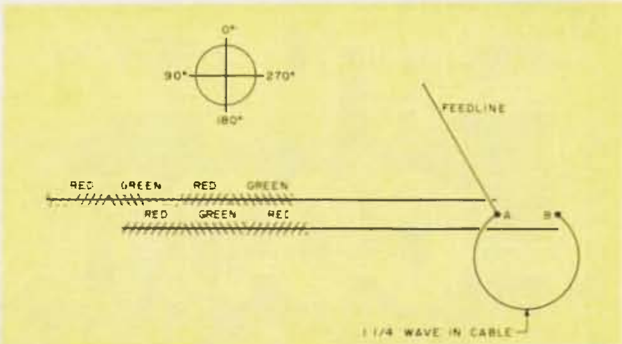

Fig. 4(c). Radiation pattern as observed at 90°. Note cancellation. Contrast this with the pattern observed at 270°, and you'll see the unidirectional effect of this antenna-and-feed configuration.

radiation from that element by 180°.

If you start with the strings pulled out in the same direction, 0°, as in the first portion of the prior check, you'll notice the adjacent colors are unlike. This indicates a minimum (a near null) in field strength at 0°, quite unlike what you found before. As you then swing the "elements" counterclockwise around 360°, you'll note a radiation pattern quite similar to that of the first check but having the points of minimum and maximum field strength displaced by 90°.

But what about other spacing of the radiating elements? Let's try 90° (¼-wave) spacing. This calls for

reducing the spacing between pins to one-half what you've been using. Also, you'll need to use equal-length strings for observing the pattern for in-phase feed. After you've looked at that, as in Fig. 3, you might want to shorten one string by one-half wavelength (180°) and check the pattern for out-of-phase feed.

When you've explored those patterns, look at Fig. 4. In this setup, you retain the quarter-wave spacing between elements but delay the rf power fed to one element by 90° (¼ wave). To compensate for this delay, you'll need to shorten the string for the pin representing that element by a quarter wave. Run through the same procedure you've used before. Note now that the pattern is unidirectional instead of bi-directional as on previous checks.

By using proper pin spacing to simulate actual radiating element spacing and proper string length to simulate the initial phase relationship, you can explore any combination your fancy may dictate! Just remember, these simulations are valid only for situations in which the radiating elements are fed equal rf power.

The methods of feeding antenna elements, as shown in the several figures, are displayed in a manner intended to show clearly the delay (or lack of delay) in the phase of rf power fed to one element as related to the phase of rf power delivered to its paired element. There's nothing wrong with these systems other than their requiring an inordinate length of feedline cable. There are other, preferable, ways of doing this in actual antenna installations, so you should consider alternative methods. ■

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A Beam for Less than a Buck

—have a ball for eighty cents

Title catch your eye? I thought it would. No, your contacts didn't fall out, you read it right—80 cents!

Looking for something fast, easy, inexpensive, and effective on 10 meters? Well, this could be right down your alley.

A good majority of amateurs in the ham world started out as CBers. What these ex-CBers don't realize is that they probably have the materials for a good two-element 10-meter beam around the house just sitting there and collecting dust. How about that old CB ground plane you used to use? If this is one of your household treasures, half the battle is won. Here's what I did.

I took my half-wave ground plane, (the particular one I used was a Super Mag), and disassembled the four radials and hardware that fastened the radials to the base. I then went to the local lumber store and got a five-foot piece of 2 x 2. Jerry Swank W8HXR was the supplier of the technical information, such as length of the driven and director elements, the spacing, etc.

What I was going to attempt to build was a 10-meter beam incorporating 2 elements. In this beam, one element is fed directly from the feedline and is a half wavelength of the operating frequency (Fig. 1). This is called the driven element. The other element receives power by either induction or radiation from the driven element and is known as the director element.

The elements were fastened to the wooden boom by using the hardware from my ground plane. Since the four radials were approximately 8½' long each, I had to cut two of them to a length of 7' 7" for a combined length of 15' 2" for the director. The other two radials were cut to 8' 2" each, for a combined length of 16' 4" for the driven element.

If you cut one or both of the elements too short, don't fret, because all is not lost. The length of the driven element will vary a little according to the design frequency. I cut my driven element too short and coiled a piece of bare wire on both sides of the driven element. I then let the wire drape down until I got a good swr reading (Fig. 2). Coaxial cable was then connected between the two radials of the driven element, being sure the shield was insulated from the center conductor. Spacing between driven element and director was around 4' 3".

The gain of this antenna was figured to be somewhere around 5 dB, but don't let this small figure scare you. Using the Kenwood TS-520S, this 80-cent cheapie (the cost of the 2 x 2) was found to make a difference in receiving of 2 to 4 S-units higher than my 4-BTV vertical, and 2 S-units when transmitting. (Polarization of the other station will, of course, play an important role.)

So, as you can see, for a very small amount of space you can have a pretty darn effective DX antenna for a fraction-fraction-fraction of the cost of a commercially-made beam. However, if you really feel ambitious and have the extra aluminum around the house or can obtain it for a reasonable price, another element can be added for an additional 3 dB of gain. A balun is not essential, but it could prove to be quite helpful in preventing your coax from radiating.

If you're thinking that it takes an expert craftsman and years of experience to build your own beam, you're wrong. When I built this antenna (about two years ago), I was 15 years old and had just a Novice class license; I know that if I can build my own antenna, *anybody* can!

I truly hope that you will be as satisfied and pleased with your antenna as I am with mine! ■

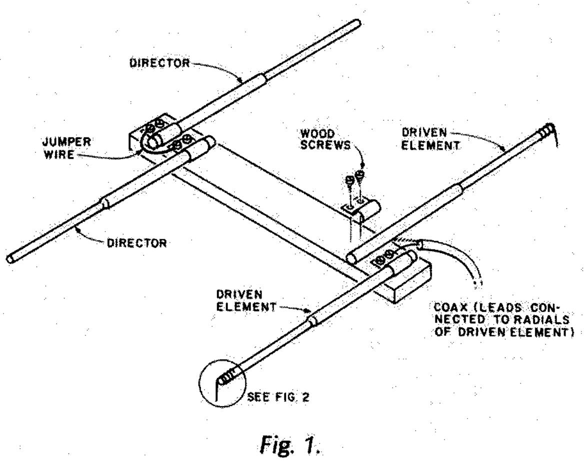

Fig. 1.

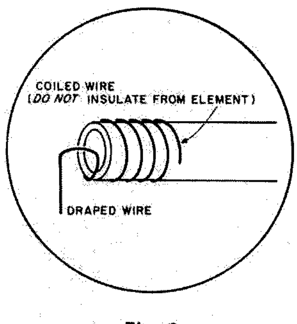

Fig. 2.

The California Crank-Up
—most convenient mast around

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Recently, while looking for some sort of tower for my two-meter, ten-element yagi, I found myself looking at those sliding push-up tubular masts which are used for hanging up television antennas.

I reasoned that if they could support some of those heavy, long-range DX television monstrosities, they certainly would not suffer under the weight of my two-meter antenna.

At the local ham outlet, I found a sale on these. The twenty-foot masts were going for $16.95. Upon arriving home with my purchase and extending it out on the patio, it was apparent that once installed on the roof, I would have to climb a six-foot ladder in order to push up the top section. As my house consists of three stories, this meant that once I was on the ladder, I would be looking down thirty-six feet to street level with nothing to hold on to. No thanks!

As a result, the mast rested in the yard for many weeks while several ideas for raising the top section were thought of and discarded. Only one method seemed to be reasonable, and that was converting to a crank-up.

If only I could insert a strong aircraft-type cable between the inner and outer tubular sections and attach the cable to the bottom of the inner section employing the same method used on commercial crank-up towers, I would have a cheap, functional, and lightweight mast. The fit between the two sections was quite sloppy and on my first try I was able to insert a 1/16" cable between the outer 1½" and the inner 1¼" tubular sections, but the fit was so tight it was obvious that a smaller cable would be necessary.

The next try was with a 3/32" aircraft cable which allowed the inner mast to move up and down freely. The cable then was attached to the bottom of the inner section and brought out over the top of the outer mast. Now, by pulling on the cable, the top section could be raised and lowered with ease. It became evident, however, that the cable traveling over the lip of the outer mast would become badly abraded, so an extension was fabricated with a wheel guide on one end. This was attached near the top of the outer mast in order to change the angle of cable entry. The lip of the mast was filed and sanded to a smooth contour and a heavy deposit of waterproof grease was applied. The extension containing the wheel guide is made of 1/8" x 1" x 10" fairly malleable steel scrap with the guide mounted on the end. Shims were used to maintain the extension at the desired angle. I'm sure that anyone with access to machine tools can improve on this, but this simple assembly works very smoothly. As an afterthought, I realized that a larger wheel would improve this operation.

Near the bottom of the mast is mounted a small winch rated at 1000 pounds. Although overrated for this application, it was on sale at K-Mart at $14.95. This is secured with two 1¾" muffler clamps and is easily moved up or down vertically as required.

In choosing a mast for this application, it would be advisable to pick one with as much space as possible between the inner and outer sections for ease of cable access.

The mast has been on the roof for the past seven months. The antenna has been raised and lowered six or seven times for swr or element adjustment. All these were made at eyeball level with both feet flat on the elevated bedroom roof while the base of the mast was mounted at second-story level. The convenience, safety, and low cost of this easily constructed crank-up mast should not be overlooked. For light duty, it has all the attributes of a commercial one. ■

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St. Augustine FL 32084

The Beachside 2-Meter Beam

—stands up to salt spray

For several months each year, I live on the beach on Anastasia Island just south of St. Augustine, Florida. The chief enemy of all antennas used in a coastal region is salt spray aided by heavy dews and tropical rains. These will reduce steel bolts to rust and render insulators useless in just a few short weeks.

There are no hills here, and the prevailing northeast winds plus the fact that I live in a trailer dictate the use of a simple design with low surface area and the use of only moderate height—about 20 feet.

I wanted to operate repeaters in Jacksonville (about 55 miles north), Daytona Beach (45 miles south), and Gainesville (about 75 miles west). The 3-element, balun-fed, Y-matched, all dc-grounded beam that I designed and built will do this when fed with the 1½-Watt output from a Tempo S1. When fed 25 Watts from my Kenwood 7625, it will deliver ample signal to operate repeaters in Titusville, Orlando, and St. Petersburg, all of which are more than twice as far away.

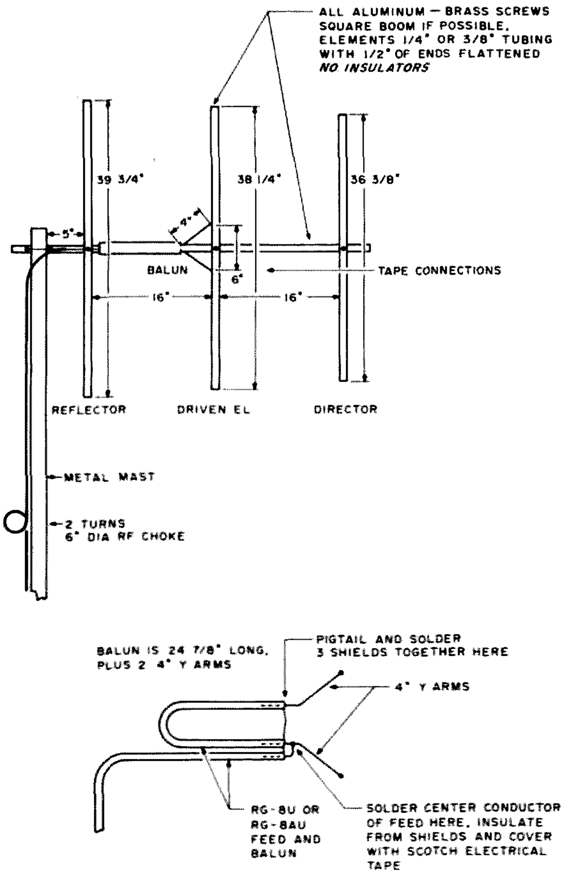
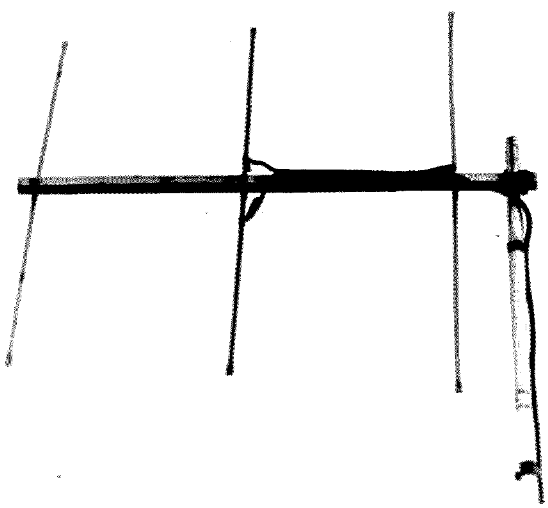


Fig. 1.



Beachside 2-meter beam with Y-match and balun.

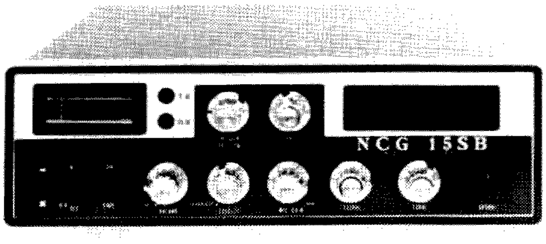
The beam is made from a junked TV antenna. It is mounted on a piece of TV mast, vertically, with a single U-clamp about 5" behind the reflector. The metal mast has no appreciable effect on the gain and provides a perfect dc ground, which is very useful here in Florida where 12-hour thunderstorms are not uncommon.

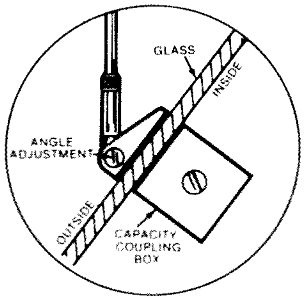
The element dimensions given will enable use anywhere in the 2-meter band; the Y-arms are exactly 4" and are attached to the driven element exactly 3" either side of the center, or 6" apart, with either clips or screws. These connections should be covered with a double layer of Scotch electrical tape. If this is done carefully, the joints will remain clean for several years even in this tropical climate.

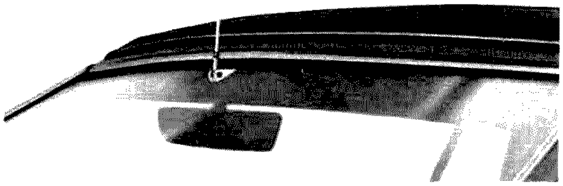
The balun is made from RG-8/U or other good quality, 52-Ohm coax, and is 24 7/8" long plus the 4" Y-arms on either end. The arms and the joint where the three shields are soldered together also are covered with Scotch electrical tape. The balun is attached to the driven element, folded lengthwise alongside the feedline, taped to the boom, and then led down the mast.

Although circulating rf currents on the coax shield do not seem to be a problem if the line is arranged as shown, it is always good practice to make a 2-turn, 6"-7"-diameter coil in the coax down away from the field of the beam and before the coax enters the shack.

The Beachside 2-meter beam can be dismounted, folded, and transported easily, as it occupies a space only 39" long and about 2" in diameter. ■







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Auburn AL 36830

Double Duty Mag-Mount Antenna

—it's a portable GP, too

When on the road, I have always enjoyed operating two meters with a modified IC-22S and a Hy-Gain ¼-wave magnetic-mount antenna. The rig operates well from the car, but has had swr problems when operated with the antenna in hotel rooms. Without the car acting as a ground plane, the swr of the antenna was above 3:1, which caused the swr protection circuitry of the IC-22S to substantially reduce the power output of the rig. I decided to try to modify the antenna so that it also could be used as a ground plane for portable operation. I wanted the conversion to ground-plane operation to be simple and not interfere with the antenna operation when mounted on the car top.

The resulting conversion is shown in Photo A. The ground plane is constructed from the small brass tubing found in most hobby shops. Each arm is built from one 12-inch length of 1/8-inch diameter tubing and one 11-inch piece of 5/32-inch diameter tubing. The two pieces are slipped together and adjusted to a total length of 20 inches. The joint and ends of the tubing are then soldered. One-inch pieces of 5/32-inch tubing are soldered to the base of the magnetic mount antenna and serve as mounting sleeves to hold the ground-plane legs. It was necessary to sand the base of the ¼-wave antenna in order to make a good solder connection.

The ground-plane antenna in its broken-down form is shown in Photo B. The antenna with its ground-plane arms still fits very nicely in my suitcase when traveling. The antenna attaches in its normal fashion to the top of the car for mobile operation and the ground-plane arms slip into the mounting sleeves for quick conversion to portable operation. The swr of the antenna has been measured to be slightly more than 1.4:1. This represents the minimum swr to be expected from the 36-Ohm radiation resistance of a ground-plane antenna with horizontal arms. The IC-22S now operates into the converted antenna without any noticeable power reduction and the antenna has added to my operating enjoyment on numerous trips and on vacation.■

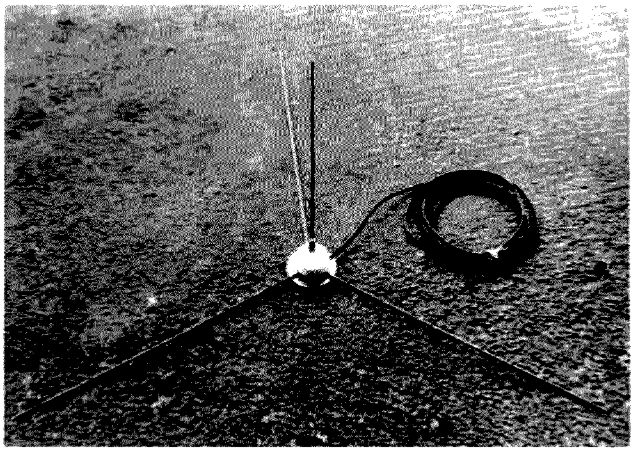

Photo A.

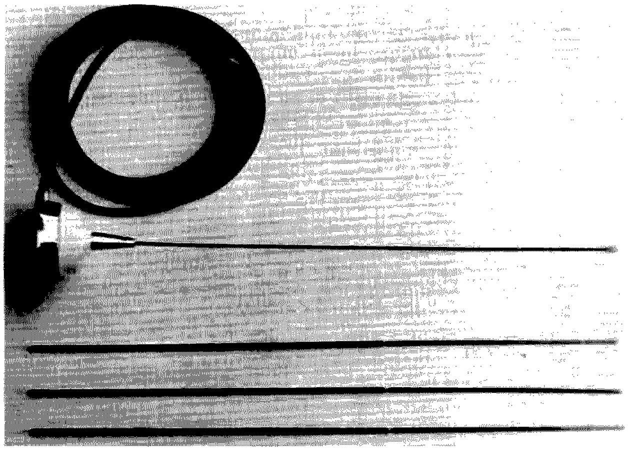

Photo B.

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Somerset KY 42501

A 40-Meter Quad for $20

—assuming you own two towers

With the increased DX activities on 80 and 40 meters, I decided to try my hand at 40-meter DXing. I soon found out that the old inverted vee antenna just did not make the grade. I could do a fair job running a kW, but in the pileups with all the big guns, it was an entirely different story.

What I needed was an antenna with gain and directivity but with low cost and low wind loading. So a beam was out of the question. I decided, therefore, upon a fixed-direction quad. Since I have towers on the east and west ends of my lot located approximately 200′ apart, I decided to string the quad between these two towers.

My first try was a driven element only. This was an improvement in signal gain but was bi-directional north and south. One added advantage was a decrease of broadcast QRM from Europe, but, like everyone else, I wanted something better, so I decided to add a reflector element.

How to do it, was the problem. It then dawned on me that since the spacing between elements was around 17 feet, why not use 20′ two-by-fours in the top of the towers to get the element spacing? So, after a look in my junk box and a visit to the local hardware store, I was ready to start work.

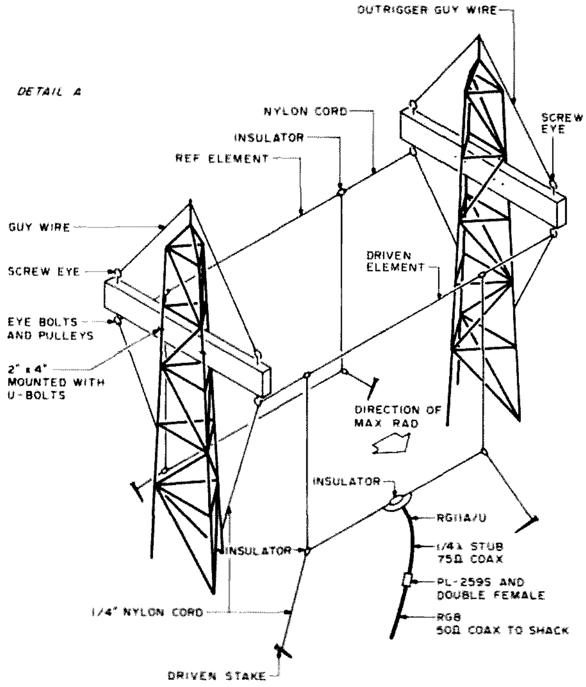
After cutting the wire for the driven element and reflector to their respective lengths, I installed four insulators on the reflector so that each side was 35′ 8″ in length. Five insulators were used on the driven element to give each side a length of 34′ 8″, with the fifth insulator used where the coax is attached.

I drilled holes 17′ apart in each of the two-by-fours and installed eye bolts with pulleys in each hole. Screw eyes were installed in the end of each to attach the outrigger support wires to keep the two-by-fours from bending from element strain. I used spar varnish to weatherproof them. They were mounted in the top of the towers with 1½″ U-bolts. Guy wire was used as an outrigger.

Be sure to get some help installing the two-by-fours as they are hard to handle by yourself. Quarter-inch nylon cord was used to pull each element into the air; the bottom halves were tied off to ground stakes.

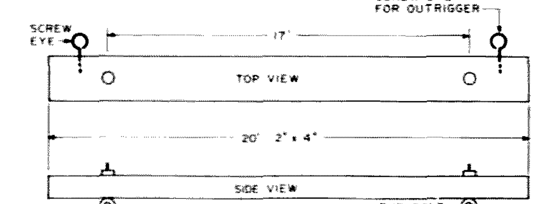
After the antenna was installed, swr and bandwidth checks proved to be better than I had hoped for. The swr meter showed that reflected power was lowest at 7.200 MHz. On-the-air tests

DETAIL A



REF ELEMENT 5% LONGER THAN DRIVEN ELEMENT
2 x 4s MOUNTED TO TOWERS WITH U-BOLTS

DETAIL B



have proven to be excellent. The quad is fixed to the south south-west, and reports from VK and ZL have been S9 plus constantly. I've received S9 into Japan, long path. So, if you can't put up a 40-meter beam, then try this antenna. You might be surprised. Total cost of this antenna was $20.00. ■

Construction Details

Specifications:
Two-element quad; 8.0 dB gain; 20 dB front-to-back ratio; spacing is 1/8 λ, which is 17.0 feet; No. 14 wire, enameled copper; 5% *difference factor* between elements; design frequency is 7.200 MHz.

Driven Element
For the driven element, I used $L = 1005/F_{MHz}$ to obtain the element length. For 7.200 MHz, this is 139' 5" or 34' 8" per side.

Reflector
Here, I used $L = 1030/F_{MHz}$ to obtain a wire length for 7.200 MHz of 143' 0" or 35' 9" per side.

Feeding the Quad
I decided to use a quarter-wave stub to feed the driven element. I used 72-Ohm coax since I had a large amount on hand. However, kW-rated twinlead also can be used. Below are the lengths for both coax and twinlead.

Stubs
The formula $L = 246(VF)/F_{MHz}$ is used for stub length.
For RG-11A/U coax, Z = 72 Ohms and VF = 0.66. Driven element stub length for 7.200 MHz is 22' 6½".
For 1 kW-rated twinlead, Z = 72 Ohms and VF = 0.71. Stub length for 7.200 MHz is 24' 3".
The stubs should be cut as close to calculated lengths as possible. Using a PL-259 with a barrel connector, I attached the stub to the 52-Ohm coax feedline to the shack. Using my noise bridge and R-4C, I tuned the 52-Ohm coax stub for lowest swr.

References

1. *Radio Handbook*, 20th edition, Orr.
2. *Cubical Quad Antennas*, Orr.
3. *Antenna Handbook*, 78 edition, Orr.
4. ARRL *Antenna Book*, 78 edition, ARRL.

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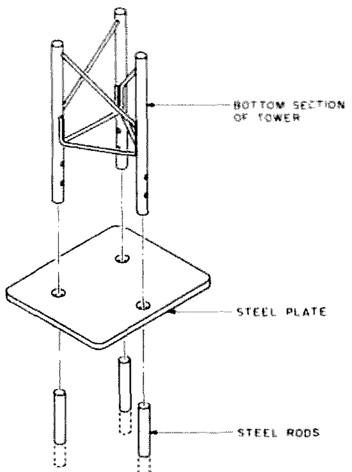
Lubbock TX 79490

A Dirt-Cheap Tower Base

—you can take it with you

When I finally bought the antenna tower I had wanted for years, I found I had given little thought to how it would be anchored to the ground. Obviously, the base should be anchored so that lateral movement parallel to the ground is not possible and also so that the base will not settle into the ground and thus slacken the guy wires. The salesman at the electronics store suggested I buy the short section that Rohn sells with its 24-series towers. I was told that most people set the short section in a hole and pour concrete around it, filling up the hole and leaving a few inches of the section protruding above the top—just enough to attach a section of the tower.

The salesman and I discussed what would happen to this excellent mounting base when it came time to move to another home. He told me that most hams remove the tower from the base and simply saw off the three protruding legs of the short section (flush with the surface of the concrete) and cover the remains with a thin layer of dirt. Somehow I could not reconcile myself to the thought of leaving a part of my precious tower buried in someone's backyard, so I decided to buy five sections of Rohn 24 tower and a top section as planned—and went home to study the problem.



During the years I spent growing up on a farm and later working as a welder and electrician, I was exposed to a variety of problems that required improvisational techniques (jury-rigging). I was determined to utilize my experience in finding another method by which I could anchor my tower. The answer lay on the scrap pile of steel which I have collected over the years. I dug out a 2′ x 2′ piece of ¼″-thick steel plate and three 4′-long steel rods having a diameter slightly less than the inside diameter of the legs of a tower section. I set the bottom of a tower section on the approximate center of the plate and marked the location of each of the three legs. Then I drilled a hole just large enough to allow a rod to pass through at each of the three marks. The plate was placed flat on the ground at the location where the tower would stand. Each rod was run through a drilled hole in the plate and pounded into the ground with a sledgehammer until about eight inches of each rod was left protruding above the plate. The legs of the first section of the tower were placed over the ends of the rods, and a level was used to ensure that this section was perfectly vertical before proceeding.

I then drilled holes through the rods using the bolt holes in the tower legs as guides. Then I installed bolts and nuts to secure each rod and leg together. My tower was now anchored against any lateral movement by the steel rods, and further settling was prevented by the steel plate which the bottom of each leg rested upon. *Caution: This type of mounting is not secure enough to keep the tower section upright while supporting the weight of a climber. The first section of tower must be firmly guyed or supported until the first set of permanent guy wires is installed further up the tower.*

My tower has now been up for three years and has withstood countless assaults by the notorious west Texas wind, along with ice storms, without settling or shifting. The tower is guyed at the 20-, 40-, and 58-foot levels in all four directions, and there are no less than eight HF, VHF, and UHF antennas mounted on the top 20 feet. Naturally, if your soil is softer than my hardpacked dirt, the square

footage of the steel plate should be increased. As the area of the plate is increased, the thickness should also be increased proportionately.

Now, you say, how does this anchor method benefit you when you pack up to leave town? Read on! Disassemble your tower and remove the bottom section from the rods. Enlist the aid of your auto bumper jack and a few feet of sturdy chain. The chain is looped around the top of the rod and prevented from sliding by a bolt or pin inserted through the bolt hole in the rod. The remainder of the chain is looped over the hook of the jack and the rod can then be jacked out of the ground. If it cannot be pulled out of the ground by hand (after the jack has reached the upper limit of travel), simply allow the chain to slide downward on the rod as the jack is lowered, clamp a large vise-grip plier on the rod above the chain, and crank it out of the ground with the jack. Now you can load up everything and start over again somewhere else!

A word of caution—*never* climb a tower without a sturdy pair of boots (preferably lineman-type with steel arch supports), a sturdy climbing belt or safety belt of the industrial type, and an approved hard hat or hard cap. You may think a hard hat is unnecessary and silly if you are the strong and virile type, but I assure you that you will be glad you have one should a gust of wind catch an antenna on the way up and clobber the old cranium! Head protection is also a must for anyone working *under* a climber. A 3-inch screwdriver dropped from 50 feet can penetrate even a hard head like mine. *Be careful* and have fun! ■

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Triband Dual Delta

—here's an attic antenna that works

One of the nicest things about amateur radio is that one often can obtain excellent performance from simple antennas. I recently moved into a new house which depleted my bank account beyond my wildest nightmares. I had hoped to be able to find a triband beam antenna that would fit my financial situation, but it did not take long for reality to ruin my dreams of a cheap, effective beam antenna. Consequently, I decided to homebrew the most effective triband antenna that I could for the least amount of money.

After much searching and experimenting, the type of antenna I finally settled on covered 20, 15, and 10 meters, and was cheap, reasonably effective, and, as a bonus, was completely hidden from view. The antenna I chose was a delta-loop antenna, using the driven element of a delta-loop beam mounted horizontally *inside* the attic of my new house.

Construction

The formula for the length of the driven element of a delta loop is $1005/f_{MHz}$. Since I was bound to need some extra wire at the ends, I cut the antenna to 71 feet overall in length for a 20-meter loop. I mounted the antenna to the rafters inside the attic, using screw hooks and ceramic insulators to hold the wire at three corners.

I used #14 solid, Formvar-insulated wire simply because it was cheap and available; you could use smaller wire if cost considerations were important, however. Try to select a section of the attic that doesn't have a lot of metal ductwork or plumbing lines that could detract from the performance of the delta loop. Also, make sure that the wire isn't touching any wood or metal inside the attic.

I initially fed the antenna with a random length of 50-Ohm coaxial cable and a 1:1 balun. However, I found out that the swr was substantially higher than I wished. I measured the antenna with a noise bridge and found out that an impedance-matching device would be necessary to use the antenna on 20 meters. Rather than changing the length of the antenna, using a length of 72-Ohm coaxial cable to match the impedance, or using a gamma match, I chose to substitute a 4:1 balun for the 1:1 balun already on the antenna. I was rewarded with an swr of 1.3 to 1 across almost all of the 20-meter band. The broadband characteristics of the antenna were helpful with respect to swr, although overall efficiency suffered due to the relatively low Q. As a bonus, the antenna worked very well on the entire 10-meter band also, with an swr of 1.8 to 1 on the entire band.

For a total investment of $25, I had a 20- and 10-meter antenna that had a theoretical gain of 2 dB over a dipole and, best of all, it was completely invisible to the neighbors.

Not happy with missing out on the action on 15 meters, however, I added a second delta loop inside

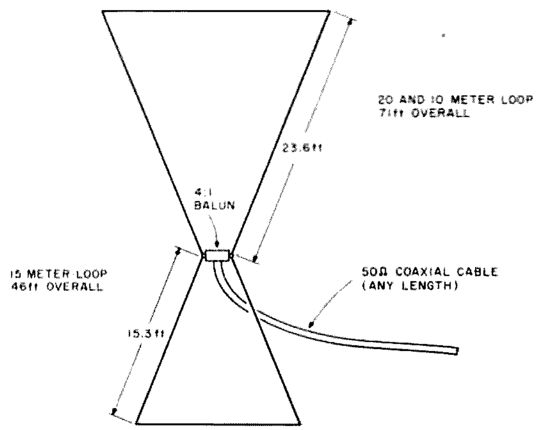

Fig. 1. Top view of the dual delta loop.

the first loop. The second loop was cut to 46 feet and also was laid out in the form of an equilateral triangle. The 15-meter loop was soldered to the 4:1 balun at the same point that the 20- and 10-meter loop was soldered.

Needless to say, adding the 15-meter loop increased the swr of the 20- and 10-meter loop to over 2.5 to 1 on both bands. Since I wasn't ready to give up yet, I took the 15-meter loop and rotated it 180 degrees so that the balun was now at the apex of two delta loops (see Fig. 1). This variation was a winner, with the swr on 20 and 10 returning to its original values and the 15-meter loop giving a 2.1 to 1 swr across the entire band.

Performance

While I would like to say that I worked some exotic DX while running barefoot with 3 Watts on sideband, I can't say that the performance of my dual delta loop is equal to that of a beam, but it will provide a bit better performance than a longwire or a dipole, and with an acceptable swr on 20, 15, and 10 meters.

The antenna appears to be omnidirectional, although ductwork inside the attic might affect the radiation pattern somewhat. Needless to say, mounting the dual delta loop outside and much higher than the 10-foot height of mine will provide some increase in performance.

The low price ($30) and unobtrusive nature of the dual delta loop make it attractive to hams who are faced with restrictive covenants regarding towers and antennas. Try the dual delta loop; you can't beat it for performance, price, and simplicity. It really beats a dipole! ■

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Try a Fox and Hare Special

—antenna for DF operations

I always have sought unusual objects to use as antennas ever since I first saw my brother load into a curtain rod in his shack and work Japan on 10 meters.

One old idea I never tried was to check the radiation characteristics of a globe as a driven element. The idea is that half the circumference of a globe is really the same as many quarter wavelength verticals bent in an arc.

I didn't have a globe of 12½" diameter, so I thought I would try a circle of wire, total length 38", and see if it would load. Not knowing how to approach counterpoise construction for such a configuration, I added one radial, horizontal and in line with the loop. The field strength meter I had nearby for comparison of the globe vs vertical antenna indicated an extremely sharp single directivity.

I also tried bending the radial down 45° from horizontal; however, this only increased the beamwidth to about 40°. I tried several other settings but returned to the original, which proved to be the optimum position for narrow beamwidth.

Construction

The antenna loop and radial are made of #14 copperweld wire. After soldering the loop together, it is securely fastened to a 10" long wooden handle by wire staples. The radial is connected in a like manner. A small bead (from XYL?) should be epoxied on the end for safety.

Conclusion

This highly directional antenna, combined with a portable 2 meter rig with S-meter, makes an excellent "fox and hare" transmitter hunt combination. Its relatively small physical size and excellent front to back/front to side ratio make this antenna also practical for HF experimentation. ■

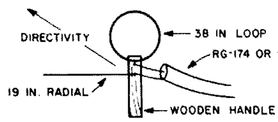

Fig. 1.

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Norfolk VA 23508

Norman V. Cohen WB4LJM
7719 Sheryl Drive
Norfolk VA 23508

The IC Outener

—remove soldered-in chips

We thought that we would never try to salvage integrated circuits from surplus boards until the construction of a microprocessor was started. After pricing the needed integrated circuits, it became obvious that salvaging would have to be done or we would simply have to forget the idea of a personal computer.

The first method tried was using a vacuum-powered solder remover. It was too slow, and a fair number of the circuits were destroyed or their operation became marginal because they were overheated. There were similar results using wire braid to absorb the solder.

Using a propane torch to heat all of the pins simultaneously was faster and less damaging, but was dangerous. We almost set the workbench on fire twice, and we did not like the fumes coming from the overheated printed circuit board.

Putting our heads and resources together, a more practical solution was found. A sixteen-pin integrated circuit socket-hole pattern was laid out on a piece of 3/16" brass measuring .5" × .9". The holes were drilled through with a #43 drill as shown in Fig. 1. The oversized holes permit even heating around each pin of the integrated circuit simultaneously.

Fig. 2 illustrates how the tool was mounted to a small 50-Watt soldering pencil. For our pencil, a cut-off 6-32 brass screw was used, but you might have to devise a slightly different arrangement, depending on the pencil you have.

With the tool pressed against the bottom of the printed circuit board, the typical time to desolder an integrated circuit is only three seconds. ■

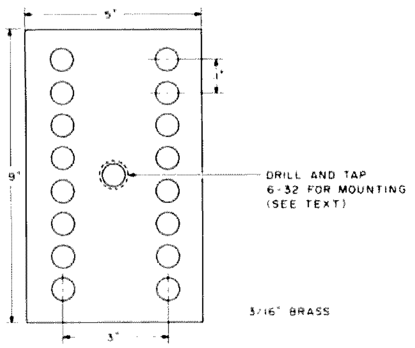


Fig. 1. Desoldering tool.

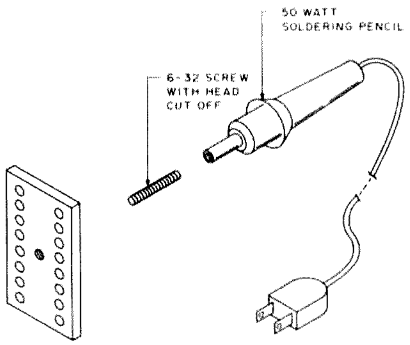


Fig. 2. Mounting arrangement.

OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR MAY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
24972	1	0019:11	74.8
24985	2	0113:27	88.4
24997	3	0012:46	73.3
25010	4	0107:01	86.9
25022	5	0006:20	71.7
25035	6	0100:36	85.3
25048	7	0154:51	98.9
25060	8	0054:10	83.7
25073	9	0148:26	97.3
25085	10	0047:45	82.2
25098	11	0142:00	95.8
25110	12	0041:19	80.6
25123	13	0135:35	94.2
25135	14	0034:53	79.1
25148	15	0129:09	92.6
25160	16	0028:28	77.5
25173	17	0122:43	91.1
25185	18	0022:02	75.9
25198	19	0116:18	89.5
25210	20	0015:36	74.4
25223	21	0109:52	88.0
25235	22	0009:11	72.8
25248	23	0103:26	86.4
25260	24	0002:45	71.2
25273	25	0057:01	84.8
25286	26	0151:16	98.4
25298	27	0050:35	83.3
25311	28	0144:50	96.8
25323	29	0044:09	81.7
25336	30	0138:25	95.3
25348	31	0037:43	80.1

OSCAR 8 ORBITAL INFORMATION FOR MAY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
10983	1	0010:51	53.8
10997	2	0015:43	55.1
11011	3	0020:35	56.3
11025	4	0025:27	57.6
11039	5	0030:19	58.8
11053	6	0035:11	60.0
11067	7	0040:03	61.3
11081	8	0044:55	62.5
11095	9	0049:47	63.7
11109	10	0054:38	65.0
11123	11	0059:30	66.2
11137	12	0104:22	67.5
11151	13	0109:13	68.7
11165	14	0114:05	69.9
11179	15	0118:56	71.2
11193	16	0123:48	72.4
11207	17	0128:39	73.6
11221	18	0133:31	74.9
11235	19	0138:22	76.1
11248	20	0000:01	51.6
11262	21	0004:52	52.8
11276	22	0009:43	54.0
11290	23	0014:34	55.3
11304	24	0019:25	56.5
11318	25	0024:16	57.7
11332	26	0029:07	59.0
11346	27	0033:58	60.2
11360	28	0038:49	61.4
11374	29	0043:40	62.7
11388	30	0048:30	63.9
11402	31	0053:21	65.1

OSCAR 7 ORBITAL INFORMATION FOR JUNE

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
25361	1	0131:59	93.7
25373	2	0031:18	78.6
25386	3	0125:33	92.2
25398	4	0024:52	77.0
25411	5	0119:07	90.6
25423	6	0018:26	75.4
25436	7	0112:42	89.0
25448	8	0012:01	73.9
25461	9	0106:16	87.5
25473	10	0005:35	72.3
25486	11	0059:50	85.9
25499	12	0154:06	99.5
25511	13	0053:25	84.3
25524	14	0147:40	97.9
25536	15	0046:59	82.8
25549	16	0141:14	96.4
25561	17	0040:33	81.2
25574	18	0134:48	94.8
25586	19	0034:07	79.6
25599	20	0128:22	93.2
25611	21	0027:41	78.1
25624	22	0121:57	91.7
25636	23	0021:15	76.5
25649	24	0115:31	90.1
25661	25	0014:50	75.0
25674	26	0109:05	88.5
25686	27	0008:24	73.4
25699	28	0102:39	87.0
25711	29	0001:58	71.8
25724	30	0056:13	85.4

OSCAR 8 ORBITAL INFORMATION FOR JUNE

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
11416	1	0058:12	66.4
11430	2	0103:02	67.6
11444	3	0107:53	68.8
11458	4	0112:43	70.1
11472	5	0117:34	71.3
11486	6	0122:24	72.5
11500	7	0127:15	73.8
11514	8	0132:05	75.0
11528	9	0136:55	76.2
11542	10	0141:45	77.5
11555	11	0003:23	52.9
11569	12	0008:13	54.1
11583	13	0013:03	55.4
11597	14	0017:53	56.6
11611	15	0022:43	57.8
11625	16	0027:33	59.0
11639	17	0032:23	60.3
11653	18	0037:13	61.5
11667	19	0042:03	62.7
11681	20	0046:52	64.0
11695	21	0051:42	65.2
11709	22	0056:31	66.4
11723	23	0101:21	67.7
11737	24	0106:10	68.9
11751	25	0111:00	70.1
11765	26	0115:49	71.3
11779	27	0120:39	72.6
11793	28	0125:28	73.8
11807	29	0130:17	75.0
11821	30	0135:06	76.3

Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

NEENAH WI
MAY 3

The 3-F Amateur Radio Club will hold its swapfest on Saturday, May 3, 1980, at the Neenah Labor Temple, 157 South Green Bay Road, Neenah WI. Admission is $1.50 in advance for tickets and $1.50 for tables. Admission at the door will be $2.00 for tickets and $2.00 for tables. Facilities include a large parking area, and large indoor and outdoor swap area, with a free auction provided at the conclusion of the day. Food and beverages will be available. For further information, write Mark Michel W9OP, 339 Naymut Street, Menasha WI 54952, or phone (414)-722-4034.

MEADVILLE PA
MAY 3

The sixth annual Northwestern Pennsylvania Hamfest will be held on May 3, 1980, at the Crawford County Fairgrounds, Meadville PA. The gates will open at 8:00 am. Admission is $3.00; children under 12 are free. Indoor table spaces are $5.00 and outside car spaces are $2.00. Bring your own tables. Refreshments will be available. Talk-in on .04/.64, .81/.21, and .63/.03. For information, write CARS, PO Box 653, Meadville PA 16335, Attention: Hamfest Committee.

DULUTH MN
MAY 3

The Arrowhead Radio Amateurs will hold their annual spring swapfest at the First United Methodist Church, 230 E. Skyline, Duluth, Minnesota, from 10:00 am to 3:00 pm on Saturday, May 3, 1980. Activities include a flea market, silent and live auctions, special-interest

programs (ARRL, VHF, and DXing), and prizes. There will be food available and plenty of free parking. Talk-in on .34/.94, W0GKP. For more details, send an SASE to ARAC Swapfest, 123 E. 1st Street, Duluth MN 55802.

LYNCHBURG VA
MAY 3

The Lynchburg Amateur Radio Club will hold its annual swapfest on May 3, 1980, at Brookville High School in Lynchburg. Doors will open at 10:00 am. Tables will be available, along with plenty of free parking, space for tailgaters, and food service. For further information, contact John McClenon, 712 Riverside Drive, Lynchburg VA 24503.

WARMINSTER PA
MAY 4

The Warminster Amateur Radio Club will hold the sixth annual Ham-Mart on Sunday, May 4, 1980, from 9:00 am to 4:00 pm at the William Tennent Intermediate High School, Route 132 (Street) and Newtown Roads, Warminster PA. There will be door prizes, a flea market, an auction, and a free FM clinic. There will be food, drink, and tables available. Registration is $2.00 per person (children under 14 free), $3.00 per space for sellers, and $5.00 per space for one indoor table. Tickets for the Wilson HT drawing are additional. Talk-in on 146.52 simplex or 146.16/.76 on the PARA repeater. For more information, write WARC, PO Box 113, Warminster PA 18974, or call Pat Cawthorne W3DNI, (215)-672-5289.

FALL RIVER MA
MAY 4

The fourth annual Bristol County Amateur Radio Association flea market and radio auction will be held on Sunday, May 4, 1980, from 9:00 am until 5:00 pm at the Knights of Columbus Hall, Meridian Street, Fall River MA. Talk-in on 146.31/.91. For more information, write to Gerald P. DiChiara AA1Q, 35 Central Avenue, Assonet MA 02702.

STIRLING NJ
MAY 4

The Tri-County Radio Association will hold its annual indoor hamfest/flea market on May 4, 1980, at the Passaic Township Youth Center, Valley Road, Stirling NJ, from 9:00 am to 4:00 pm. Admission is $2.00 and tables are $5.00. Food will be served. There will be many door prizes. Talk-in on 147.855/.255 or 146.52. For information, write TCRA, Box 412, Scotch Plains NJ 07076, or phone Herb Klawunn at (201)-647-3461.

DE KALB IL
MAY 4

The Kishwaukee Radio Club and the De Kalb County Amateur Repeater Club will hold their annual indoor/outdoor hamfest on Sunday, May 4, 1980, from 8:00 am to 3:00 pm at the Notre Dame School (3 miles south of De Kalb, between Highway 23 and South 1st Street on Gurler Road). Tickets are $1.50 in advance and $2.00 at the door. Indoor tables are available, but if you bring your own, the setup is free. Talk-in on 146.13/.73 and .94 simplex. For further information, send an SASE to Howard WA9TXW, PO Box 349, Sycamore IL 60178.

AURINGEN GERMANY
MAY 4

The Wiesbaden Amateur Radio Club and DOK F20 Club of Wiesbaden will sponsor a hamfest on Sunday, May 4, 1980, starting at 10:00 am at Auringen (5 km North of Wiesbaden on Highway 455). The activities will include a flea market, vendors, displays, computer demonstrations, technical assistance, left-foot CW contest with 5 wpm certificate, prizes, and plenty of refreshments. Talk-in on 145.55 MHz. Signs will be posted giving directions to the hamfest from the major Autobahns passing Wiesbaden.

NEWPORT RI
MAY 5

The Newport County Radio Club will hold an auction on May 5, 1980, at 7:00 pm at the Seamen's Institute, 18 Market Square, Newport RI 02840.

FRESNO CA
MAY 9-11

The Fresno Amateur Radio Club, Inc., will hold the 38th annual Fresno Hamfest on May 9-11, 1980, at the Hacienda Inn, Clinton and 99, Fresno CA. Full registration is $20.00 in advance; $23.00 at the door. Partial registration is $5.00. The ladies' program is $7.00. Advance registration closes May 2, 1980. There are many activities planned, including a prime rib banquet. Talk-in on 146.34/.94. For more information, write to Fresno Hamfest, PO Box 783, Fresno CA 93712.

SANTA BARBARA CA
MAY 9-11

The 25th annual West Coast VHF Conference will be held on May 9-11, 1980, at the Miramar Hotel, Santa Barbara CA. Highlights will include a hospitality room on Friday evening (May 9), technical sessions on Saturday (May 10), a program featuring key participants in the VHF-UHF propagation breakthroughs of 1979-80, noise-figure measurements on Saturday evening, antenna gain measurements on Sunday morning, plus technical exhibits, door prizes, and a drawing. Pre-registration is $4.00 per person until May 1, 1980, and registration at the door is $6.00. Registration forms, hotel information, and further details may be obtained by writing to Wayne Overbeck N6NB, Conference Coordinator, 5818 Woodlake Avenue, Woodland Hills CA 91367; (213)-347-3456 (home) or (213)-446-4311 (office).

GREEN BAY WI
MAY 10

The Green Bay Mike and Key Club will hold its swapfest from 8:30 am to 3:30 pm on May 10, 1980, at the Ashwaubenon Recreation Center. Admission will be $1.50 advanced and $2.00 at the door. Food and beverages will be served. There will be drawings for door prizes. For more information, contact Bob Duescher KA9BXG, 1011 13th Ave., Green Bay WI 54304. Talk-in on .72/.12.

DEERFIELD NH
MAY 10

The Hosstraders Net will hold its 7th annual tailgate swapfest on Saturday, May 10, 1980, at the Deerfield Fairgrounds, Deerfield NH. There will be covered buildings, in case of rain. Admission is $1.00, with no commission or percentage. Commercial dealers are welcome at the same rate. Excess revenues will benefit the Boston Burns Unit of the Shriner's Hospital for Crippled Children. Last year we donated $1,355. Talk-in on .52 and 146.40/147.00. For information or map, send an SASE to Joe Demaso K1RQG, Star Route, Box 56, Bucksport ME 04416, or Norm Blake WA1IVB, PO Box 32, Cornish ME 04020.

ROCHESTER NY
MAY 16-17

The Rochester Hamfest and New York State ARRL Convention will be held on Friday and Saturday, May 16-17, at the Monroe County Fairgrounds Dome Center, Route 15A, Rochester, New York. Indoor and outdoor flea-market space will be available. Forums, technical programs, and other meetings will be held on Saturday. Equipment displays and flea market will open on Friday afternoon. Hamfest headquarters is the Rochester Marriott Inn at the NY State Thruway. Send a QSL to Rochester Hamfest, Box 1388, Rochester NY 14603, to have your name added to the mailing list, or call us at (716)-424-1100 for specific information.

BOXBOROUGH MA
MAY 16-18

The sixth annual Eastern VHF/UHF Conference will be held on May 16-18, 1980, at The Sheraton Inn and Conference Center, I-495 at Route 111, Boxborough MA. Registration is $10.00 in advance of May 1, 1980, and $15.00 at the door. Reservations for the Saturday evening banquet are $16.50 and must be made by May 1, 1980. Room accommodations and meals will be available. Features will include a hospitality room Friday evening; technical talks on antennas, propagation, receiver design, OSCAR Phase III, transmitter design, and microwave circuitry; noise figure measurements through 2300 MHz; EME panel discussion; 70-cm antenna gain measurement; technical exhibits; door prize drawings for early registration. For reservations, make checks out to Eastern VHF/UHF Conference. For more information, contact Rick Commo K1LOG, 3 Pryor Road, Natick MA 01760.

DALLAS TX
MAY 16-18

The Region 4 Conference of Air Force MARS will be held on May 16-18, 1980, in Dallas TX. Prospective members are welcome. For further details, contact Jerry Barnes K5AKB/AFF4C, 637 Pinehurst Drive, Richardson TX 75080.

COEUR D'ALENE ID
MAY 17

The Kootenai Amateur Radio

Society will hold its annual Ham Meet on May 17, 1980, at the Northern Idaho Fairgrounds, Government Way, Coeur d'Alene ID. There will be commercial displays, auctions, a swap and shop, contests, and a snack bar. On Friday evening there will be entertainment. Doors will open at 7:00 am and the show will start at 9:00 am. Parking will be available at the fairgrounds. Talk-in on 146.52 simplex and 146.37/.97, club repeater W7LQT/R. For information on free table reservations or tickets, write KARS, Route 1, Box 87, Rathdrum ID 83858.

CADILLAC MI
MAY 17

The Wexaukee Amateur Radio Association will hold its 20th annual swap shop on Saturday, May 17, 1980, from 9:00 am until 4:00 pm at the National Guard Armory, 415 Haynes Street, Cadillac MI. Tickets are $2.00. Door prizes, free parking, and lunches will be available. Talk-in on 146.37/.97. For further information, write Robert Bednarick WD8RZL, PO Box 163, Cadillac MI 49601.

LOS ALTOS HILLS CA
MAY 17

The Electronics Museum Amateur Radio Club will hold its annual swap meet on Saturday, May 17, 1980, starting at 9:00 am at Foothill College, Los Altos Hills CA 94022. The flea market will be restricted to radio and electronic items only. Sellers' spaces will be $5.00. There will be plenty of free parking available. Talk-in on .52.

WOODBRIDGE NJ
MAY 17

The DeVry Tech Amateur Radio Club will hold its fourth annual flea market on Saturday, May 17, 1980, in the rear parking lot at the DeVry Technical Institute, 479 Green Street (between Route 1 and Route 9), Woodbridge NJ. Admission is free and space is $3.00. Talk-in on 146.52.

BIRMINGHAM AL
MAY 17-18

The Birmingham Amateur Radio Club, Inc., will hold its Birminghamfest '80 on May 17-18, 1980, in the Birmingham-Jefferson Civic Center. Highlights will include hourly prize drawings and a buffet banquet on Saturday night with a nationally prominent speaker. There is a possibility of FCC exams being given. There will be exhibitors' booths, and lodging and food will be available within a short distance. For more details, contact Bill Hocutt KC4P, Exhibits Chairman, Birminghamfest '80, PO Box 603, Birmingham AL 35201.

DURHAM NC
MAY 17-18

The Durham FM Association will hold its annual Durhamfest on May 17-18, 1980, at the South Square Mall, Durham, US 15-501 South. Activities will include prizes, a totally covered flea market, free tailgating spaces, overnight parking, and possible FCC exams. There will be lodging, food, and facilities available, as well as tables with electrical power. Admission is free with a $3.00 admission charge for dealers and vendors. A shopping mall will be available and there will be Sunday bingo for the family. Talk-in on 147.825/.225, 146.34/.94, 222.34/.94. For more information, write Durhamfest, Box 8651, Durham NC 27707.

WABASH IN
MAY 18

The Wabash County Amateur Radio Club will hold its 12th annual hamfest on Sunday, May 18, 1980, from 6:00 am until 3:00 pm at the Wabash County 4-H Fairgrounds, Wabash IN. Admission will be $3.00 at the gate or $2.50 in advance and will include a chance in the major prize drawing. There will be plenty of food, door prizes, and parking. Camping space is available for Saturday night. Talk-in on 147.63/.03 and 146.52 simplex. For tickets or more info, send an SASE to Dave Spangler N9ADO, 45 Grant St., Wabash IN 46992.

EASTON MD
MAY 18

The sixth annual Easton Amateur Radio Society hamfest will be held on May 18, 1980, rain or shine, at the Easton Senior High School cafetorium on Route 50, just south of Easton at mile marker 66, from 10:00 am until 4:00 pm. Donation is $2.00, with an additional $2.00 for tables or tailgaters. Talk-in on .52 simplex and 146.445/147.045 on the repeater in Easton. For more details, write R. C. Thompson KA3BKW, PO Box 1473, Easton MD 21601, or Easton Amateur

Radio Society, Inc., Box 781, Easton MD 21601.

YAKIMA WA
MAY 18

The Yakima Amateur Radio Club, W7AQ, will hold its annual hamfest on Sunday, May 18, 1980, in Yakima WA. Breakfast and lunch will be served, starting at 7:00 am. There will be door prizes, a swap shop, and new product dealers will be present. A free parking area for self-contained vehicles at the hamfest site will be available. Talk-in on .34/.94, .25/.85, and .01/.61. For further information, call Walt Hart at 575-4488 or Kenneth Zahn at 452-7982.

ISLIP LI NY
MAY 18

The Long Island Mobile Amateur Radio Club, Inc., will hold the ARRL Hamfair '80 on May 18, 1980, from 9:00 am to 4:00 pm at the Islip Speedway, on Islip Avenue (Rte. 111), one block south of the Southern State Parkway, Exit 43. There will be over 300 exhibitors and no reservations are needed. General admission is $2.00 and exhibitors' admission is $3.00 per space. There will be many door prizes awarded and plenty of parking space. Food and refreshments will be available at the track. The rain date will be June 1, 1980. For additional information, phone Sid Wolin K2LJH (516)-379-2861 nights, or Hank Wener WB2ALW (516)-484-4322 days.

EVANSVILLE IN
MAY 18

The Tri-State Amateur Radio Society will hold its annual hamfest on May 18, 1980, at the Vanderburg County 4-H Center, Evansville IN. Grounds for the hamfest will be open at 8:00 am CST Sunday morning. There will be no admission charge. Tickets will be on sale for door prizes. In addition, there will be many other lesser prizes awarded for hamfest attendance. Exhibit tables inside the hall will be $2.50 each, and a 4-by-8-foot space in a covered area adjacent to the hamfest will be available for $1.00 per space. Food and beverage will be available. Saturday overnight camping space is available for those so equipped. Talk-in will be on the Evansville 147.75/.15 repeater. For further details, contact Dave Bradford N6ACP/9, 313 E. Franklin Street, Evansville IN 47711.

WASHINGTON DC
MAY 24

The Maryland FM Association will hold its third hamfest on Saturday, May 24, 1980, 8:00 am to 4:00 pm at the Greenbelt Armory at the intersection of Greenbelt Road (MD Route 193) and the Baltimore-Washington Parkway, NE of Washington DC, just off I-95/495. Activities include cash prizes, catered food, indoor displays and flea market, and a separate outdoor tailgating area. Donations are $3.00, tailgating is $2.00, and tables are $5.00. Talk-in on 52.525 simplex, 146.16/.76, 146.28/.88, 146.52 simplex, and 449.1/444.1. Tables may be reserved by paying in advance to Fred Siebert K3PNL, 8357 Reservoir Road, Fulton MD 20759. If acknowledgement is desired, please include an SASE.

GORHAM ME
MAY 24

The Portland Amateur Wireless Association and the University of Southern Maine Radio Club will hold a flea market on May 24, 1980, from 9:00 am to 5:00 pm on the campus of the University of Maine, Gorham ME. Admission is $1.00 per person. Indoor and outdoor sites will be available. Talk-in on .52, .73, and .06. For further information, contact Jon Taylor N1SD, 44 Mitton Street, Portland ME 04102, or phone (207)-773-2651.

ST. LOUIS MO
MAY 24-25

The ARRL Midwest and Central Divisions will hold their amateur radio and computer hobbyist convention on May 24-25, 1980, at the Cervantes Convention Center, St. Louis, Missouri. Featured will be prominent speakers, information forums, equipment displays and demonstrations, and an indoor flea-market sale. Friday night, May 23rd, will be "Amateur Radio Night" at Busch Memorial Stadium, where the St. Louis Cardinals will play the San Diego Padres. On Saturday night, May 24th, the convention banquet and dance will be held on the riverboat *Admiral*. On Memorial Day, May 26th, there will be an all-day visit to Six Flags Over Mid-America. For more information, write to the Gateway Amateur Radio Association, Inc., Box 68, Marissa IL 62257.

FREMONT OH
MAY 25

The Sandusky Valley Amateur Radio Club will hold its third annual hamfest on Sunday, May 25, 1980, at the Sandusky County Fairgrounds, Fremont OH. Doors open at 7:00 am. Admission is $1.00 and all tables are free. Talk-in on .52/.52 and 146.31/.91. For tickets or additional information, send an SASE to Ron Winke WB8NMK, 1200 Stilwell Avenue, Fremont OH 43420.

HAMBURG PA
MAY 25

The Reading Radio Club will hold its second annual hamfest on Sunday, May 25, 1980, in the Hamburg PA Fieldhouse (take Rte. 22 from east or west, Rte. 61 from north or south). There are indoor as well as outdoor sites. Cash and equipment prizes will be awarded. Talk-in on 146.31/.91 and 146.52. For information, write W3BN, PO Box 124, Reading PA 19603.

ST. PAUL MN
MAY 31

The North Area Repeater Association, Inc., will hold its Amateur Fair on Saturday, May 31, 1980, at the Minnesota State Fairgrounds, St. Paul MN. This is a swapfest and exposition for amateur radio operators and computer enthusiasts. There will be free overnight parking for self-contained campers on May 30th. Exhibits, booths, and prizes will be featured. Admission is $3.00. For information or reservations, write Amateur Fair, PO Box 30054, St. Paul MN 55175.

MANASSAS VA
JUN 1

The Ole Virginia Hams Amateur Radio Club, Inc., will hold its seventh annual Manassas Hamfest on Sunday, June 1, 1980, at the Prince William County Fairgrounds, Route 234, Manassas VA. Booths are available. Admission is $3.00, children under 12 are free, and tailgaters are $2.00. Talk-in on 146.37/146.97 repeater (WB4HHN) and 146.52 simplex. For further information, contact Joseph A. Schlatter K4FPT, Ole Virginia Hams ARC, Inc., PO Box 1255, Manassas VA 22110.

WILMINGTON OH
JUN 1

Clinton County area amateurs will sponsor the first annual Clinton County area Hamfest 1980 on June 1, 1980, 8:00 am to 5:00 pm, at the Clinton County Fairgrounds, Wilmington OH. Admission will be $3.00; 12 and under are free. Flea-market space is free. There will be door prizes and free parking. Food and drinks will be available. Talk-in on .72/.12. For more info, send an SASE to CCARA c/o Russ Eidemiller WD8NPZ, 310 Bethel Lane, Wilmington OH 45177.

BRAINTREE MA
JUN 1

The South Shore Amateur Radio Club will hold its annual auction on Sunday, June 1, 1980, at the Viking Club, 410 Quincy Avenue (Route 53), Braintree MA. A flea market will precede the auction from 10:00 am to 2:00 pm in the Viking Club parking lot, weather permitting. Space is $3.00; bring your own table. No reservations are necessary. The auction will start at 2:00 pm and admission is free. There will be a 15 percent club commission on auction items only. For further information, contact The South Shore Amateur Radio Club, c/o Kristen Johnson K1WQ, 86 Alton Road, Quincy MA 02169.

CHELSEA MI
JUN 1

The Chelsea Swap and Shop will be held on Sunday, June 1, 1980, at the Chelsea Fairgrounds, Chelsea MI. Gates will open for sellers at 5:00 am and for the public from 8:00 am until 2:00 pm. Admission is $1.50 in advance or $2.00 at the gate. Children under 12 and non-ham spouses are admitted free. Talk-in on .52 and .37/.97. For more information, write William Altenberndt, 3132 Timberline, Jackson MI 49201.

GREELEY CO
JUN 7

The Northern Colorado Amateur Radio Club will hold its Superfest II hamfest on Saturday, June 7, 1980, from 7:00 am to 4:30 pm in the Weld County Exhibition Building, Greeley CO. Features will include an operating satellite television receiving station, the Colorado Code Contest, and an auction. Additional special events are planned for families. Registration will be $3.00, with exhibition space and swap tables included at no extra

cost. For further information, including details about commercial exhibit space, contact Gus Fox, PO Box 895, Greeley CO 80632.

GUELPH ONT CAN
JUN 7

The Guelph Amateur Radio Club will hold the Central Ontario Amateur Radio Fleamarket and Computer Fest on Saturday, June 7, 1980, from 8:00 am until 4:00 pm at the Centennial Arena, College Avenue West, Guelph, Ontario, Canada. Admission is $1.00, with children 12 years and under admitted free. Admission for vendors is an additional $2.00. There will be commercial displays, home-computer displays, and the Sidebanders dinner at 5:00 pm (contact Jack Kirby VE3AFN). Refreshments will be available during the day. Talk-in on .52/.52, .37/.97 KSR, and .96/.36 ZMG. For further information, contact Rocco Furfaro VE3HGZ, Guelph Amateur Radio Club, PO Box 1305, Guelph, Ontario, Canada N1H 6N9 or call (519)-824-1157.

HUNTINGTON WV
JUN 7-8

The Tri-State Amateur Radio Association will hold its 18th annual hamfest on June 7-8, 1980, at the Huntington Civic Center, Huntington WV. Admission is $3.00 for both days, with additional prize tickets $1.00 each. Prizes will be awarded both days. Commercial and flea market spaces are available at reasonable prices. Activities will include forums, hidden-transmitter hunts, a left-footed CW contest, a Saturday-night banquet, and lots of demonstrations and activities for the non-amateurs, XYLs and harmonics. Hotels, restaurants, shopping areas, and a limited number of RV hookups are within walking distance. Talk-in on 146.04/146.64. For more information, contact the Tri-State Amateur Radio Association, c/o Phil Jones WD8OTJ, 309 22nd Street West, Huntington WV 25704.

GRANITE CITY IL
JUN 8

The Egyptian Radio Club will hold a hamfest and flea market on June 8, 1980, beginning at 8:00 am at the ERC Clubhouse, Slough Road, Granite City IL. Tickets are $1.50. Refreshments, activities for women and children, and overnight camping are available. Prizes will be awarded. Talk-in on 146.16/.76 and 146.52.

JEFFERSON CITY MO
JUN 8

The Missouri Single Side Band Net Picnic will be held on Sunday, June 8, 1980, at Binder Lake, Jefferson City MO. There will be a covered dish dinner served at noon and drinks will be furnished by the Net. For information, contact Benton C. Smith KØPCK, net manager, Prairie Home MO 65068.

MAYVILLE ND
JUN 8

The Goose River Amateur Radio Club will hold its annual hamfest on June 8, 1980, at Island Park, Mayville ND. Features will include a flea market, an auction, door prizes, free coffee, and camping facilities. For more information, call or write Mary Carlson, Route 2, Hatton ND, (701)-543-3287.

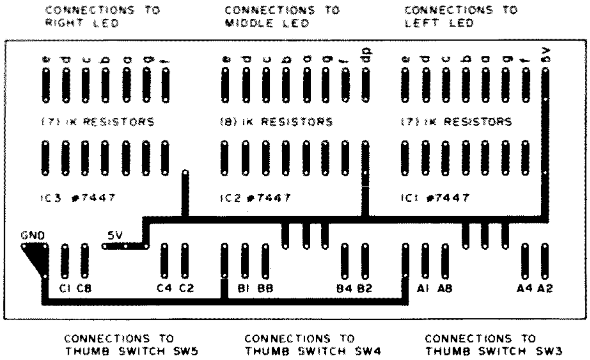
ALLENWOOD PA
JUN 8

The 9th annual Milton Amateur Radio Club Hamfest will be held on June 8, 1980, rain or shine, at the Allenwood Firemen's Fairgrounds, located on US Route 15, 4 miles north of I-80, Allenwood PA. Hours are from 8:00 am to 5:00 pm. Registration for sellers is $2.50 in advance or $3.00 at the gate. XYLs and children are free. Featured will be a flea market, an auction, contests, cash door prizes, a free portable and mobile FM clinic, and supervised children's activities. There will be an indoor area available, plus food and beverages. Camping and motels are located nearby. Talk-in on .37/.97 and .52 simplex. For further details, write Kenneth E. Hering WA3IJU, RD #1, Box 381, Allenwood PA 17810, or phone (717)-538-9168.

JACKSONVILLE IL
JUN 15

The Jacksonville Area Amateur Radio Club will hold its 15th annual hamfest and flea market on June 15, 1980, at the Morgan County Fairgrounds, Jacksonville IL. Tickets are $1.50 each or four for $5.00.

Corrections



Revised Fig. 2, "Neat Readout for the 2036."

In my article, "Neat Readout for the 2036" (March, 1980, p. 62), the switch connection designations on the foil pattern, Fig. 2, are wrong. The schematic, Fig. 1, is correct. All three switch connections' sequences in Fig. 2 *should read* 1-8-4-2, instead of 8-4-2-1.

I recently learned of a kit with the same type of readout and a slightly different circuit. For those who don't like to make circuit boards, a note to Jim Forkin, 3210 Shadyway Drive, Pittsburgh PA 15227, will bring details.

Richard W. List K3GRX
Pittsburgh PA

RTTY Loop

from page 12

will prevail. Thus, the "standard" 170-Hz shift, low-space on FSK, should be the way to go on HF. On VHF, the choice would be between using the old 2975-Hz/2125-Hz AFSK tones or trying something new. I look forward to the day when modem tone pairs are tried, for full-duplex communication! Baud rates will be another stumbling block. Hams without computers, just eight-level terminals, may be using mechanical printers, such as KSR/ASR Teletype® machines, that are limited to 110 baud. Much in the way of "standard" interchange over modem circuits is conducted at 300 baud. Certainly most of us with computers and/or video displays will be able to handle 1200 baud or faster, and it will be interesting to see what turns up on 450 MHz, where baud rates are nearly unbounded!

So there we have it—an exciting new frontier for RTTY. ASCII shall join with the introduction of personal computers to revolutionize the way we look at non-voice amateur communication. And RTTY Loop will be there!

Review

THE ILLUSTRATED DICTIONARY OF ELECTRONICS

If you have been looking for a *comprehensive* electronics dictionary, then TAB BOOKS' *The Illustrated Dictionary of Electronics* (No. 1066) by Rufus P. Turner just may be the ticket. As the cover states, this work (868 pages!) contains "Complete, modern definitions for well over 24,000 electronics/computer terms!" The "illustrated" part comes from the nice sprinkling of explanatory drawings found throughout.

Many so-called electronics dictionaries have, in the past, been very skimpy in numbers of terms and lengths of definitions. This is not the case with this one. On top of having a listing for just about everything that you can think of, many definitions refer to related subjects which may further enhance your understanding of a word or phrase. For instance, if you look up "transverse electric mode," the explanation also asks you to "Compare *transverse magnetic mode*" and to "Also see *waveguide mode.*"

Definitions of "monkey chatter," "water capacitor," "von Hippel breakdown theory," "episcotister," and "Bunet's Formula" are included in this very comprehensive listing of common and not-so-common electronics and computer terms and phrases. Lest you think that this book is too deep for a non-engineer, it also has definitions for ham-type terms such as "sideswiper," "double-extended Zepp antenna," "bazooka," and "slow-blow fuse."

Also included is a "Tables and Data" section, which contains, among other things, a wire gauge table, C°-to-F° conversions, many general-purpose conversion factors, electronic abbreviations, and many math and electronics constants.

The real way to appreciate this dictionary is to get ahold of one. Even at $14.95, it won't take long to pay for itself in the confidence that you gain by increasing your vocabulary and your understanding of the electronics revolution. Once you start thumbing through this one, it will be tough to put it back on the shelf. *TAB BOOKS, Blue Ridge Summit PA 17214.*

Gene Smarte WB6TOV
News Editor

Ham Help

I am presently here at ISP in Ft. Madison, Iowa, and am interested in trying to take my Novice license test here. This would be under unusual conditions, among which are not being able to use a code oscillator or have any radios besides the regular AM-FM broadcast receivers. This is because the feeling is that we may be able to hear police broadcasts on a ham or amateur radio. I know that this isn't possible, having studied electronics and radio schematics for several years and also having been in business.

I would like to get a small amateur club started inside these walls, but help is needed to explain to the staff just what amateur radio is, what it does in times of emergencies, and what a person could even learn if just given the chance to prove it.

I've been trying to learn the Novice theory and also the code here by my own means, and have learned much of it already. I'm also studying the *Novice Class License Study Guide* and working on all 49 test questions, in hopes I'd be able to get the Novice license exam while here. Possibly, that may prove to some in here that a man can do something on his own even when locked up.

I'm presently a subscriber to *73 Magazine* and enjoy very much the articles that everyone has written. I would like to hear from anyone who may have an answer for me while I'm here.

I'm also trying to get into the electronics shop here in hopes of being able to learn more in the field of electronics and, hopefully, also being able to take a correspondence course in electronics/communications and work towards a 2nd class license, too.

I'm presently doing a 10-year sentence and may possibly go up for a parole in October of this year. I hope I'll have my Novice license and, possibly, the communications course completed and my diploma received to show the board here by that time.

I sincerely hope that any readers who may be able to help will write me here.

Richard Hollingshead
Box 316-201957
Ft. Madison IA 52627

I would appreciate any information on converting a CPI 400 CB rig to 10 meters.

Ron Feldstein KA6IPY
PO Box 681
Simi Valley CA 93065

I would like to contact anyone who is interested in or operating with 10-GHz equipment. I live in the Toledo, Ohio, area in southern Michigan.

Paul Bachman WB8ATA
11705 Munson Hwy.
Morenci MI 49256

I need a manual or parts list and schematic for a National NC-183 receiver.

I would also like to contact members of the WWII San Pedro/Espirito Santo Sonar Team: Bates, E.T. and C.R., Jackson, Harrison, and others.

R. L. Story K5ANG
705 W. Gravwyler
Irving TX 75061

I have a Hammarlund HQ-160 in good condition, but I need i-f transformer T1 and 2 (455/3035 kHz) to restore it to its original condition. I will buy a salvaged transformer or a junked 160 for parts. I also have an original owner's manual which I would duplicate for cost and postage if anyone needs it.

Stan Horne WD4HKG
5939 Redberry Lane
Jacksonville FL 32211

I would like to acquire the location, time, and any other important information about a CW County Hunters Net currently in operation. Thank you.

Michael Cent WD9GFL
840 E. 166th Place
S. Holland IL 60473

I need a DC7302N or a Mostek MK50362 40-pin clock chip to complete K6SK's "A Single IC Time Machine" in the February, 1979, *73*. If you have one surplus to your requirements or have information on possible sources, please write to me. No reasonable price refused.

Bill Maxwell VK1MX
33 Dunbar Street
Fraser, A.C.T.
Australia 2615

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

with a similar interest. In order to talk about loudspeaker enclosures, I need both RTTY and SSTV techniques... so I can show drawings and calculations. Oh, it can be done via voice, but it would be faster and better via other modes.

The coming new bands? The only one with an estimated date for our use is only 50 kHz wide, so let's not worry about it. That will fill up solid the first day with certificate hunters and be of little use from then on. Allowing 3 kHz per channel, we will be able to accommodate about 15 QSOs at once. What we will actually have is fifty almost-impossible-to-understand contacts going on simultaneously.

The prospects for further satellite communications are not a lot brighter. Once we get a satellite which is usable over much of the day instead of for a few minutes every few hours during a small part of the day, as we have at present, the small passband of the satellite will, I suspect, fill right up. It will only take one kilowatt KP4 to screw up everything... as we have already discovered. Like the 10-MHz band, the satellite passband will probably develop into a solid mass of hard-to-read signals. Digital techniques may permit more dependable communications if we change to admitting that it is time to stop wasting spectrum with unnecessary communications.

What is unnecessary? Well, we could argue that a lot, but assuming that idle chitchat is considered necessary, we might cut down on the frequency and time required for station identification. I've heard emergency nets spending almost half their time reciting calls instead of keeping at message handling. If we cut callsigns out of repeater contacts, we would be able to accommodate double the number of stations without building any more repeaters.

In all fairness to those operating mobile, if we start restricting the communications by eliminating most of the call identification, the recitation of the equipment, the detailed news of where the car is at that moment, and a few other such items of equal significance, the air would get very quiet. When we are driving, much of our attention is on the road and it is difficult to think of anything of interest to talk about... so we fill the air with the insignificant, happy in the thought that we are communicating. We really aren't.

What about the microwaves? Well, after a good deal of work with 10.5 GHz, I can report that I will be surprised if anything much develops in these frequencies. We lost them in 1971 for ham satellite use... and the limited range we can get with them without a satellite repeater makes them of little value to us in the foreseeable future. The equipment is difficult to build, breaks down constantly, and is expensive.

If we could get some microwave bands for ham satellite use, we could see some fantastic developments in these frequencies. This is one of the reasons why I think is it important for us to start working seriously on getting amateur radio developed in as many of the Third World countries as possible. We need all the enthusiastic support we can get if we are ever going to make any headway towards regaining some satellite channels.

There is a lot of worry about 220 MHz... and rightfully so. First, it was the EIA, backed by some of the bigger CB manufacturers, trying to get it turned into a new CB band. When this was thwarted, we found the FCC, backed by the ARRL, thinking in terms of using it as a pseudo-CB band for entry level (no-code) hams. Then the marine interests started getting into the act. It takes an act of courage to spend the time and money to develop a repeater system on 220 MHz these days.

The time was when amateurs did not have to immediately fill up bands with signals in order to preserve them. Indeed, there is strong historical reason for adhering to this policy. Unfortunately, much of government and the emotions of hams run on a here-and-now basis, with little consideration for the future, and this lack of perspective has to be taken into mind when dealing with our ham bands.

For instance, the top half of two meters was virtually unused from the time it opened in 1946 until over twenty years later. This brought on pressures for giving these frequencies away for CB use, a suggestion put forth by one of the ham magazines, no less. If those frequencies had not been lying fallow, it might have been impossible for us to develop the network of repeaters and channelized communications we have today. We started to see FM coming in the early 1960s, but the time wasn't right until the frustration over incentive licensing had quieted down.

Today, we have a great many ham bands which are virtually unused. We may come up with modes of communications which will populate these bands. If we could solve the problem of developing program material, we could use the 1200-MHz band for a network of television repeaters. So far, the pioneers of ham television have come up with no solution to this problem, and this, more than any other obstacle, has kept interest in this mode at a minimum. A few test repeaters have been set up on 420 MHz, but these have not caught interest generally and growth has been unimpressive.

The communications we need for our home computers is not along ham lines, so I think this will take the route of telephone lines and TV cables, so that anyone can be accessed, not just hams. Some hams may set up test repeaters for digital communications, but the limitations against commercial use will not permit extensive investment of time or money in this direction.

If we were to take away the utterly mundane content of ham communications, would amateur radio continue to even exist? Experiments with trying to carry on contacts without mentioning the ham gear used, the weather, or extensive drivel about one's hometown have been dismal failures, leading us to surmise that an intelligent conversation between two newly-met people, trying to hear each other through interference from others, Is too elusive a goal. When one enters into this, one quickly discovers that the mouth is as dry as the wits and that outside of a stuttering about the signal strength, little conversation comes to mind. It's as vacuous as cocktail-party talk. Perhaps some amateurs will tackle this situation and pioneer the use of intelligence and wit over the air, being kind enough to take notes and let the rest of us know how in the hell they did it. This is unlikely.

There may be some renewed pressure for the development of the completely unattended station... where DXCC can be achieved automatically within a few minutes by means of two-way digital communications. This might clear up a lot of the clutter. Will the complete ham rig of 1990 have counters on it to indicate the countries worked that day, that week, that month, and so far that year? With perhaps a switch to indicate the number of prefixes worked, states, continents, zones, ITU zones, etc.? Perhaps we'll have certificates for nine-band DXCC in one day which are popular by 1990.

With a growth in crossband repeating, we may need to open up more control channels on the 420-MHz band, squeezing those television pioneers up to the 1200-MHz band... where some think they should have gone in the first place. We may see more hams with HTs on their belts, grabbing them to say hello to a friend in Zanzibar as DXing via repeaters gets more popular... and more automated. I remember hearing the hams in Vail working a DXpedition while I was skiing and my hoping I could at least be patched through from the slopes to make the contact. It didn't work. On Navassa, I did make several contacts via a two-meter link to the low-band station and at one time I had a two-meter repeater set up at the *73* offices in Peterborough through which I worked a lot of 20-meter DX. It's great fun and I think it will be popular.

What about narrowband voice modulation? That was covered in an article recently in *73* and none of the letters resulting gives any serious hope that

this mode is going to be popular. Our reports that the League has dropped it seem factual, despite their early enthusiasm for it, complete with articles in *QST*, chapter in the *Handbook*, etc.

The recent move by the FCC to disenfranchise us from giving Novice exams is one which should be countered. I'd like to see ham clubs given the power to give all of the ham tests.

In 1960, we could clearly see sideband coming on strong. In 1970, we could see FM beginning to develop. Now, in 1980, I don't see any changes of those magnitudes starting up. Maybe in another year we'll have some changes which cast their shadow ahead and enlighten us as to what amateur radio may be like in 1990. Right now, it looks a lot like it will be much as it is today.

My unasked-for advice is to jealously preserve our amateur frequencies, whether we are using them or not. We will have a healthy amateur radio service in 1990 if our industry is able to stop knifing itself and work toward setting up a lobby in Washington to deal with the FCC and Congress . . . a national lobby to encourage the growth of the hobby nationwide . . . and an international lobby to get amateur radio into as many small countries as possible.

With your help, I'll do all I can toward these goals.

My own goal is to have *73* at least 500 pages thick by 1990, serving over a million U.S. hams and encouraging even more pioneering of new communications techniques.

CLARIFICATION REQUESTED

One of the hams in California who has done much to make things happen wrote recently to say that in those areas where he is familiar with the ARRL, he has found my editorials accurate. His suggestion for those who feel like beefing about my "anti-ARRL" stance is for them to write to the League and demand an explanation of the facts I have presented. Find out whether I am right or wrong. If I'm wrong, then let me know in what way, because I want to know that more than they do. If I am right, then get after the League to clean up their act. When it comes to my editorials about the ARRL, I don't think you are going to find any areas of error of fact . . . I make darned sure I know what's what before I write.

If all readers would get indignant about the things going on and make it their business to really find out for themselves, the ARRL would have to make some big changes in short order. It is the sheep-like acceptance of bad management, dishonesty, pompous arrogance, and coverups which greatly weaken amateur radio. It's your money, fellows. Don't you object to being ripped off? I sure wish you could hear the disdain some of the HQ gang express for the average amateur while they are boozing it up at the members' expense at League cocktail parties. They seem to think you are a bunch of suckers . . . and if you continue to apologize for them and let them get away with highway robbery, they may be right.

EIA ATTACKING 220 MHz AGAIN

The Electronic Industries Association (EIA), which gets money from the CB industry rather than the ham industry, is again putting pressure on the FCC for the opening of two megahertz of the amateur 220-225-MHz band. They point out that this would provide 80 channels for CB FM use to meet personal radio needs, leaving three MHz for existing government and amateur use.

When there is a constant pressure in Washington, backed by a good deal of money and expertise, with no opposing ham lobby pressure, eventually it is going to prevail. Persistence is a powerful tool, particularly when it is virtually unopposed. Sure, the reasonable thing is to keep the band for ham use, but when did you last see reason prevail with our government? Money and power talk in Washington.

The argument goes that a few hundred amateurs should not keep 15 million CBers from getting a service that they badly need. The FCC Commissioners are thus under pressure to accede to the EIA and the huge CB market, while the ham industry can't even keep an industry organization going to speak up for the hams.

THE WOODPECKER AGAIN

A couple of readers sent along a clipping from *The Spotlight*, one of those sensational weekly papers like the *Enquirer*. This had to do with Russian experiments to change our weather by means of high frequency radio transmissions. The article pointed out that the experiments had backfired, giving the US a mild winter and ravaging the USSR.

The article attributes the concept of changing the weather to Nikola Tesla and his experiments with transmitting power. It says that Tesla said that his findings could be used to modify the weather. Well, I've read everything by Tesla that I could find and I don't recall any such thing in his articles, lectures, or other writings. I'd like to see a reference on that one.

I really can't imagine what the results would be to the world if the Tesla system of transmitting power were put into effect. He generated enormous amounts of power, stepped up the voltage with a gigantic induction coil (Tesla coil), and arced the voltage into the Earth at a frequency which set the entire Earth into oscillation. He calculated the time it would take for the wave from the lightning charge to travel all the way through the Earth and reflect back and set his arcing frequency equal to that. It seemed to work, for he was able to go many miles from the transmitting station and light up banks of lamps with an antenna and ground connection.

Unfortunately, Tesla was not one for keeping much around in plans for his ideas and inventions, so the details of his power transmitting system are either lost or possibly under lock by our government. Many of his papers were locked up by the US government when he died.

Tesla was probably one of the greatest inventors the world has ever seen, in case you have missed articles or books about him. He, single-handedly, invented alternating current and got all of the basic patents for the system. He invented the ac generator, the ac motor, the transformer, the transmission line, the tuned circuit, the loudspeaker, the electric clock, and a raft of other devices. Unfortunately, he was not a businessman and was screwed out of millions of dollars; eventually, he went into bankruptcy when he had the audacity to start building a world power transmitting station on Long Island. His station was also going to transmit radio . . . news and music. This is strange only when you realize that at this time most radio experts were convinced that it would never be possible to send the human voice over the radio. I have several old books which are quite positive about this. Tesla was years ahead of everyone in both power and radio.

Well, the *Spotlight* story was that the woodpecker signals we've been hearing are a Russian effort to change the weather patterns, an effort which screwed up this winter, and that the Russians have been getting the bum weather instead of us. Baloney.

Those powerful radio transmissions from Russia are thought to be over-the-horizon radar and this seems most likely. The ability of amateurs to force the woodpecker to move frequency indicates that the Russians are listening to signals bouncing back. All we have to do is get on a channel where the woodpecker is very strong and match the pulses with dits from our rigs and they soon change frequency. We can move up or down with them and keep them moving in this way. If they were trying to zap us with strong radio signals to drive us nuts or to push around the jet stream, there is no good reason for them to be listening to the return echoes. My bid is for long-range radar and *The Spotlight* can look for some other fishing expedition.

FED UP YET?

Say, when are we Americans going to get fed up with the inroads Russia is making all over the world? They announced years ago that they intended to take over the world and they have been hard at it ever since. We blind ourselves with wishful thinking . . . getting suckered into SALT agreements which hold us back and appear to be ignored by Russia.

The sooner we start making a fuss about this with Congress and get them to do something to counter this steady pressure, which has been working wonderfully, the sooner we will see things start to turn around.

What good does it do us to abhor our CIA people doing sneaky things when we are doing nothing to stop or counter the same or worse type of things being done by Russia? It is al-

most time to stop being silly about this and recognize that Russia means exactly what it has been saying all these years.

In the meanwhile, we have lost our clout just about everywhere in the world. It was just a few years ago that we spent several billion dollars and a good bunch of our men conquering all of the countries of North Africa and most of Europe. Then, instead of setting up some means of long-range control, we quickly got out and left vacuums which have been filled by some pretty rotten people. And we further pressured the European countries to get out of their colonies, with disastrous results all over Africa. We have little to be proud of in the countries I've visited there: Uganda, Tanzania, Ethiopia, Sudan. All of them are in terrible shape.

The stupid action in Viet Nam might have been avoided if we had some brains behind our foreign policies. We turned that situation over to the military and they did the only thing in their book—fight. There was no attempt at any time to try to outsmart the enemy. I visited the area in 1966 and talked with people in the neighboring countries and came up with an alternate to the fighting which I still think would have worked. I couldn't get anyone to pay any attention to it.

Russia is pouring fuel on the Iranian situation with emotional broadcasts. They are supplying arms and technical help in every known trouble spot, trying to undermine the governments so Russian agents can take over. They have an impressive record of winning at this, and we have an incredible record of screwing up and losing.

So what do I suggest? Call me reactionary, if you will, but isn't it time to beef up the CIA and get them back into their old business? We need to know what the hell is going on in all of the countries of the world. Call it spying, if you want . . . though I tend to think in terms of spy stories and secret plans, new weapons, etc., as being the main purpose of spying, not the keeping track of the political and economic progress of a country.

We would do well to know where Russia is setting up shop to upset things. We want to know where they are supporting insurgents and coups. We also want to know ahead of time of popular resistances to governments such as those recent ones in Central America and Iran. With better intelligence, we might not continually find our country backing bad dictators; we might find ourselves on the side of the people of these countries. I'm not sure how I feel about getting in there and helping overthrow bum governments, but I'm thinking about it.

Other than Central America, South America, Africa, and Asia, we are in pretty good shape. Or are we that sure of Mexico and Canada? I think Germany is on our side, but I'm not at all sure about France. It's getting lonely.

DRATTED DRAFT

Carter got all involved with the brouhaha over the draft, when all he apparently had in mind was trying to send a message to the Russians that he was serious about being irritated over the invasion of Afghanistan. All this ado got me to thinking about the whole matter of recruiting military people via the draft system.

A few hundred years ago, when kings needed to get an army together to either take over some other country or protect their own, they sent out a bunch of recruiters who grabbed every young man in sight and put them into uniform. They used a similar system to get navy personnel, and this caused some irritation when Britain began "impressing" American sailors. Whatever name you put on it, it comes down to slavery as a way to keep costs down.

The slavery concept is still popular for filling the ranks of the armed forces, where the pay is low and personal freedom quite restricted. Other than trying to pay less than the going price for help, what justification is there for the draft?

Some parallels are drawn with Sweden and Switzerland, where all men are required to put in some time for their country. Those are small countries and they have to have every man trained and ready to protect their country from invasion. We don't. What we need are a few people to fight in the limited wars which spring up around the world (since the drastic use of nuclear weapons is unlikely) and the technicians and office personnel to back them up. We do have to continue to have the nuclear backup, but that will take mostly technicians.

The technicians and office personnel don't have to be trained for field combat, and their pay should be on a par with industry so they will stay at their jobs for twenty to forty years as they would in private industry. When you consider the cost of training and retraining, higher salaries are not that much more costly.

We do need a continuing source of youngsters to be ready for combat, and here again, if we provide incentive, I think we can get good ones. In return for their work, we might provide them with extensive vocational training which would fit them for the job market. This might be a good way to provide help for the underschooled and underprivileged. If the benefits are right, we'll see people going for it . . . men, women, black, and white.

Of course, I have perhaps an unusual viewpoint when it comes to fighting. I figure that using force indicates that you have been outsmarted. I much prefer to try to set things up so we are continually outsmarting the other side. Notice that I *did* not refer to them as the "enemy." They are people, too, though we may be at odds due to some psychological difference in programming since birth. I don't think that hate is going to solve much; I think that we would get a more amicable solution to problems if we would try hard to understand those with whom we disagree and try to bring them around.

Just as an example . . . what would happen in a war where prisoners were treated well instead of being made miserable? Suppose we fed them well, entertained them, gave them interesting work to do, educated them, provided them with companionship, and, in general, made it far better than they had it at home? Sure, it would be expensive, but far less costly than a long war. We were spending over $500,000 each to kill off the North Vietnamese and that was no bargain.

Before you start arguing with me over my example, see if you can get hold of the concept behind it first. Otherwise we'll be going through the same silly routine Carter got started with his draft bunk.

There is a basic problem with politicians . . . they try hard to to tell us what they think we want to hear. Where Churchill waved the symbol of victory at us with two fingers, our politicians are waving one finger at us, wet, trying to see which way the wind is blowing. We need a leader, not someone standing there asking us which way we want to go.

Most Americans don't want to have to worry continuously about Russia aiming at taking over the world, so we don't think about it and our politicians pretend it isn't happening. We go through brief times of anxiety when they march into a country such as Hungary, Czechoslovakia, or Afghanistan, but we soon listen to politicians who tell us not to worry and we stop worrying.

A visit to any store will tell you that the world is a global community. Much of our food comes from abroad, as do our cars, our electronic equipment, our clothes, our furniture, etc. We can't fool ourselves that we can let up the pressure to make the world the way we think best, because if we do, we will find the Russians have not let up their pressure for a minute. They are supplying arms for fighting in several parts of Africa. They are supplying arms for the Middle East combatants, for Asia fighting, and for any other group which might upset a country enough for communism to take over. It's hard on the world, but can we do any less than our best to oppose this relentless force in every part of the world?

We got outsmarted in Viet Nam and we lost that battle. This was so traumatic that we curled up and tried to avoid confrontation from then on . . . and we see what that has done. The mess is not improving because we try to hide from it . . . it's getting much worse.

On the one hand, we gripe about the cost of gas, yet we seem to be taking no long-range measures to improve that situation. We have countries who would be our friends if we supported them as well as Russia supports their surrogates. The world leaders know the difference between the U.S. and the USSR. Perhaps we need some sort of marketing organization for America . . . something a bit more up front than the CIA spooks and far less inhibited than our State Department, known in Washington as Foggy Bottom.

When you get into a war, you

are trying to push directly against your adversary. Perhaps we can do better if we use the techniques of judo and go along with those we want to change, applying a steady pressure to gradually change their direction in the way we want them to go. This is what Russia has been doing, with great success. It gets them into no wars directly and lets others do the fighting.

Sure, world hunger is a big problem and it is forcing most of the small countries into changes. I hope there is no disagreement that the direction to take to work out of this bind is toward education and civilization. I think that microcomputers will be having a profound effect on world education by the end of this century by substantially reducing the cost of education. I think that amateur radio can have a tremendous effect, too, by helping to bring technical education to emerging nations and thus speeding their paths toward civilization via less expensive education and the supply of technicians and engineers needed for telephone, radio, television, and computerized communications.

In this spirit, I have established a fee arrangement for my talks to hamfests and conventions which includes $1,000 to be put into an account for use in developing amateur radio in Third World countries. There is no advantage to this being a one-man drive, so I call on all ARRL members to get their directors to have the League set up a system for sending top hams to visit the heads of Third World nations and get them interested in setting up a network of amateur radio clubs throughout their countries as a way to speed progress. If League officials also asked for $1,000 for such a fund for speaking at hamfests, this movement would be funded in essence by every amateur attending a hamfest or convention.

Without inexpensive and effective communications, both government and business are hobbled . . . and there would be no good way to take the next step of providing inexpensive education via this communications network. Hamming has to come first before anything else will be economically feasible. Yes, I've only helped open amateur radio in one country . . . but that is one more than anyone else has so far. There is much to be done.

GETTING MOVING AGAIN

The drop in new licensees has resulted in some serious chain reactions, such as a loss of prestige with the FCC, loss in sales of ham gear by dealers (which makes ham gear cost more), increasing failures of small ham manufacturing firms and the possible loss of at least one of the ham magazines . . . and maybe even two or three.

Most of the two-hundred-plus small firms making ham gear are made up of one or two avid hams who got started on the kitchen table with some unit or service they thought might be of interest to fellow hams. These entrepreneurs were, almost without exception, underfinanced and with little commercial experience before they went into the ham business. They are in it as much for the fun of it as making a living. I really hate to see the downturns in ham buying come along and sink these small firms by the dozens, dashing hopes of enthusiastic hams who hope to make it big one of these days.

Many of the large firms got started in just this way . . . in fact, most of them did. Now they are making a living for hundreds of employees and dealers, furnishing us with the latest in state-of-the-art ham gear at prices that astound commercial communications people.

So what can be done to get amateur radio back into a growth mode? While part of the responsibility for this lies with every amateur, I think that our best way to tackle the situation is via our ham clubs. I've written before that studies of new hams in the past have indicated that half of the newcomers are either 14 or 15 years old. So why go hunting for new blood where the results are going to be more difficult to achieve? The obvious place to go is to the high schools, where the 14/15-year-olds are in quantity, all separated for you.

If your club starts contacting high schools in your area, I think you will find them quite cooperative in putting you in touch with the students. This can be done via posters announcing a special talk by someone from your club on the prospects for jobs in the electronics and communications industry during the next twenty years . . . pointing out that the best way to really get into this is via amateur radio . . . and that your club, oddly enough, has some low-cost classes to get them started with their Novice tickets.

You might also have some of your teenage club members set up a special events station at the school for a few days so the students can get an idea of what ham contacts are like, see that their classmates are involved, and see that it is not all that difficult to get into.

Your club classes can be a success if you get good teachers and remember that one of the basic secrets is to keep it fun. You don't get any cooperation by using shame to force people to attend classes or to teach them. You get students to sign up by emphasizing the benefits to them . . . the fun, the peer prestige of understanding radio and electronics, the fun of being able to carry around an HT, etc. It seems best to charge for the classes as this tends to keep students coming in spite of other interests. It doesn't hurt to set up a certificate for completion of the class and passing of the Novice test.

Beyond that, as I've said before, if your club has worked out any stratagems which help attract people to classes or help them to graduate, please write them up and send them in so we can pass the word.

PICTURES WANTED

Further, to encourage clubs and classes, please make sure that someone in your club snaps a good picture of the club with the class and gets it to *73* for possible publication. The more of these I can publish, the more clubs may be encouraged to get into action.

If we can get just 2,000 ham clubs to get ham classes going, we will be able to get back into a growth situation with our hobby. We need about 5,000 new licensees per month if we are going to grow, so this averages out to just 2½ per club per month. There are 3,855 clubs listed in the *Callbook*, so 5,000 new hams per month should not be all that difficult to accomplish. But it's entirely up to *you*.

I'd like to see an honor roll of ham clubs which promise to meet that minimum of 2½ new licensees per month. If your club will send a statement making such a promise to me, I'll start such an honor roll in *73*.

THAT CODE

Rather than spending a lot of time in class teaching the code, you'll get it done easier and faster if you encourage the students to get a good set of code tapes. I happen to think that the *73 Magazine* tapes are by far the best and I don't know of a single scientific study which has shown otherwise. Some of the other code tapes are so bad that it is a disgrace. I don't see how anyone can honestly sell a tape with variable speed code on it. We have lost more ham prospects due to this than any other single factor . . . hundreds of thousands of good ham prospects have been frustrated by the code . . . needlessly.

Clubs would do well to contact *73* and buy code cassettes wholesale, passing along the savings to the students or to the club. If each student had a cassette and spent a half hour a day with it, your code problems would be over. *Never* give code speed tests. Students should copy code at the FCC test speed until they are able to copy easily and know that they are 100% in their copy. Anything less may cause panic under test conditions.

With my code system, there is no plateau. You learn each character at 13 wpm and you know it from then on, reading it on a subconscious basis. It is fast and easy.

The *73* code tapes start with an introductory cassette which teaches the sound patterns of all of the letters, numbers, and punctuation you will need. It starts right out with complete words in the first few minutes, giving the first-time student confidence that the code is not really difficult to master. Clubs should use this tape for the first session with Morse code, and there is no reason a student should ever have to use it a second time.

The next step is a 6-wpm tape. This is aimed at students who are going to try for the Novice or Technician test. Each character is sent at 13 wpm, just as on the official FCC tests, but the spacing is at the six-wpm rate. This is not only preparing the student for the Novice test, but also enforcing the code sound patterns subconsciously for the 13-wpm test later on. Oddly enough, it does not take much more time to get proficient at copying code

at 13 wpm than it does at 5 wpm. Some students get started right off at 20 wpm and find that within a few days, they have that mastered.

The code groups on my 6-wpm tape are designed to be as difficult as possible, making it duck soup when you come to the FCC tests which are in plain language. It is far better to be overtrained than under. The tenseness during a test is far less when you hear the code coming at you at well below your ability to copy. You immediately relax and copy to perfection, rather than working up a sweat and struggling. It makes a world of difference.

Next, I have a 13-wpm tape . . . which is really at 14-wpm, even if it sounds like 20 wpm when you first start trying to copy. Again, I send the most difficult patterns of characters, purposely trying to make life difficult for you. And, again, you'll almost fall asleep when you sit down to the FCC plain-text exam.

My 20-wpm tape is at 21 wpm, of course, and when you can copy it with comfort, you will also be able to hack plain text at 25 wpm or even 30. Some users of these tapes accuse me of being positively vicious in my character groups. I do admit to a fiendish delight and I love to see eyes pop open with disbelief when students first try to copy this. Heh, heh!

The *73* tapes sell through most ham stores for $4.95 each. Clubs may buy them in bulk (ten or more per order) for a 25% discount: $37 for ten tapes or $73 for twenty tapes.

Looking West

from page 10

they are on two. Jamming of any sort is a rare occurrence and, by and large, 220 MHz is a happy family of currently about 5,000.

You need not take my word for this. Next time you venture west, bring along your 220 radio. There are plenty of wide-coverage open systems on many mountaintops, like WA6VNV/RPT and WA6LHK/RPT on Oat Mountain, W6NUI/RPT in Palos Verdes, and many, many more. If you need an up-to-date list of repeaters in this area, an SASE sent to the 220-SMA of Southern California, PO Box 8306, Van Nuys CA 91409, will bring one. If you have any questions about repeater operation, coordination, or anything else, write them and they will respond. By and large, the southern California 220-MHz sub-community is an excellent example of how good a band can be.

THAT GENIUS IN MARISSA DEPARTMENT

I want to relate a story to you that happened recently. In January, when Bill Orenstein and I took off to cover the Consumer Electronics Show in Las Vegas, we were unaware that about 24 hours after our departure the Collins RP-150 cartridge tape player that feeds the weekly Westlink News took an unexpected nose dive. Needless to say, Murphy's Law had taken its course in our absence, and we returned to find a blown fuse and burned-out motor. Also, the phone was ringing off the hook. Bill spent the next few days "hand feeding" callers from the master tape on the Teac, while I did what I could for the RP-150. I needed a new motor and such was not available at a moment's notice. This is not your standard home-entertainment recorder. It uses special continuous-loop broadcast tape cartridges and cues off on an audio pulse. In general, such machines are very reliable, but when you realize that this one was dated 1960, it's obvious to see how a failure such as this can occur. We had another P-130 play-only unit, but that, too, had some problems. We needed a replacement fast, something to hold us for a few weeks until we could get the Collins repaired.

The answer did not come in a blinding flash; rather, it came subtly, when my copy of *73* arrived. I was sitting in the shack, listening to a Neil Diamond tape, when I happened across an article by Bob Heil K9EID (January, 1980, page 92) on the voice ID system used on the M.A.R.C. repeater. It used an 8-track-type tape deck and some very simple circuitry. Hmmm . . . could it be adapted to get Westlink back in operation? I had a drawerful of 7402 integrated circuits, quite a few NPN transistors, and even though it was Sunday, the local Radio Shack could provide the rest of the needed parts. It took about 2 hours, including a trip to RS to finish the controller and another half hour to interface it to the Juliette 8-track player that I had been listening to earlier in the day. I won't go into all the technical details here. If enough of you are interested, I will write a technical article on how to convert an 8-track player to an automatic telephone tape feed unit which responds to an unattended ringing telephone and has yet to fail. The main thing is that it worked, and, while for our purposes the overall quality of audio was not equal to the Collins machine, it kept Westlink in operation for the necessary time period so that repairs could be made to the normal news-feed equipment.

Bob and I have never met, though we have spoken on the phone and exchanged many letters. In fact, for those of you who are unaware, Bob is the guy spearheading the A.R.C.H. Convention in St. Louis the 24th and 25th of this month. Even though air travel has become very expensive of late, after the reports I heard about last year's outing, this is one I don't intend to miss. For example, the banquet will be held aboard the riverboat *Admiral*, while cruising the Mississippi river. There will be dining and dancing, and the guest speaker will be a friend of mine named Roy Neal K6DUE. Bob and his group have gone all out to make this the best convention of 1980, and knowing the drive of Bob Heil, I suspect it's going to exceed even his expectations. Oh . . . I hear rumors that a certain Wayne Green W2NSD/1 will also be speaking. As a newsman, that alone is worth the trip. So, if you see a guy toting a JVC video camera and Sony field recorder, looking as if he is about to keel over from the weight at any moment, stop and say hello. It might just be yours truly putting together yet another video production of the Westlink video lending library.

Meanwhile, to those who say experimentation is a thing of the past, phooey. As long as there are hams around like Bob Heil K9EID, this hobby service will never be lacking in new ideas. Bob is one of those "one in a million" people whom this hobby is blessed with, and I can't wait to meet him and thank him personally for bailing us out of a tough position. To the genius of Marissa, Illinois, I say thanks.

SPEAKING ABOUT WESTLINK DEPARTMENT

When I took over this shoestring operation last summer, I never envisioned that it would grow as big as it has. They say that every ham finds a particular niche in amateur radio. If this is true, then I guess I have finally found mine. Producing a weekly 10-minute QST takes about 10 hours of time each week and I love every minute. What makes it all the better are the people who work with me. I have mentioned Bill Orenstein KH6IAF many times in this column. Bill is a radio engineer with NBC network news out of Burbank's famed "peacock factory." It was Bill who donated office and studio space in Hollywood and it's Bill who spends many hours hand-cutting each newscast, doing the same thing as a hobby as he does for a living. That's dedication.

We are also very lucky to have four regular announcers who do a great job. Burt Hicks WB6MQV is broadcast engineer as well, with on-the-air experience in Armed Forces radio and television. Alan Kaul W6RCL, who also produces some of our newscasts, is a network television field producer for NBC News. Jim Davis KA6IUH (ex-KA8BWZ) is currently Program Director for radio station KMPC and has many, many years of on-the-air experience in radio. Our last "regular" needs no introduction other than to say the magic words, "Lenore Jensen W6NAZ." In my 38 years, I have not met a more devoted and lovely person than Lenore. She is the epitome of what this service is all about and deserves all the kudos that the amateur community can give her. She is a true professional in every sense of the word.

As time has passed, others have become members of the Westlink News Team. Legal items are covered by Joe Merdler N6AHU, President of the Personal Communications Foundation, professor Norman Chalfin K6PGX of JPL is our AMSAT/OSCAR correspondent, and Mike Michaels WA8ARZ/

KH6 and Pat Corrigan KH6DD cover the Pacific islands for us. Pat is a well-known DXer and Mike is a radio personality on KIOE in Honolulu. Finally, there is Mitch Wolfson DJ0QN in Munich, who files his reports from the Continent. An "unofficial" but very important part of the operation is Joe Schroeder W9JUV in Chicago. Joe single-handedly produces *HR Report*. We have been very lucky to be able to develop a good dialogue with Joe and all of the amateur publications, and, frankly, I feel that this has been of benefit to everyone.

There are many other people who volunteer their time and talent to make the weekly QST come about. None of us is paid. In fact, Westlink has no paid employees whatsoever. From time to time, people ask us why we do it, why we devote that much time each week to the project. I cannot speak for the others, but I love it. So we continue, and will keep going till the time comes when someone comes along who can do it better. Maybe some day someone will, but for the moment, we are doing the best we can with the limited resources at our disposal. We hope you like what we do. Those of you who might like more information about the weekly news service, which in this over-inflated world is still free, can drop us a note at the Westlink Radio Network, 7046 Hollywood Boulevard, Suite 718, Hollywood CA 90028. Please include an SASE.

By the way, if you need a program for your next radio club meeting, we have several videotaped presentations available on a free-loan basis. Included are several talks by Wayne Green, several technical films, and a spectacular talk by Alan Kaul W6RCL on producing news in foreign (and often hostile) places like Iran and Thailand. A request sent to the same address, with an SASE, will bring you a complete list and, like the newscasts, loan of the tapes is free except for postage. Wayne's presentation on microwave communications is a dandy. Oh, yes, these tapes are available on VHS, SP speed only.

FAREWELL WA6TDD, ET AL

I should have written about this some time ago, but the demise of the WA6TDD repeater was something very personal to me, and it took a while to get my perspective back on the matter. Over the years, WA6TDD had several callsigns, including WR6ABE and WR6AMD. When the Mt. Wilson-based system went to its final reward, it bore the callsign WA6KOS/RPT, a callsign that is still with us from a new location. More about this later on.

WA6TDD was born of a childhood dream of Burt Weiner K6OQK. In the 16 or so years of its existence, WA6TDD showed the "others" how to do it. Innovations such as the reset beep tone, microwave control, and state-of-the-art audio processing all came to the world of amateur FM repeater communication because of Burt and WA6TDD. Sitting atop Mt. Wilson, the system could be heard for over 175 miles in most directions and, to my knowledge, it was one of the first systems to pioneer the use of circular polarization for FM communications. WA6TDD was truly a repeater ahead of its time.

Its demise cannot be blamed on the aloof repeater owner syndrome. Unlike most two-meter system licensees, Burt and those who took over the license of the system after his decision to only involve himself in the technical aspects of its operation were always on the air. Maybe it's that they cared too much. I don't really know. I do know that for all its technical achievements over the years, the user problems it incurred the last few years of its life were the reason for its being taken out of service. In my opinion, Burt did the only thing he could. How would you feel if you saw the utilization of something you had nurtured for years being destroyed by a small but arrogant group of people who returned your kindness with hate and ridicule? In the end, virtually all of the regular users had gone elsewhere and, where there had once been joy and sunlight, there was only ongoing bickering and character assassination. Much of the latter was directed toward the person providing the service. This group claimed to be "liberating" the channel from its tyranny, but there had been no "tyranny" until they showed up and made the claim. Why? I cannot read the minds of others. What's really ironic is that in "killing" WA6TDD, they only proved to other system owners that the concept of aloofness was the only way to go.

PICKING UP THE PIECES DEPARTMENT

Though WA6TDD is now only a memory, the channel pair is still quite active. Dave Faraone WA6KOS, who was the last licensee of the Mt. Wilson operation, had made a promise that another repeater would come into being to replace Wilson. Dave has kept that promise. Currently operating from atop Santiago Peak in Orange County is the new WA6KOS/RPT. There are a few differences, but not many. In order to appease the many remote-base owners using the same mountaintop, Dave was forced to invert the channel pair. Currently, the system operates 146.40 MHz in, 147.435 MHz out. In getting an open repeater on that mountaintop on that channel pair, Dave performed a minor miracle. For years, Santiago had been strictly the domain of the remote owner. An open two-meter box, especially one that operated anywhere near the 146.46 remote-base intercom channel, had been taboo. But Dave didn't just plunk down a repeater and say, "Here I am." He spent many months laying the groundwork. He met many times with the remote owners and enlisted their aid in the project. He took a positive cooperative attitude, and by doing so, he was well received on the hill when it came time to fire up the box. He has since worked hand in hand with the remote owners to clean up any small amount of interference the new repeater might have been giving the remotes, and has never once complained about interference his system has suffered due to the others. This statesman-like approach has made his system a welcome addition to Santiago, rather than a liability.

Dave has been very successful on Santiago, although he was not when he was on Wilson. Remember, he was the licensee of Wilson at the time of its demise. The people who hounded TDD off the air rarely show up there any more, and when they do, it's the same old rhetoric, but nobody seems to pay attention. The word is that they're out "liberating" other repeaters, but are having a bit of trouble, in that repeaters keep getting shut down on them abruptly. It's kind of hard to hassle a licensee you cannot reach either on the phone, on the air, or via the mail. Moreover, there are rumblings that many of the repeater owners who abandoned SCRA/TASMA when it restructured along the lines of permitting voting membership to non-system owners have now formed a new "repeater-owners-only organization" along the lines of the old SCRA. I have heard this story from far too many sources to discount it, but at press time, the details, even the organization's name (if it has one), are unknown. I can tell you that it's almost impossible to find a two-meter open repeater owner on his system these days anywhere in the Los Angeles-San Diego rf corridor, and the same seems to hold true for control operators. Oh, they're definitely listening. Obviously, someone is turning the machines off on the problems, but there is never a comment or a voice of ridicule. Just someone inconspicuously pulling the big switch.

There is one exception to this rule. His name is Dave Faraone and, somehow, for some unexplainable reason, he seems to be succeeding while remaining totally visible and accessible to the system's usership. From the new location, he has picked up a crop of new users who could not access the system when it was on Wilson. Additionally, some of those who had abandoned TDD during its "dark days" drift by now and again to say hello. Why Dave is succeeding from this location when he could not from the Wilson site, I cannot say. I never saw the claimed tyranny, so I see no difference between Wilson and Santiago, other than the lack of certain technical details like the amazing audio processing and the little reset beep that was company to me on many nights.

ANOTHER OWNER FIGHTS BACK DEPARTMENT

Our final item this month concerns the WR6ABN/K6MYK/W6MEP/RPT 147.84/.24 repeater. The story goes something like this. After liberating the TDD system, the next system to fall prey to problems was the old K6MYK/WR6ABN repeater. Though not the nation's first repeater, it is the longest continually operating system, dating back to an era when most repeaters were AM rather than FM. In November of '79, Art Gentry, its owner, announced that

as of the expiration of the WR6ABN license, the system would cease open operation. Everyone, including me, thought that this meant that under the W6MEP/RPT callsign, the system would become a closed- or private-category repeater with select usership. Only one small detail—Art never elaborated on the details of the change and just about everyone was caught off guard when the system reappeared under its new format. You see, it really remained an open repeater technically, but for the past three months, W6MEP/RPT has spent 24 hours a day, 7 days a week, in what might best be termed a random code practice mode. It still repeats from its input channel, but the single signal it's repeating is the practice CW.

Is it legal? According to FCC sources, it's very legal. In fact, since the CW is the primary signal, anyone talking over it might be held in violation of the rules! How about being fair to the users?

By the time the repeater reverted to this operation, the system provided little in the way of utility. It was jammed constantly and might well be serving a far better purpose operating the way it is now. With well over 300 repeaters in southern California on 2 meters, 90% of which are open, it's really hard to say that there is no other repeater to operate on, though that's the claim many have already made. There's only one question yet unanswered and that's how long this status quo will remain—how long W6MEP/RPT will remain a "CW practice" channel. Like other things, this is one that cannot easily be answered, since the system owner is unavailable for comment. Meanwhile, at least in this case, our phony liberationists have failed, and, boy, do they have egg on their faces this time. They need an enemy to fight, and the so-called "enemy" just isn't around any more.

LETTERS

from page 21

the world. Or, perhaps, a ten-cent stamp to be used on QSL cards mailed in the U.S., Canada, and our territories.

Placing the American flag into homes all over the world would do much to impress the world with the importance of international peace through free and unrestricted communications by amateur radio operators. We are hoping you all will flood Congress with your letters.

Loren Carlberg WB5WDG
Muskogee OK

TECH VS. CRAFT

After reading your editorial in the January issue of *73*, I felt compelled to make a few comments!

First of all, I would *never* recommend the occupation of electronics tech to anyone. It is the most underpaid occupation that I can think of. Suggest to young hams that, if they cannot get a degree, train to be an electrician—it pays *much* more!

In 19 years of experience as a tech, fairly well qualified in most disciplines, very well in several, and with employment in large companies (Texas Instruments), many small companies, ham radio companies, state agencies, city agencies, and field-service organizations (IBM and Industrial Nucleonics), plus a federal job or two, I have come to these conclusions: not only is the pay scale consistently lower than that of "craft skills" (electrician, plumber, carpenter, etc.), but the "bennies" are usually inferior and the advancement chances are *usually* limited by the custom of considering a technician as a "junior engineer," rather than as being in a totally separate profession.

Adding this to your argument as to the reason for the defection of the majority of the electronics industry to the far east, I think, perhaps, the conclusions may be somewhat different. I personally believe the fault lies with the greed of many companies, going around possible labor problems to have their products produced elsewhere for a larger profit. I find no fault with a profit motive, but I think that there are several kinds of profit, and that the quickest is not necessarily the best.

These companies which go bankrupt generally have themselves and their own attitude to blame; we are well rid of them.

R. R. De Jongh WB7CPT
Bellevue WA

SCHOLARSHIPS

The Foundation for Amateur Radio, Inc., a nonprofit organization with its headquarters in Washington DC, plans to award seven scholarships for the academic year 1980-81.

All amateurs holding a license of at least the FCC General class or equivalent can compete for one or more of the awards if they plan to pursue a full-time course of study beyond high school and are enrolled or have been accepted for enrollment in an accredited university, college, or technical school. The scholarship awards range from $300 to $900, with preference given in some of them to residents of various areas.

Additional information and an application form can be requested by a letter or postcard, postmarked prior to May 31, 1980.

The Foundation is devoted exclusively to promoting the interests of amateur radio and to scientific, literary, and educational pursuits which advance the purpose of amateur radio.

FAR Scholarships
8101 Hampden Lane
Bethesda MD 20014

MORE RFI DOPE

Thank you for the informative articles in the February, 1980, issue. I especially enjoy your editorials and letters and also enjoy the historical articles.

In regard to the WARC conference, I see no reason why the USA doesn't have 50 votes. The USSR counts all their satellites and republics within their borders.

Also, in regard to W4PZV's excellent article, "In Search of Power Line Interference," I was quite surprised that some power companies take such a dim view of TVI and RI complaints. In this area, just a phone call to the local office will suffice and they will send a technician to investigate.

Prior to retirement, I did considerable TVI and RI for the local power company and can attest to the use of a Sprague 610 Locater, tunable from 550 kHz to 220 MHz, and the sledge (hi!). In fact, some customers have called the office to report that an employee was knocking down poles!

Wet weather clears up noise because it not only shorts out gaps but swells the poles and cross-arms and tightens the hardware.

In regard to noisy transformers, this noise will never stop until the culprit is replaced. The noise will usually peak at about 2.5 to 3.5 MHz, depending on the kW capacity of the transformer, to 50 MHz on extremely noisy ones.

The worst case, a radiated carrier traveling thirty miles and varying in frequency up to 160 MHz, was traced by directional bearings to a solid-state intercom using building wiring as an intercom path *and* as a high-quality antenna! This carrier varied with signal strength and frequency and had 60-Hz modulation. It took two weeks to locate.

Other items to check out are photoelectric cells on street lights, heating pads, water beds, fluorescent lamps, TV sets, electric blankets, etc.

Robert K. Brenstein KA6EUP
Santa Rosa CA

THANKS TO ALL

Letters of praise are always fun to write, but I'll add one more.

I have read your magazine's regular articles on CB-to-10 conversions, and the itch finally had to be scratched. First, I laid my hands on a 23-channel CB. When I popped the top off, all the things I memorized for the various exams that regularly confront us disappeared from my gray matter. Not being the shy type, I called your editorial staff and pleaded for some direction on finding a conver-

sion scheme. The understanding given the caller was both appreciated and friendly. Being in the hotel business, I am sensitive to attitudes and genuine concern. Both these qualities were apparent.

My particular rig had not been covered by your articles, but I was directed to one of your advertisers—American Crystal Supply Co. Well, I called up to West Yarmouth and hooked up with Arthur Mott at ACS. Being totally inexperienced, I was looking for guidance. What I received was overwhelming support and technical advice. I ordered the crystal kit from Arthur and received it via parcel post in two days. So far, so good.

Then I tried to read the instructions—nothing! I couldn't get past step one, so I called Arthur again. He lent a sympathetic ear to me and had saintly patience. On this advice, I armed myself with a Sams Photofact® and set to work.

After several conversations with Arthur, covering everything from weather to schematics and varactors, I fired up the flame thrower I use as a soldering gun (is 75 Watts too much heat?) and in 90 minutes I was on the air . . . Swan Island QRP!

Wayne, Arthur Mott, American Crystal Supply, and your staff deserve high praise. We always claim to be a fraternity, but often it's a quick hello and a kiss good-by . . . you're on your own, chum. However, this wasn't the case with the fine people above, and I hope to someday meet them and treat them to some adult beverages. They are what hamming is all about.

Greg Smith KB5PE
Cypress TX

Awards

from page 23

ed for the 200, 300, and 400 bar awards. Where it will end, nobody knows, for the most numbers collected to date is by Grace K5MRU, who now has 8200 confirmed.

When you reach the 500 bar, serial numbers are then assigned to each bar issued thereafter. Once the applicant reaches 1000, he or she reaches the first step in which award plaques are issued. Plaques are issued also for 2500, 5000, and 7500 contacts.

Of course, the awards program does not stop here. Following are some others.

10-10 WAS AWARD

This award requires an applicant to make at least one contact in each state with another member of Ten-Ten International. QSL cards and sufficient postage for their safe return are to be sent with your application to WB6OMH. This award is issued for contacts made only after January 1, 1973, on any authorized mode on the ten-meter band.

THE VP CERTIFICATE

To qualify for this award, a Net member must have earned his or her "500 bar," at which time a VP Number and certificate were assigned. The idea for the VP Certificate issued here is to work at least 100 other Net members who have achieved their 500 bar and who have been issued a VP serial number. To be valid, all contacts must be made between 28.500 and 28.550 MHz or above 29 MHz, with the contact lasting at least 5 minutes. As with all 10-10 awards, application must indicate the 10-10 number, callsign, name, frequency, and exact QTH. Also, a definite requirement is to list the station's VP serial number.

All contacts must be made on or after October 15, 1979, to qualify. Send your application to: Grace Dunlap K5MRU, Box 445, La Feria TX 78559.

To the best of our knowledge, there is no award fee.

LUCKY 13 AWARD

The Lucky 13 Award is to prove that your station is capable of working the entire 10-meter band. This is not a frequency-measuring test and it is not necessary to stay exactly on the prescribed frequencies. The idea here is to make contact with 13 different VP members on each 100-kHz segment of the band: 28.500, 28.600, 28.700, 28.800, 28.900, 29.000, 29.100, 29.200, 29.300, 29.400, 29.500, 29.600, and 29.690 (29.700 is the band edge, so be careful). Any mode or mixed mode is permissible. As with all awards, you must log the callsign, the VP number, the first name, the QTH, and, in this case, the date and time of each contact claimed. It is not necessary to send QSLs, but you should have your list verified and mailed to: Rich Richardson WB0FQD, 960 E. Cottonwood Avenue, Littleton CO 80121.

FEARL AWARDS

I just received award information from a personal friend of mine who used to reside here on Whidbey Island, Glenn KA8GW (WB7SPD), who is stationed with the US Navy in Masawa, Japan. Glenn urges those seeking the awards being offered by the Far East Auxiliary Radio League (FEARL) to be careful to only count those contacts with KA stations in Japan and not to include those in the continental United States.

Glenn mentioned a couple of nets which may assist those wishing to meet the award requirements in a minimum of time. 14.285 MHz is the golden frequency on Sundays at 0200Z and Wednesdays at 1200Z.

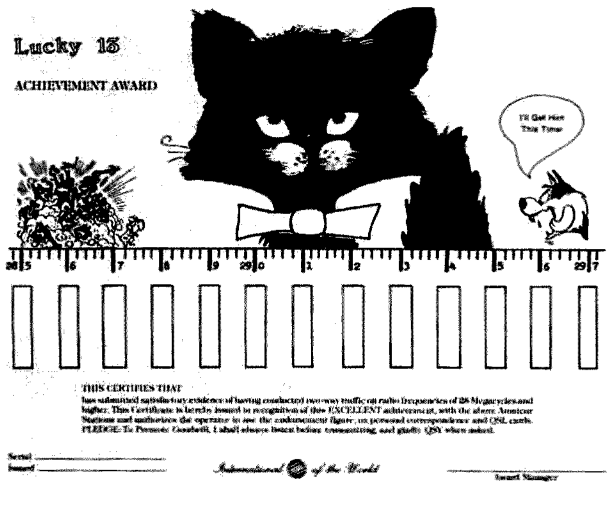
All FEARL awards are available for $1.00 or 7 IRCs, which must be sent with your application to: Far East Auxiliary Radio League, Attention: Awards Manager, c/o Sam Fleming KA2SF, GARH-ID-GS-M NCS Japan, APO San Francisco CA 96343.

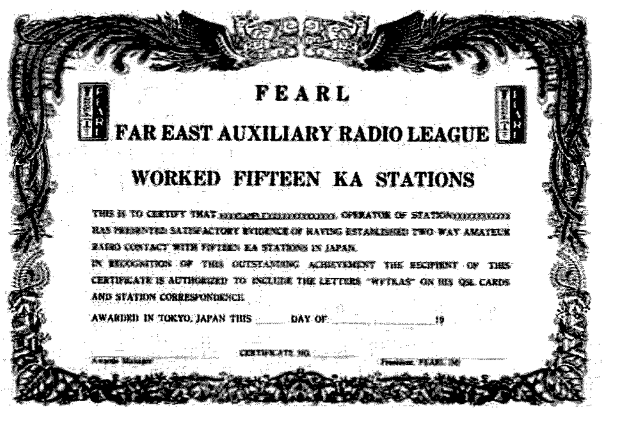
WORKED FIFTEEN KA STATIONS

To qualify for the WFTKAS Award, applicants must work a minimum of at least 15 KA stations located in Japan or Okinawa. Stateside KA stations do not count. There are no mode or band restrictions nor are there any date limitations. General certification rules apply, with proper logbook data.

KA RAG CHEWERS CLUB

This award certifies the applicant has presented evidence of having had a rag chew with a KA station in the Orient for a period





of not less than thirty minutes. There are no band, mode, or date limitations. To apply, merely give general logbook data, including the time your QSO began and ended. GCR apply.

RAG CHEWER SUPREME

Should you be longwinded and were fortunate to enjoy an hour-long QSO with any KA station in the Orient, then the Rag Chewer Supreme Award is designed especially for you. To apply, merely provide logbook data and the appropriate award fee of $1.00 or 7 IRCs. GCR apply.

KA ROUNDTABLE AWARD

To qualify for this award, the applicant must establish and maintain two-way amateur radio communications with at least two KA stations in the Orient on the same frequency at the same time for a minimum of thirty minutes. There are no special band or mode endorsements. Date is not a factor. GCR apply.

SHORTWAVE LISTENER AWARD

For the shortwave listeners, FEARL presents this award for having heard and rendered a signal report to the operators of at least two KA stations in the Orient. Applicants merely send general logbook data and the appropriate award fee when applying.

CHARLES DENNIS WBØZKG

Probably one of the toughest bands on which to obtain contacts in all 50 states is 6 meters. Nevertheless, the challenge didn't stop Charlie WBØZKG from Toledo, Iowa.

Charlie, equipped with a Swan 250 six-meter rig and a Wilson six-element wide-spaced yagi, began his pursuit in June, 1979. Within 5 months, he had worked all 50 US states and was awarded *73 Magazine*'s Worked All USA Award #1 for his 6-meter feat. Since that time, Charlie has gone on to add over a dozen DX countries to his list of QSOs, plus a host of contacts via 6/10 meter crossband from Europe.

First licensed in January, 1977, Charlie was issued his present call, WBØZKG, as a Novice. Fourteen months later, he upgraded to his present status of Technician.

Not being able to utilize HF phone privileges, he purchased a Yaesu FT-221R all-mode two-meter transceiver and a 22-element Cushcraft 2-meter array and settled for FM communications. Wishing to find a new frontier, Charlie then purchased a 50-foot crank-up tower, two F9FT (32-element total) arrays, and set out to conquer 2-meter sideband. For his efforts, over 20 US states and several Canadian provinces were added to his list of credits.

It was shortly after this that Charlie began getting frustrated again and wanted to move on. This is when he got his first taste of six-meter operation, a band which he now calls home.

Charlie is president of the Central Iowa Amateur Radio Club, and his wife, Mary KAØCWR, assists him in editing the monthly club newsletter.

Charlie met his wife in 1977 and they were married the following year in June at the Field-Day site, right smack dab in the middle of all the contesting that was going on!

In the future, Charlie hopes to expand his station to include multiple antenna arrays for 50, 144, 432, and 1296 MHz. His present HF station, although not too productive lately, consists of a TS-520 with a TA-33-40KR and SB-220. As Charlie puts it, "About the only way I'll ever get to use it is to upgrade, but I'm having too much fun on 6 meters!"

FCC

Reprinted from the Federal Register.

[Docket No. 20777; RM-2429; RM-2550; and RM-2771; FCC 80-35]

Deregulation of Part 97 of the Rules Regarding Emissions Authorized in the Amateur Radio Service

AGENCY: Federal Communications Commission.

ACTION: Third report and order.

SUMMARY: The Commission adopts rules allowing amateur radio operators to use the American Standard Code for Information Interchange (ASCII) for radioteleprinter communications, remote control operations, the operation of data networks, and other uses consistent with the amateur rules.

EFFECTIVE DATE: March 17, 1980.

ADDRESSES: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: John B. Johnston, Chief, Personal Radio Branch, Private Radio Bureau, (202) 254-6884.

SUPPLEMENTARY INFORMATION:

Third Report and Order

Adopted: January 30, 1980.
(Released: February 7, 1980.

By the Commission:

1. On August 8, 1978, the Commission adopted a Notice of Inquiry and Further Notice of Proposed Rule Making which was published in the Federal Register (43 FR 36984) on August 11, 1978. This Notice proposed deregulating the emissions authorized in the Amateur Radio Service by providing for the use of the American Standard Code for Information Interchange (ASCII)[1] by amateur radioteleprinter operators. Section 97.69 of the Commission's Rules, which regulates radioteleprinter transmissions in the Amateur Radio Service, presently allows only the use of the International Telegraphic Alphabet No. 2 (often referred to as the "Baudot Code") under carefully specified technical parameters. Since 1968, ASCII has largely replaced the Baudot Code as the teleprinter code in common commercial usage in the United States. The Commission felt it appropriate, therefore, that it make provision for the use of ASCII in the Amateur Radio Service.

2. In the above-mentioned Notice, the Commission discussed the composition of ASCII and various factors which make its use desirable. In addition, we raised a number of questions concerning the technical limitations which should be applicable to its use, such as the maximum permissible bandwidth, sending speed, frequency deviation and modulating frequency, permissible emission types, the use of parity bits, synchronous and asynchronous transmission, and the order of the data bits.

[1] The term "ASCII", used throughout this proceeding, refers to the USA Standard Code for Information Interchange as defined in the United States of America Standards Institute Standard X3.4-1968.

Summary of Comments

3. Approximately 55 comments were filed, including 2 reply comments. Almost 80 percent of those filing comments expressed the belief that if the Commission was to be true to the spirit of § 97.1 of the amateur rules (which explains the basis and purpose of the Amateur Radio Service), particularly in reference to the provisions concerning "continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art,"[2] and "advancing skills in both the communications and technical phases of the art,"[3] then it should adopt few, if any, restrictions or standards relating to radioteleprinter operation. The comments generally reflect the view that any standards adopted should be as broad as possible (such as the specification of maximum permissible bandwidth) and should not be concerned with specific radioteleprinter code types or the transmission parameters normally associated with the use of such codes. A number of those filing comments expressed the belief that in raising such detailed questions about the specifics of radioteleprinter operation, the Commission was in fact proposing a "reregulation" of the Amateur Radio Service, not the "deregulation" which was represented. Thus, in the face of what was perceived as conflicting and contradictory intentions on the Commission's part, many of those filing comments, after initially arguing for only the most minimal or necessary technical standards, went on to make specific recommendations in response to the questions raised by the Commission in the Notice.

4. There was virtually unanimous agreement that the Commission should not concern itself with (or adopt rules relating to) the use of a parity bit, the order of the bits (in terms of most or least significant), or the use of synchronous or asynchronous transmission. There was also general agreement that the permissible bandwidths of ASCII or other radioteleprinter signals should be similar to the traditional bandwidths associated with the use of the Baudot Code in the various frequency bands. In most cases, these traditional radioteleprinter bandwidths were taken as the basis for calculating maximum permissible sending speeds (but not "standard" sending speeds), inasmuch as operation within such maximum specified limits is very easily ascertained (thus facilitating compliance); and provides amateur radioteleprinter operators with some latitude in sending speed which would be lost with little, if any, advantage, if we were to specify or require the use of "standard" speeds within certain tolerances. Thus, there appeared to be a general consensus of opinion that the speed between 3.5 and 29.7 MHz should be limited to 300 bauds where the use of F1 emission is authorized, 1200 bauds between 50.1 and 225 MHz where the use of F1, F2 and A2 emissions are authorized, and no limit above 420 MHz. Several of those filing comments, however, pointed out the dual "wideband" and "narrowband" nature of the 10 meter band (28.0–29.7 MHz), and argued that the use of up to 1200 bauds would appear to be appropriate. There were also some comments

[2] See Section 97.1, Paragraph (b) of the Commission's Rules.

[3] Ibid, Paragraph (c).

suggesting that 19.6 kilobauds would be an appropriate limit in the higher (i.e., above 420 MHz) amateur frequency bands. There were many indications, in the comments, that while amateur operators, in general, favored flexible rules which fostered experimentation; many would none the less use conventional codes and sending speeds in conjunction with traditional or generally accepted frequency shifts or modulating frequencies, or with technical parameters chosen with more of a view toward more efficient, spectrum conserving operation.

5. In other comments, amateur operators expressed interest in using radioteleprinter codes other than Baudot or ASCII. Frequently cited examples were the Binary Coded Decimal (BCD), Extended Binary Coded Decimal Interchange Code (EBCDIC), Moore and Correspondence (IBM Selectric) codes. It was also felt that the Commission should allow the use of various "computer" or "machine" languages for computer-to-computer communication; and that the rules should provide for experimentation in the use of "packet switching" techniques. Recognizing that under such an approach, it would be impossible for the Commission's enforcement personnel to intercept all radioteleprinter transmissions, several of those filing comments pointed out that amateurs have repeatedly demonstrated their ability to enforce self-imposed standards, and recommended that the Commission take an approach of adopting generalized and non-specific rules which deal only with the general form, and not the content of transmissions. Reference is made to the generally high degree of amateur operator compliance with the rules relating to permissible communications as the foundation for this deregulatory approach.

6. About the only comments at variance with the general amateur operator consensus on this matter were filed by the National Communications System (NCS). [4] NCS argued that the Commission should adopt relatively detailed technical standards (based on ANSI, CCITT and CCIR standards [5] in order to foster what it terms "interoperability." NCS views the Amateir Radio Service as a valuable national resource of potentially great significance in augmenting commercial and Federal Government communications networks. It feels that "interoperability" or communications system compatibility would be best ensured by the Commission's adoption of technical limitations on radioteleprinter operation. While these limitations would be specified in rather considerable detail, NCS nevertheless feels that they would still allow ample room for technological innovation and advancement in performance.

Conclusions

7. Our intent in this proceeding was simply to expand the operating capabilities available to amateur radioteleprinter operators by providing for the use of ASCII. We find, however, that the comments generally go beyond our proposal and seek more or less total deregulation in the area of radioteleprinter operation. We are not necessarily opposed to such extensive deregulation; and we agree that it would be in perfect harmony with the basis and purpose of the Amateur Radio Service as articulated in § 97.1 of the rules. However, it is not clear that such an action would be consistent with Article 41 of the International Telecommunications Union (ITU) Regulations. [6] Additional exploration is needed to verify the literal and implied intent of Article 41 in relation to international radioteleprinter communications.

8. Past experience with the use of the Baudot code in the Amateur Radio Service indicates that the vast majority of operatore use common radioteleprinter standards, thus simplifying enforcement monitoring both by amateurs and our monitoring personnel. Accordingly, we are not adopting further standards at this time with regard to the use of the ASCII radioteleprinter code.

9. On the matter of "interoperability" raised by the National Communications System, the Commission feels that even if no standards were being adopted, most amateur radioteleprinter operators would communicate with conventional equipment and operate in accordance with generally accepted technical standards. Even those operators who may be heavily involved in experimentation would certainly provide themselves with the capability of conventional operation within a very short time frame. We feel, then, that NCS's concern about "interoperability" is needless, particularly in view of the record of amateur operator preparedness in past emergencies.

10. In view of the foregoing discussion, we have decided to amend § 97.69 of the amateur rules to provide for the use of ASCII in the Amateur Radio Service. The only limitation we are placing on the use of ASCII is a sending speed limit applicable to each band. [7] The Commission recognizes that ASCII, as a means of digital communication, may have uses other than as a means of radioteleprinter communication (such as, but not restricted to, control of a station or object, transfer of computer programs or direct computer-to-computer communications and communication in data networks). To the extent that such uses do not conflict with other provisions set forth in rules, they are permissible.

11. Accordingly, it is ordered, that effective, March 17, 1980, Part 97 of the Commission's rules is amended as shown in the Appendix, pursuant to the authority contained in Sections 4(i) and 303 of the Communications Act of 1934, as amended. Further information on this matter may be obtained by contacting John B. Johnston, Private Radio Bureau, Rules Division, Personal Radio Branch, at (202) 254-6884.

(Secs. 4, 303, 48 stat., as amended, 1066, 1082; 47 U.S.C. 154, 303)

Federal Communications Commission,
William J. Tricarico,
Secretary.

Appendix

I. Part 97 of the Commission's Rules and Regulations is amended as follows:

1. in § 97.69, is re-entitled "Digital transmissions" and is amended to read as follows:

§ 97.69 Digital transmissions.

Subject to the special conditions contained in paragraphs (a) and (b) below, the use of the International Telegraphic Alphabet No. 2 (also known as the Baudot Code) and the American Standard Code for Information Interchange (ASCII) may be used for such purposes as (but not restricted to) radio teleprinter communications, control of amateur radio stations, models and other objects, transfer of computer programs or direct computer-to-computer communications, and communications in various types of data networks (including so-called "packet switching" systems); provided that such operation is carried out in accordance with the other regulations set forth in this Part.

(a) Use of the International Telegraphic Alphabet No. 2 (Baudot Code) is subject to the following requirements:

(1) Transmission shall consist of a single channel, five-unit (start-stop) teleprinter code conforming to International Telegraphic Alphabet No. 2 with respect to all letters and numerals (including the slant sign or fraction bar); however, in "figures" positions not utilized for numerals, special signals may be employed for the remote control of receiving printers, or for other purposes indicated in this section.

(2) The transmitting speed shall be maintained within 5 words per minute of one of the following standard speeds: 60 (45 bauds), 67 (50 bauds), 75 (56.25 bauds) or 100 (75 bauds) words per minute.

(3) When frequency shift keying (type F1 emission) is utilized, the deviation in frequency from the mark signal to the space signal, or from the space signal to the mark signal, shall be less than 900 Hertz.

(4) When audio frequency shift keying (type A2 or F2 emission) is utilized, the highest fundamental modulating frequency shall not exceed 3000 Hertz, and the difference between the modulating audio frequency for the mark signal and that for the space signal shall be less than 900 Hertz.

(b) Use of the American Standard Code for Information Interchange (ASCII) is subject to the following requirements:

(1) The code shall conform to the American Standard Code for Information Interchange (ASCII) as defined in American National Standard Institute (ANSI) Standard X3.4-1968.

(2) F1 emission shall be utilized on those frequencies between 3.5 and 21.25 MHz where its use is permissible; and the sending speed shall not exceed 300 bauds.

(3) F1, F2 and A2 emissions may be utilized on those frequencies between 28 and 225 MHz where their use is permissible; and the sending speed shall not exceed 1200 bauds.

(4) F1, F2 and A2 emissions may be utilized on those frequencies above 420 MHz where their use is permissible; and the sending speed shall not exceed 19.6 kilobauds.

[4] The National Communications System is a confederation in which certain Federal Agencies participate with their assets to provide necessary communications for the Federal Government under all conditions raging from a normal situation to national emergencies and international crises, including nuclear attacks. The primary assets of the NCS include the telecommunications networks of the Departments of State, Defense, Interior, Commerce, Energy and the Federal Aviation Administration, the General Services Administration, the Central Intelligence Agency, the National Aeronautics and Space Administration, and the International Communications Agency.

[5] ANSI—American National Standards Institute, CCIR—International telegraph and telephone consultative committee, CCIR—International Radio Consultative Committee.

[6] A preliminary opinion on this matter is that Article 41, section 2(1) (which states, in part, that "transmissions between amateur stations of different countries . . . shall be made in plain language") could be construed to allow the use of "standard" radioteleprinter codes for international communications, but no other type of radioteleprinter code, whether it be used for experimental purposes or otherwise. However, Article 41 does not appear to prohibit the use of an unlimited number of radioteleprinter codes domestically.

[7] Recognizing that the use of slower speeds is likely to be the norm, we have, in order to provide maximum flexibility, decided to permit speeds up to 300 bauds between 3.5 and 28 MHz, 1200 bauds between 28 and 225 MHz, and 19.6 kilobauds above 420 MHz. (See the Appendix, revised 97.69 for additional details.)

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Federal Communications Commission
Private Radio Bureau
Washington, D.C. 20554

STUDY GUIDE FOR THE AMATEUR RADIO OPERATOR LICENSE EXAMINATIONS

This Bulletin contains syllabi for the FCC amateur radio examinations.

WHY ARE AMATEUR RADIO OPERATOR EXAMINATIONS REQUIRED?

The examinations determine if you are qualified for the privileges conveyed by an amateur radio license. Those privileges are many and diverse. As an amateur radio operator, you will be allowed to build, repair, and modify your radio transmitters. You will be responsible for the technical quality of your station's transmissions. You will be allowed to communicate with amateur radio operators in other countries around the world and, in some cases, send messages for friends. As you upgrade to the higher operator license classes, you will be allowed to communicate using not only telegraphy and voice, but also teleprinting, facsimile, and several forms of television. For such a flexible radio service to be practical, you and every other amateur radio operator must thoroughly understand your responsibilities and develop the skills needed to operate your amateur radio station properly.

WHAT SUBJECTS DO THE AMATEUR RADIO EXAMINATIONS COVER?

The examinations cover the rules, practices, procedures, and technical material that you will need to know in order to operate your amateur radio station properly. Each examination element is composed of questions which will determine whether you have an adequate understanding of the topics listed in the corresponding syllabus. For example, all Element 3 examination questions are derived from the Element 3 syllabus, which appears on pages 5, 6, and 7 of this Bulletin. To properly prepare for an examination, you should become knowledgeable about all of the topics in the syllabus for the element you will be taking. Every examination covers nine general subjects:

- Rules and Regulations
- Electrical Principles
- Signals and Emissions
- Circuit Components
- Practical Circuits
- Operating Procedures
- Antennas and Feedlines
- Radio Wave Propagation
- Amateur Radio Practice

Periodically, the syllebi are updated to reflect changing technology and amateur radio practices. Comments on the study guide contents are welcome. Mail them to:

Personal Radio Branch
Federal Communications Commission
Washington, D.C. 20554

WHERE CAN STUDY MANUALS BE OBTAINED?

A study manual can be helpful in preparing for an examination. Several publishers offer manuals or courses based upon the material in this Bulletin. These may be found in many public libraries and radio stores. The FCC does not offer such manuals, nor recommend any specific publisher. However, you will find two FCC publications, Part 97 - Rules and Regulations for the Amateur Radio Service and How to Identify and Resolve Radio-TV Interference Problems, useful when preparing for the amateur radio examinations. Copies are sold by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Specify stock number 004-000-00357-8 for Part 97 and stock number 004-000-00345-4 for the Radio-TV interference booklet.

STUDY TOPICS FOR THE NOVICE CLASS AMATEUR RADIO OPERATOR LICENSE EXAMINATION
(Element 2 Syllabus)

A. RULES AND REGULATIONS

DEFINE:

(1) AMATEUR RADIO SERVICE 97.3(a)
(2) AMATEUR RADIO OPERATOR 97.3(c)
(3) AMATEUR RADIO STATION 97.3(e)
(4) AMATEUR RADIO COMMUNICATIONS 97.3(b)
(5) OPERATOR LICENSE 97.3(d)
(6) STATION LICENSE 97.3(d)
(7) CONTROL OPERATOR 97.3(o)
(8) THIRD PARTY TRAFFIC 97.3(v)

NOVICE CLASS OPERATOR PRIVILEGES:

(9) AUTHORIZED FREQUENCY BANDS 97.7(e)
(10) AUTHORIZED EMISSION (A1) 97.7(e)

PROHIBITED PRACTICES:

(11) UNIDENTIFIED COMMUNICATIONS 97.123
(12) INTENTIONAL INTERFERENCE 97.125
(13) FALSE SIGNALS 97.121
(14) COMMUNICATION FOR HIRE 97.112(a)

BASIS AND PURPOSE OF THE AMATEUR RADIO SERVICE RULES AND REGULATIONS:

(15) TO RECOGNIZE AND ENHANCE THE VALUE OF THE AMATEUR RADIO SERVICE TO THE PUBLIC AS A VOLUNTARY, NON-COMMERCIAL COMMUNICATION SERVICE, PARTICULARLY WITH RESPECT TO PROVIDING EMERGENCY COMMUNICATIONS. 97.1(a)
(16) TO CONTINUE AND EXTEND THE AMATEUR RADIO OPERATORS' PROVEN ABILITY TO CONTRIBUTE TO THE ADVANCEMENT OF THE RADIO ART. 97.1(b)
(17) TO ENCOURAGE AND IMPROVE THE AMATEUR RADIO SERVICE BY PROVIDING FOR ADVANCING SKILLS IN BOTH THE COMMUNICATION AND TECHNICAL PHASES. 97.1(c)
(18) TO EXPAND THE EXISTING RESERVOIR WITHIN THE AMATEUR RADIO SERVICE OF TRAINED OPERATORS, TECHNICIANS, AND ELECTRONICS EXPERTS. 97.1(d)
(19) TO CONTINUE AND EXTEND THE RADIO AMATEURS' UNIQUE ABILITY TO ENHANCE INTERNATIONAL GOOD WILL. 97.1(e)

OPERATING RULES:

(20) U. S. AMATEUR RADIO STATION CALL SIGNS 2.302 and FCC Public Notice
(21) PERMISSIBLE POINTS OF COMMUNICATIONS 97.89(a)(1)
(22) STATION LOGBOOK, LOGGING REQUIREMENTS 97.103(a), (b); 97.105
(23) STATION IDENTIFICATION 97.84(a)
(24) NOVICE BAND TRANSMITTER POWER LIMITATION 97.67(b), (d)
(25) NECESSARY PROCEDURE IN RESPONSE TO AN OFFICIAL NOTICE OF VIOLATION 97.137
(26) CONTROL OPERATOR REQUIREMENTS 97.79(a), (b)

B. OPERATING PROCEDURES

(1) R-S-T SIGNAL REPORTING SYSTEM
(2) CHOICE OF TELEGRAPHY SPEED
(3) ZERO-BEATING RECEIVED SIGNAL
(4) TRANSMITTER TUNE-UP PROCEDURE

(5) USE OF COMMON AND INTERNATIONALLY RECOGNIZED TELEGRAPHY ABBREVIATIONS, INCLUDING: CQ, DE, K, SK, R, $\overline{AR}$, 73, QRS, QRZ, QTH, QSL, QRM, QRN

C. RADIO WAVE PROPAGATION

(1) SKY WAVE; "SKIP"
(2) GROUND WAVE

D. AMATEUR RADIO PRACTICE

(1) MEASURES TO PREVENT USE OF AMATEUR RADIO STATION EQUIPMENT BY UNAUTHORIZED PERSONS

SAFETY PRECAUTIONS:

(2) LIGHTNING PROTECTION FOR ANTENNA SYSTEM
(3) GROUND SYSTEM
(4) ANTENNA INSTALLATION SAFETY PROCEDURES

ELECTROMAGNETIC COMPATABILITY - IDENTIFY AND SUGGEST CURE:

(5) OVERLOAD OF CONSUMER ELECTRONIC PRODUCTS BY STRONG RADIO FREQUENCY FIELDS
(6) INTERFERENCE TO CONSUMER ELECTRONIC PRODUCTS CAUSED BY RADIATED HARMONICS

INTERPRETATION OF S.W.R. READINGS AS RELATED TO FAULTS IN ANTENNA SYSTEM:

(7) ACCEPTABLE READINGS
(8) POSSIBLE CAUSES OF UNACCEPTABLE READINGS

E. ELECTRICAL PRINCIPLES

CONCEPTS:

(1) VOLTAGE
(2) ALTERNATING CURRENT, DIRECT CURRENT
(3) CONDUCTOR, INSULATOR
(4) OPEN CIRCUIT, SHORT CIRCUIT
(5) ENERGY, POWER
(6) FREQUENCY, WAVELENGTH
(7) RADIO FREQUENCY
(8) AUDIO FREQUENCY

ELECTRICAL UNITS:

(9) VOLT
(10) AMPERE
(11) WATT
(12) HERTZ

(13) METRIC PREFIXES: MEGA, KILO, CENTI, MILLI, MICRO, PICO

F. CIRCUIT COMPONENTS

PHYSICAL APPEARANCE, APPLICATIONS, AND SCHEMATIC SYMBOLS OF:

(1) QUARTZ CRYSTALS
(2) METERS (D'ARSONVAL MOVEMENT)
(3) VACUUM TUBES
(4) FUSES

G. PRACTICAL CIRCUITS

BLOCK DIAGRAMS:

(1) THE STAGES IN A SIMPLE TELEGRAPHY (A1) TRANSMITTER
(2) THE STAGES IN A SIMPLE RECEIVER CAPABLE OF TELEGRAPHY (A1) RECEPTION
(3) THE FUNCTIONAL LAYOUT OF NOVICE STATION EQUIPMENT, INCLUDING TRANSMITTER, RECEIVER, ANTENNA SWITCHING, ANTENNA FEEDLINE, ANTENNA, AND TELEGRAPH KEY

H. SIGNALS AND EMISSIONS

(1) EMISSION TYPE A1

CAUSE AND CURE:

(2) BACKWAVE
(3) KEY CLICKS
(4) CHIRP
(5) SUPERIMPOSED HUM
(6) UNDESIRABLE HARMONIC EMISSIONS
(7) SPURIOUS EMISSIONS

I. ANTENNAS AND FEEDLINES

NECESSARY PHYSICAL DIMENSIONS OF THESE POPULAR HIGH FREQUENCY ANTENNAS FOR RESONANCE ON AMATEUR RADIO FREQUENCIES:

(1) A HALF-WAVE DIPOLE
(2) A QUARTER-WAVE VERTICAL

COMMON TYPES OF FEEDLINES USED AT AMATEUR RADIO STATIONS

(3) COAXIAL CABLE
(4) PARALLEL CONDUCTOR LINE

STUDY TOPICS FOR THE TECHNICIAN/GENERAL CLASS AMATEUR RADIO OPERATOR LICENSE EXAMINATION (Element 3 Syllabus)

A. RULES AND REGULATIONS

(1) CONTROL POINT 97.3(p)
(2) EMERGENCY COMMUNICATIONS 97.3(w); 97.107
(3) AMATEUR RADIO TRANSMITTER POWER LIMITATIONS 97.67
(4) STATION IDENTIFICATION REQUIREMENTS 97.84(b), (f), (g); 97.79(c)
(5) THIRD PARTY PARTICIPATION IN AMATEUR RADIO COMMUNICATIONS 97.79(d)
(6) DOMESTIC AND INTERNATIONAL THIRD PARTY TRAFFIC 97.114; Appendix 2, Art. 41, Sec. 2
(7) PERMISSIBLE ONE-WAY TRANSMISSIONS 97.91
(8) FREQUENCY BANDS AVAILABLE TO THE TECHNICIAN CLASS 97.7(d)
(9) FREQUENCY BANDS AVAILABLE TO THE GENERAL CLASS 97.7(b)
(10) LIMITATIONS ON USE OF AMATEUR RADIO FREQUENCIES 97.61
(11) SELECTION AND USE OF FREQUENCIES 97.63
(12) RADIO CONTROLLED MODEL CRAFTS AND VEHICLES 97.65(e); 97.99
(13) RADIOTELEPRINTER EMISSIONS 97.69

PROHIBITED PRACTICES:

(14) BROADCASTING 97.113
(15) MUSIC 97.115
(16) CODES AND CIPHERS 97.117
(17) OBSCENITY, INDECENCY, PROFANITY 97.119

B. OPERATING PROCEDURES

(1) RADIOTELEPHONY
(2) RADIO TELEPRINTING
(3) USE OF REPEATERS
(4) VOX TRANSMITTER CONTROL
(5) FULL BREAK-IN TELEGRAPHY
(6) OPERATING COURTESY
(7) ANTENNA ORIENTATION
(8) INTERNATIONAL COMMUNICATION
(9) EMERGENCY PREPAREDNESS DRILLS

C. RADIO WAVE PROPAGATION

(1) IONOSPHERIC LAYERS; D, E, F1, F2
(2) ABSORPTION
(3) MAXIMUM USABLE FREQUENCY
(4) REGULAR DAILY VARIATIONS
(5) SUDDEN IONOSPHERIC DISTURBANCE
(6) SCATTER
(7) SUNSPOT CYCLE
(8) LINE-OF-SIGHT
(9) DUCTING, TROPOSPHERIC BENDING

D. AMATEUR RADIO PRACTICE

SAFETY PRECAUTIONS:

(1) HOUSEHOLD AC SUPPLY AND ELECTRICAL WIRING SAFETY
(2) DANGEROUS VOLTAGES IN EQUIPMENT MADE INACCESSIBLE TO ACCIDENTAL CONTACT

TRANSMITTER PERFORMANCE:

(3) TWO TONE TEST
(4) NEUTRALIZING FINAL AMPLIFIER
(5) POWER MEASUREMENT

USE OF TEST EQUIPMENT:

(6) OSCILLOSCOPE
(7) MULTIMETER
(8) SIGNAL GENERATORS
(9) SIGNAL TRACER

ELECTROMAGNETIC COMPATIBILITY; IDENTIFY AND SUGGEST CURE:

(10) DISTURBANCE IN CONSUMER ELECTRONIC PRODUCTS CAUSED BY AUDIO RECTIFICATION

PROPER USE OF THE FOLLOWING STATION COMPONENTS AND ACCESSORIES:

(11) REFLECTOMETER (VSWR METER)
(12) SPEECH PROCESSOR - RF AND AF
(13) ELECTRONIC T-R SWITCH
(14) ANTENNA TUNING UNIT; MATCHING NETWORK
(15) MONITORING OSCILLOSCOPE
(16) NON-RADIATING LOAD; "DUMMY ANTENNA"
(17) FIELD STRENGTH METER; S-METER
(18) WATTMETER

E. ELECTRICAL PRINCIPLES

CONCEPTS:

(1) IMPEDANCE
(2) RESISTANCE
(3) REACTANCE
(4) INDUCTANCE
(5) CAPACITANCE
(6) IMPEDANCE MATCHING

ELECTRICAL UNITS:

(7) OHM
(8) MICROFARAD, PICOFARAD
(9) HENRY, MILLIHENRY, MICROHENRY
(10) DECIBEL

MATHEMATICAL RELATIONSHIPS:

(11) OHM'S LAW
(12) CURRENT AND VOLTAGE DIVIDERS
(13) ELECTRICAL POWER CALCULATIONS
(14) SERIES AND PARALLEL COMBINATIONS; OF RESISTORS, OF CAPACITORS, OF INDUCTORS
(15) TURNS RATIO; VOLTAGE, CURRENT, AND IMPEDANCE TRANSFORMATION
(16) ROOT MEAN SQUARE VALUE OF A SINE WAVE ALTERNATING CURRENT

F. CIRCUIT COMPONENTS

PHYSICAL APPEARANCE, TYPES, CHARACTERISTICS, APPLICATIONS, AND SCHEMATIC SYMBOLS FOR:

(1) RESISTORS
(2) CAPACITORS
(3) INDUCTORS
(4) TRANSFORMERS

(5) POWER SUPPLY TYPE DIODE RECTIFIERS

G. PRACTICAL CIRCUITS

(1) POWER SUPPLIES
(2) HIGH-PASS, LOW-PASS, AND BAND-PASS FILTERS
(3) BLOCK DIAGRAMS SHOWING THE STAGES IN COMPLETE AM, SSB, AND FM TRANSMITTERS AND RECEIVERS

H. SIGNALS AND EMISSIONS

(1) EMISSION TYPES AØ, A3, F1, F2, F3
(2) SIGNAL; INFORMATION
(3) AMPLITUDE MODULATION
(4) DOUBLE SIDEBAND
(5) SINGLE SIDEBAND
(6) FREQUENCY MODULATION
(7) PHASE MODULATION
(8) CARRIER
(9) SIDEBANDS
(10) BANDWIDTH
(11) ENVELOPE
(12) DEVIATION
(13) OVERMODULATION
(14) SPLATTER

(15) FREQUENCY TRANSLATION; MIXING, MULTIPLICATION
(16) RADIOTELEPRINTING; AUDIO FREQUENCY SHIFT KEYING, MARK, SPACE, SHIFT

I. ANTENNAS AND FEEDLINES

POPULAR AMATEUR RADIO ANTENNAS AND THEIR CHARACTERISTICS:

(1) YAGI ANTENNA
(2) QUAD ANTENNA
(3) PHYSICAL DIMENSIONS
(4) VERTICAL AND HORIZONTAL POLARIZATION

(5) FEEDPOINT IMPEDANCE OF HALF-WAVE DIPOLE, QUARTER WAVE VERTICAL
(6) RADIATION PATTERNS; DIRECTIVITY, MAJOR LOBES

CHARACTERISTICS OF POPULAR AMATEUR RADIO ANTENNA FEEDLINES; RELATED CONCEPTS:

(7) CHARACTERISTIC IMPEDANCE
(8) STANDING WAVES
(9) STANDING WAVE RATIO; SIGNIFICANCE OF
(10) BALANCED, UNBALANCED
(11) ATTENUATION
(12) ANTENNA-FEEDLINE MISMATCH

STUDY TOPICS FOR THE ADVANCED CLASS AMATEUR RADIO OPERATOR LICENSE EXAMINATION
(Element 4A Syllabus)

A. RULES AND REGULATIONS

(1) FREQUENCY BANDS AVAILABLE TO THE ADVANCED CLASS AMATEUR RADIO OPERATOR AND LIMITATIONS ON USE 97.7(a); 97.61
(2) AUTOMATIC RETRANSMISSION OF AMATEUR RADIO SIGNALS AND SIGNALS FROM OTHER RADIO SERVICES 97.3(x); 97.113; 97.126
(3) AMATEUR RADIO STATIONS IN REPEATER OPERATION 97.3(l); 97.85; 97.61(c)
(4) AMATEUR RADIO STATIONS IN AUXILIARY OPERATION 97.3(l); 97.86; 97.61(d)
(5) REMOTE CONTROL OF AMATEUR RADIO STATIONS 97.3(m)(2); 97.88
(6) AUTOMATIC CONTROL OF AMATEUR RADIO STATIONS 97.3(m)(3)
(7) CONTROL LINK 97.3(n)
(8) SYSTEM NETWORK DIAGRAM 97.3(u)
(9) STATION IDENTIFICATION 97.84(c), (d), (e)
(10) STATION LOG REQUIREMENTS 97.103(c), (d), (e), (f), (g)
(11) HEIGHT LIMITATIONS FOR AMATEUR RADIO STATION ANTENNA STRUCTURES, INCLUDING FAA NOTIFICATION CRITERIA, AND CALCULATION OF HEIGHT ABOVE AVERAGE TERRAIN 97.45; 97.67(c); Appendix 5

B. OPERATING PROCEDURES

(1) FACSIMILE TRANSMISSION
(2) SLOW-SCAN TELEVISION TRANSMISSION

C. RADIO WAVE PROPAGATION

(1) SPORADIC-E
(2) SELECTIVE FADING
(3) AURORAL PROPAGATION
(4) RADIO-PATH HORIZON

D. AMATEUR RADIO PRACTICE

USE OF TEST EQUIPMENT:

(1) FREQUENCY MEASUREMENT DEVICES
(2) GRID-DIP METER; SOLID STATE DIP METER

(3) PERFORMANCE LIMITATIONS OF OSCILLOSCOPES, METERS, FREQUENCY COUNTERS; ACCURACY, FREQUENCY RESPONSE, STABILITY

ELECTROMAGNETIC COMPATIBILITY:

(4) INTERMODULATION INTERFERENCE
(5) RECEIVER DESENSITIZING
(6) CROSS MODULATION INTERFERENCE
(7) CAPTURE EFFECT

E. ELECTRICAL PRINCIPLES

CONCEPTS:

(1) REACTIVE POWER
(2) SERIES AND PARALLEL RESONANCE
(3) SKIN EFFECT
(4) FIELDS, ENERGY STORAGE, ELECTROSTATIC, ELECTROMAGNETIC

MATHEMATICAL RELATIONSHIPS:

(5) RESONANT FREQUENCY, BANDWIDTH, AND "Q" OF R-L-C CIRCUITS, GIVEN COMPONENT VALUES
(6) PHASE ANGLE BETWEEN VOLTAGE AND CURRENT, GIVEN RESISTANCE AND REACTANCE
(7) POWER FACTOR, GIVEN PHASE ANGLE
(8) EFFECTIVE RADIATED POWER, GIVEN SYSTEM GAINS AND LOSSES
(9) REPLACEMENT OF VOLTAGE SOURCE AND RESISTIVE VOLTAGE DIVIDER WITH EQUIVALENT CIRCUIT CONSISTING OF A VOLTAGE SOURCE AND ONE RESISTOR (AN APPLICATION OF THEVENIN'S THEOREM, USED TO PREDICT THE CURRENT SUPPLIED BY A VOLTAGE DIVIDER TO A KNOWN LOAD)

F. CIRCUIT COMPONENTS

PHYSICAL APPEARANCE, TYPES, CHARACTERISTICS, APPLICATIONS, AND SCHEMATIC SYMBOLS FOR THE FOLLOWING:

(1) DIODES; ZENER, TUNNEL, VARACTOR, HOT-CARRIER, JUNCTION, POINT CONTACT, PIN
(2) TRANSISTORS; NPN, PNP, JUNCTION, UNIJUNCTION, POWER, GERMANIUM, SILICON
(3) SILICON CONTROLLED RECTIFIER, TRIAC
(4) LIGHT EMITTING DIODE, NEON LAMP
(5) CRYSTAL LATTICE SSB FILTERS

G. PRACTICAL CIRCUITS

(1) VOLTAGE REGULATOR CIRCUITS; DISCRETE AND INTEGRATED
(2) AMPLIFIERS; CLASS A, AB, B, C; CHARACTERISTICS OF EACH TYPE
(3) IMPEDANCE MATCHING NETWORKS; PI, L, PI-L
(4) FILTERS; CONSTANT K, M-DERIVED, BAND-STOP, NOTCH, MODERN-NETWORK-THEORY, PI-SECTION, T-SECTION, L-SECTION (NOT NECESSARY TO MEMORIZE DESIGN EQUATIONS; KNOW GENERAL DESCRIPTION, CHARACTERISTICS, RESPONSES, AND APPLICATIONS OF THESE FILTERS)
(5) OSCILLATORS; VARIOUS TYPES AND THEIR APPLICATIONS; STABILITY

TRANSMITTER AND RECEIVER CIRCUITS - KNOW PURPOSE OF EACH, AND HOW, BASICALLY, EACH FUNCTIONS:

(6) MODULATORS; AM, FM, BALANCED
(7) TRANSMITTER FINAL AMPLIFIERS
(8) DETECTORS, MIXER STAGES
(9) RF AND IF AMPLIFIER STAGES

CALCULATION OF VOLTAGES, CURRENTS, AND POWER IN COMMON AMATEUR RADIO ORIENTED CIRCUITS:

(10) COMMON EMITTER CLASS A TRANSISTOR AMPLIFIER; BIAS NETWORK, SIGNAL GAIN, INPUT AND OUTPUT IMPEDANCES

(11) COMMON COLLECTOR CLASS A TRANSISTOR AMPLIFIER; BIAS NETWORK, SIGNAL GAIN, INPUT AND OUTPUT IMPEDANCES

CIRCUIT DESIGN; SELECTION OF CIRCUIT COMPONENT VALUES:

(12) VOLTAGE REGULATOR WITH PASS TRANSISTOR AND ZENER DIODE TO PRODUCE GIVEN OUTPUT VOLTAGE
(13) SELECT COIL AND CAPACITOR TO RESONATE AT GIVEN FREQUENCY

H. SIGNALS AND EMISSIONS

(1) EMISSION TYPES A4, A5, F4, F5
(2) MODULATION METHODS
(3) DEVIATION RATIO
(4) MODULATION INDEX
(5) ELECTROMAGNETIC RADIATION
(6) WAVE POLARIZATION
(7) SINE, SQUARE, SAWTOOTH WAVEFORMS
(8) ROOT MEAN SQUARE VALUE
(9) PEAK ENVELOPE POWER RELATIVE TO AVERAGE
(10) SIGNAL TO NOISE RATIO

I. ANTENNAS AND FEEDLINES

(1) ANTENNA GAIN, BEAMWIDTH
(2) TRAP ANTENNAS
(3) PARASITIC ELEMENTS
(4) RADIATION RESISTANCE
(5) DRIVEN ELEMENTS
(6) EFFICIENCY OF ANTENNA
(7) FOLDED, MULTIPLE WIRE DIPOLES
(8) VELOCITY FACTOR
(9) ELECTRICAL LENGTH OF A FEEDLINE
(10) VOLTAGE AND CURRENT NODES
(11) MOBILE ANTENNAS
(12) LOADING COIL; BASE, CENTER, TOP

STUDY TOPICS FOR THE AMATEUR EXTRA CLASS AMATEUR RADIO OPERATOR LICENSE EXAMINATION
(Element 4B Syllabus)

A. RULES AND REGULATIONS

(1) FREQUENCY BANDS AVAILABLE TO THE U. S. AMATEUR RADIO OPERATOR AND LIMITATIONS ON THEIR USE INCLUDING VARIATIONS FOR REGIONS 1 & 3 97.61; 97.95
(2) SPACE AMATEUR RADIO STATIONS 97.3(t)
(3) PURITY OF EMISSIONS 97.73
(4) MOBILE OPERATION ABOARD SHIPS OR AIRCRAFT 97.101
(5) RACES OPERATION Part 97, Subpart F
(6) POINTS OF COMMUNICATIONS 97.89

B. OPERATING PROCEDURES

(1) USE OF AMATEUR RADIO SATELLITE
(2) AMATEUR FAST-SCAN TELEVISION

C. RADIO WAVE PROPAGATION

(1) EME; "MOONBOUNCE"
(2) METEOR BURST
(3) TRANS-EQUATORIAL

D. AMATEUR RADIO PRACTICE

USE OF TEST EQUIPMENT:

(1) SPECTRUM ANALYZER; INTERPRET DISPLAY; DISPLAY OF TRANSMITTER OUTPUT SPECTRUM, SUCH AS COMMONLY FOUND IN NEW PRODUCT REVIEW ARTICLES IN AMATEUR RADIO MAGAZINES

(2) LOGIC PROBE; INDICATION OF HIGH OR LOW STATE, PULSING STATE

ELECTROMAGNETIC COMPATABILITY:

(3) VEHICLE NOISE SUPPRESSION; IGNITION NOISE, ALTERNATOR WHINE, STATIC

(4) DIRECTION FINDING TECHNIQUES; METHODS FOR LOCATION OF SOURCE OF RADIO SIGNALS

E. ELECTRICAL PRINCIPLES

CONCEPTS:

(1) PHOTOCONDUCTIVE EFFECT
(2) EXPONENTIAL CHARGE/DISCHARGE

MATHEMATICAL RELATIONSHIPS; CALCULATIONS:

(3) TIME CONSTANT FOR R-C AND R-L CIRCUITS (INCLUDING CIRCUITS WITH MORE THAN ONE RESISTOR, CAPACITOR OR INDUCTOR)
(4) IMPEDANCE DIAGRAMS; BASIC PRINCIPLES OF SMITH CHART
(5) IMPEDANCE OF R-L-C NETWORKS AT A SPECIFIED FREQUENCY
(6) ALGEBRAIC OPERATIONS USING COMPLEX NUMBERS; REAL, IMAGINARY, MAGNITUDE, ANGLE

F. CIRCUIT COMPONENTS

PHYSICAL APPEARANCE, TYPES, CHARACTERISTICS, APPLICATIONS, AND SCHEMATIC SYMBOLS FOR:

(1) FIELD EFFECT TRANSISTORS; ENHANCEMENT, DEPLETION, MOS, CMOS, N-CHANNEL, P-CHANNEL
(2) OPERATIONAL AMPLIFIER AND PHASE-LOCKED LOOP INTEGRATED CIRCUITS
(3) 7400 SERIES TTL DIGITAL INTEGRATED CIRCUITS
(4) 4000 SERIES CMOS DIGITAL INTEGRATED CIRCUITS
(5) VIDICON; CATHODE RAY TUBE

G. PRACTICAL CIRCUITS

(1) DIGITAL LOGIC CIRCUITS; FLIP-FLOP, MULTIVIBRATOR, AND/OR/NAND/NOR/GATES
(2) DIGITAL FREQUENCY DIVIDER CIRCUITS; CRYSTAL MARKER, COUNTERS
(3) ACTIVE AUDIO FILTERS USING INTEGRATED OPERATIONAL AMPLIFIERS

HIGH PERFORMANCE RECEIVER CHARACTERISTICS

(4) NOISE FIGURE, SENSITIVITY
(5) SELECTIVITY
(6) DYNAMIC RANGE

CALCULATION OF VOLTAGES, CURRENTS, AND POWER IN COMMON AMATEUR RADIO ORIENTED CIRCUITS:

(7) INTEGRATED OPERATIONAL AMPLIFIER; VOLTAGE GAIN, FREQUENCY RESPONSE
(8) F.E.T. COMMON SOURCE AMPLIFIER; INPUT IMPEDANCE

CIRCUIT DESIGN; SELECTION OF CIRCUIT COMPONENT VALUES:

(9) L-C PRESELECTOR WITH FIXED AND VARIABLE CAPACITORS TO TUNE A GIVEN FREQUENCY RANGE
(10) SINGLE STAGE AMPLIFIER TO HAVE DESIRED FREQUENCY RESPONSE BY PROPER SELECTION OF BYPASS AND COUPLING CAPACITORS

H. SIGNALS AND EMISSIONS

(1) PULSE MODULATION; POSITION, WIDTH
(2) DIGITAL SIGNALS
(3) NARROW BAND VOICE MODULATION
(4) INFORMATION RATE VS. BANDWIDTH
(5) PEAK AMPLITUDE OF A SIGNAL
(6) PEAK-TO-PEAK VALUES OF A SIGNAL

I. ANTENNAS AND FEEDLINES

(1) ANTENNAS FOR SPACE RADIO COMMUNICATIONS; GAIN, BEAMWIDTH, TRACKING
(2) ISOTROPIC RADIATOR; USE AS A STANDARD OF COMPARISON
(3) PHASED VERTICAL ANTENNAS; RESULTANT PATTERNS, SPACING IN WAVELENGTHS
(4) RHOMBIC ANTENNAS; ADVANTAGES, DISADVANTAGES
(5) MATCHING ANTENNA TO FEEDLINE; DELTA, GAMMA, STUB
(6) PROPERTIES OF 1/8, 1/4, 3/8, AND 1/2 WAVELENGTH SECTIONS OF FEEDLINES; SHORTED, OPEN

New Products

from page 28

channel 1 and 147.330 MHz from the microphone only, since M1 CALL and 10k UP and 10k DOWN keys are built into it. The offset can be chosen at will by means of the ±600 SHIFT key, since offset information and memory are stored independently.

Other Controls

Let's discuss more fully the function of that strange rotary switch in the upper right labeled OFFSET/SCAN. The radio operates normally when this switch is to the right of center. The letters represent the scan modes "free," "busy," and "vacant." This switch is responsible for choosing the scan mode. In this respect, the left and right portion of the switch range are identical. But when the switch is to the left of center, an offset is thrown in that does not show up on the display. This offset is +1 MHz with respect to whatever is indicated on the display while transmitting. You can have three nonstandard offsets by using the ±600 SHIFT key in addition to the +1-MHz split. The offsets so obtained are +400 kHz, +1 MHz, and +1.6 MHz. The value of the offset provided by the OFFSET/SCAN switch is controlled by a crystal and can be changed to suit individual needs. This is particularly useful if MARS/CAP operation is contemplated.

The PCS-2000 has two front-panel selectable levels of output power: 25 Watts and 5 Watts. The low-power level can be adjusted from roughly 3 to 7 Watts. To operate in low power, you simply pull on the front-panel squelch knob.

There are two push-in lock switches on the front panel; one is for adding 5 kHz and the other is for selecting front-panel or microphone control of volume and squelch. (It's easy to leave the latter button depressed and then forget about it. This happened to me two or three times. I frantically twisted the front-panel volume knob, wondering why the radio was silent with the squelch wide open!)

Relative power and received signal strength are indicated by the digital LED S-/rf meter. This kind of meter gives surprising detail and is easy to read from a distance. Since each LED can vary in brightness, many different levels are discernible.

Operation and Servicing

In operation, this transceiver is smooth and quiet. There are no relays. Clicking, popping, and squelch tails are hardly noticeable. The microphone PTT button must be depressed firmly to get modulation; pushing it part way in will throw out a carrier but there won't be any audio. It won't hurt to mention again that the OFFSET/SCAN switch should be to the right of center unless you're using a nonstandard split.

The interior of the rear portion houses the transmitter and receiver circuitry which consists of four circuit boards. Each can be removed completely for servicing since all interconnecting wires can be unplugged. The construction of the control head is quite miniaturized, but it comes apart in a logical and orderly fashion. This is in contrast to some units I have seen which appear to be thrown together with no forethought at all. The physical ruggedness is as good as any I've seen. The radio carries a 90-day warranty. All warranty inquiries should be directed to the distributor.

For More Information

The Azden PCS-2000 is distributed by Amateur-Wholesale Electronics, 8817 S.W. 129 Terrace, Miami FL 33176. Detailed specification sheets are available from them, as well as MARS/CAP modification information. Several accessories are available, including a desktop microphone, a gooseneck-type mobile microphone (both with all the remote functions of the standard microphone), touchtone modification kit, 6-Amp power supply, and 15-foot remote cable with control-head mounting hardware. Standard accessories are: microphone, mobile mounting bracket with all hardware, power cable with fuse and spare fuse, and memory backup cells. The PCS-2000 sells for $299. Reader Service number 5.

Stan Gibilisco WA0OKV
Miami FL

New telescopic tower from Aluma Tower Co.

MOBILE TELESCOPIC TOWERS FROM ALUMA TOWER CO.

Aluma Tower Company is now manufacturing five styles of mobile van roof-mounted telescopic towers.

These towers will crank up on the heavier duty model to 60 feet if required. They are manufactured for easy mounting on your van ladder rack so they can be cranked up easily when needed for use and cranked down easily for storage.

These quality-made aluminum towers are tungsten inert gas welded (heli-arc) for strength. These aluminum crank-up van towers are also manufactured with a safety stop for safe, trouble-free usage.

Aluma Tower Company, 1639 Old Dixie Highway, Vero Beach FL 32960; (305)-567-3423. Reader Service number 476.

THE PACE COMMUNICATOR MX

In April of 1979, I decided to buy a hand-held 2-meter rig. I had seen an advertisement on the new Pace Communicator MX and, since I was very satisfied with my Communicator II, I decided to buy one. I bought the Communicator II because of the excellent reputation Pace has in the commercial two-way radio field. When I decided to buy a 2-meter hand-held, the Pace ads for the new Communicator MX intrigued me. Then, at the Two-Way Radio Dealers' Show at Denver, I saw one in the flesh. I was hooked and had to have one.

The controls and layout are not only simple, but also functional. On top is the on/volume control, the squelch control, and the channel selector knob. On one side is the PTT and the offset selector switch, which provides +600 kHz, −600 kHz, and simplex. On the front is the Hi-Lo power switch and the meter-type battery level indicator. The antenna connector, a BNC (my favorite: no fumbling when switching to an external antenna for mobile), and a factory-wired, external microphone jack are also located on the top. Using 13 diodes, 12 transistors, 1 FET, and 3 ICs, the Communicator MX operates in a 16F3 mode. Pace uses offset modulator crystals of 17.5 MHz for the +600, 16.9 MHz for the simplex, and 16.3 MHz for the −600 switching. Power output is rated only as 1 Watt on high (mine measured 1.6 Watts on high and .75 Watts on low) into a nominal 50 Ohms. Deviation is ±5 kHz (adjustable). Spurious harmonics are more than 50 dB below carrier level and frequency stability is better than 15 ppm from −30° to +60° C.

The receiver is a double superheterodyne using 16.9-MHz and 455-kHz i-fs. Sensitivity is rated at less than .5 microvolts for 20-dB quieting or .35 microvolts for 12-dB SINAD (mine checked out at .30 microvolts for 20 dB and .20 microvolts for 12-dB SINAD). Image and receiving spurious rejection is 60 dB down; selectivity is 60 dB down at ±12 kHz. Audio output is at least 400 mW at 10% THD.

The Communicator MX requires only one crystal per channel, weighs 1.03 pounds (with batteries), and measures 6.06" H

x 2.67" W x 1.64" T. The MX draws only 300 mA transmit (1 W) and 100 mA receive unsquelched (25 mA squelched).

By removing one screw, the front snaps off, allowing *easy* access to all controls, adjustments, and crystals. This unit is a jewel to work on, compared to many others I have seen.

The Communicator MX comes with a .52 crystal, rubber duck, vehicular charge adaptor, and nicad pack. Pace is maintaining a stock of the standard repeater frequency crystals, or these may be ordered from your regular crystal supplier. I have found the delivery from Pace excellent: less than two weeks!

The Communicator MX, priced at $265.00, carries a dealer-backed factory warrant for one year. For further information, contact a Pace dealer.

Pathcom, Inc., Amateur Radio Products Group, 24105 South Frampton Ave., Harbor City CA 90710; (800)-421-1196; in CA, (800)-261-1208. Reader Service number 478.

Larry L. Vaughan KA5ECP
Los Alamos NM

A REVIEW OF THE KENWOOD TR-2400 HAND-HELD

I can't remember when I have been as favorably impressed with a new piece of ham radio equipment as I have been with my new Kenwood TR-2400. This new microprocessor-controlled, hand-held, 2-meter FM rig has many advanced operating features that make it compare favorably with many larger mobile and base station rigs that I have used.

The TR-2400 covers the entire 2-meter band, with some additional coverage at each end of the band for MARS operation. Synthesized 5-kHz channels are selected by pushing the calculator-style keypad switches on the front of the rig, and both receive and transmit frequencies are displayed on a large liquid-crystal digital readout display above the keypad on the front panel. The liquid-crystal display is on whenever the rig is on. It is very easy to read and is not washed out by bright sunlight. A front-panel switch turns on a lamp to illuminate the display for night viewing.

For repeater operation, a top-mounted rotary switch selects the transmitter offset: +600 kHz, −600 kHz, simplex or a fourth position that allows for operation with any non-standard repeater split by offsetting the transmitter to a frequency stored in memory.

Speaking of memory, this little rig has ten programmable memories! This may seem like a bit of overkill at first, but if you are like me, you will soon find that you are using them all! It is very handy to be able to return to a frequency instantly by simply punching up the appropriate memory channel.

Memory programming is easy: Simply push the "M" key followed by a number key (0 to 9) and the displayed frequency is entered into the memory channel corresponding with the number key that was pushed.

Frequencies are recalled from memory in a similar manner, by pushing the "MR" (memory recall) key followed by the desired memory number key. All frequencies stored in memory are held in storage even if the TR-2400 power switch is turned off. The memory circuitry used draws only 700 microamps from the rig's battery, so a freshly-charged battery will hold the memories' contents for over four weeks without a battery recharge.

The TR-2400 also offers very convenient scanning features. You can scan the memory channels by simply pushing the "MS" key, and the rig will scan through the ten memories, always starting with memory number one. The memories are scanned at a rate of approximately one channel per second, which allows enough time to read the frequencies displayed as channels are sampled. A top-panel-mounted "busy/open" switch selects one of two memory scanning modes. In the "busy" position, the rig will stop scanning on the first occupied memory channel. Scanning will resume when that signal goes off the air. In the "open" switch position, the scanning will stop on the first memory channel that is not occupied. Scanning can be instantly stopped at any time by simply pushing the "stop" key.

The TR-2400 also provides a manual or "band scan" function. Two of the keys on the keypad control this feature. If the "up" key is pressed once, the frequency will increase by 5 kHz, and if this key is held down, the rig will scan rapidly up the band. Similarly, pushing the "down" key once will cause the frequency to decrease by 5 kHz, and holding this key down will cause the rig to scan rapidly down the band. Using these two keys allows you to "tune" up and down the band to search for the presence of signals. The scan rate for this function is very fast . . . about 80 kHz per second. You can scan through the entire 4 MHz of the 2-meter band in less than a minute.

The TR-2400 has two "lock" switches on the front panel: One is used to disable the push-to-talk switch, the other is used to disable the keypad switches. These two functions come in very handy if you are carrying the rig in your pocket and don't want to be surprised by an unwanted transmission or frequency change! The squelch and on-off/volume controls are top mounted, a convenience that allows adjustment of these controls without removing the transceiver from your pocket.

The liquid-crystal readout, in addition to displaying the receive and transmit frequencies, also shows the memory channel number in use and has four small triangle shaped indicators that are activated to indicate: (1) The rig is in the transmit mode, (2) the frequency displayed has been recalled from memory, (3) the lamp switch is on, and (4) the batteries need charging.

In addition to the frequency and memory control functions, the keypad also functions as a full 16-key touchtone pad when in the transmit mode. There is also a switch provided to enable an internal subaudible tone encoder or PL. Kenwood does not provide or make available a tone encoder module, but they are available from a number of sources or can be home-brewed.

A momentary action push-to-reverse switch can be used to reverse the transmit and receive frequencies instantly to listen on the input of a repeater. This feature is very handy to use for checking to determine if you are within simplex range of a station being heard or worked via a repeater.

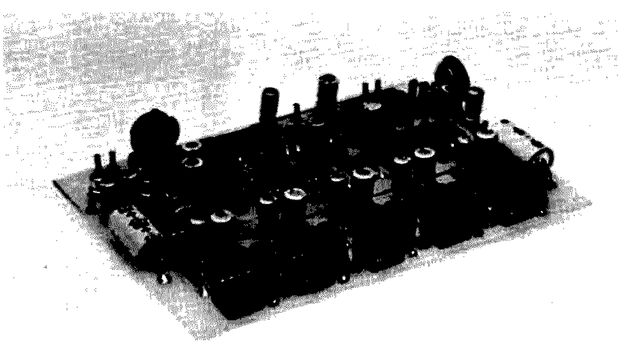
Input/output jacks include an external speaker/earphone output jack, external microphone and push-to-talk inputs, charger input, and a standard BNC connector for the antenna connection, which makes the antenna changing easy for mobile/portable change-over. This transceiver has separate speaker and microphone elements, and, like the built-in microphone, the remote microphone input is designed to accept a condenser microphone. A low-impedance dynamic microphone can also be used if a 1 microfarad non-polarized capacitor is added in series with the microphone "hot" lead to block dc.

TR-2400 hand-held from Kenwood.

The battery pack in the TR-2400 is a 9.6-volt, 500-mAh nicad unit constructed from eight size AA nicad batteries.

The ac charger that is supplied with the TR-2400 is a constant-current charger. The TR-2400 must be turned off to accept a charge from this charger, and a full charge takes 15 hours. Optional quick-chargers are available as accessory items.

Like most hand-held rigs, battery life is on the short side, but if you listen much more than you transmit, you will get surprisingly long operation from a charge. Using a laboratory-grade digital multimeter, I measured battery current drain as follows:



Spectrum's TTC100.

squelched (or scanning)—27.2 mA; squelch open, audio at minimum—37.6 mA; receiver at "normal" audio level—40.0 mA; very loud audio volume level—50 to 100 mA; transmitting—525 mA; display lamp on—25.0 mA additional.

The above current drain conditions would correspond to battery charge life conditions as follows: continuous squelched —18.4 hours; continuous receiving—12.5 hours; continuous transmitting—0.95 hours.

A realistic example of combined operating time would be: ½ hour transmitting, 8 hours receiving and scanning.

I've found the TR-2400 to be a very smooth working little machine! Not only is it a great little portable rig, but I've found its many convenient features make it a very good performer for mobile operation as well! Using a magnetic-mount 5/8-wave whip antenna on the roof of my car, I have no trouble at all hitting my favorite repeaters with the TR-2400's 1½ Watts output . . . and the TR-2400 is small enough that I even have room for it in my compact car.

Audio quality is excellent, both on transmit and on receive, and when used with a larger external speaker, the receiver sounds as good in my base station as any 2-meter rig I've used. Receiver sensitivity is excellent . . . much better than I would have expected from such a small package.

A radio this small with all its sophisticated features could have been described by a science fiction writer twenty years ago. Today, it's merely taken for granted as a product of our expanding technology. My overall impression of the TR-2400 is that it is a terrific rig . . . almost the ultimate in a hand-held. But I'm an old "nit-picker" who can find faults with anything, and I have three minor nits to pick with the TR-2400:

1. The low battery indicator, in my opinion, does not give sufficient "early warning" of a low battery condition. When the low battery indicator comes on, you have to say your 73's fast . . . because there is only about one minute of transmit time remaining!

2. There is a slight delay of about a half second after the push-to-talk switch is pressed before the rig actually starts transmitting. This fact must be constantly kept in mind or the first part of a transmission can be clipped out!

3. When using the earphone supplied with the TR-2400, there is a very loud and annoying click that occurs on squelch break. I've found that adding a 200- to 600-Ohm resistor in series with the earphone reduces the earphone's sensitivity sufficiently to allow a higher volume control setting to be used. This effectively reduces the click sound to a tolerable level. I would suggest using a 1/8-Watt resistor and installing it in the earphone itself, rather than at the earphone jack inside the rig, as this method will still allow for driving an external speaker from the earphone jack when desired.

The TR-2400 price class is under $400 and it comes complete with nicad battery pack, charger, earphone, wrist strap, and rubber flex antenna. Optional accessories include a leather holster carrying case, a spare battery pack, a service manual, and quick chargers for both ac and 12-volt dc that will fully charge a dead battery in an hour and a half.

In conclusion, the TR-2400 is a superb portable transceiver. I can only think of one thing that it is lacking: a signal strength indicator. (I think a "bar graph" type indicator incorporated in the liquid crystal display would be great for the S-meter function!) Not only is this new rig a top performer, but it is also one of the best looking rigs I've seen. I've found that carrying a portable hand-held of this type will attract a lot of attention from non-hams. It's a great way to start up a conversation and introduce someone to amateur radio. *Trio-Kenwood Communications, Inc., 1111 West Walnut, Compton CA 90220.*

John Rehak N6HI
Garden Grove CA

SPECTRUM'S TTC100 TOUCHTONE™ DECODER/CONTROL BOARD

The TTC Touch-Tone™ Decoder/Control Board is designed to remotely switch a control function in a repeater or other radio system by means of a 3-digit touchtone control code. The board can be used for various on/off applications, including transmitter on/off, autopatch on/off, PL on/off, high/low power, and audio on/off, for selective calling using individual codes, etc. The audio tone input to this board can be from the repeater's receiver, an auxiliary receiver, a land-line link or any other audio source.

The TTC100 employs a digital anti-falsing design which prevents false triggering of the control function by stray noise, voice, or other tones. Also, the correct tones must be entered in the correct sequence or the circuit will not trigger.

The output switching circuitry can be jumper-wired to produce a 5-V TTL level trigger pulse, or latch on or off. Two transistor switches are provided to trigger external circuitry, e.g., relays, external logic, etc. These transistor switches can sink as much as 100 mA each. The 3-digit code can be changed in the field with a minimum of effort by changing jumper wires and retuning the decoders. Five phase-locked-loop tone decoders are provided on the board for good flexibility in tone selection. Multi-turn cermet trimpots are used for ease of "setability" and maximum stability. Low-current-draw CMOS logic is used (TTL compatible).

Spectrum Communications, 1055 W. Germantown Pk., Norristown PA 19401; (215)-631-1710. Reader Service number 68.

HDR300 ROTATOR

Telex's model HDR300 matches a rugged heavy-duty rotator with a digital-readout control console. This is a military/industrial grade rotator which is priced to be practical for amateur use. The model HDR300 easily handles up to 25 square feet of antenna area with an additional 15% safety margin—even in high winds! This new rotator has muscle to spare, with a stall torque of 5000 in/lbs (567 N/m)—higher than any amateur antenna rotator currently on the market. It also features a brake holding torque of 7500 in/lbs. (850 N/m) and a mechanical travel of 390°. The HDR300 will support 500 lbs (227 kg), will accept masts of 1¾" (44.4 mm) to 3" (76.2 mm) o.d. and uses a 24-volt ac motor for safe, reliable operation.

The state-of-the-art control console features a digital azimuth readout which is accurate to ±1°. The brake is automatically engaged when you turn the rotator off. Furthermore, the brake release and rotation functions are separate, ensuring complete brake control and extended rotator life. A single eight-conductor control cable connects the rotator with the control console. *Telex Communications, Inc., 9600 Aldrich Avenue South, Minneapolis MN 55420; (612)-884-4061.* Reader Service number 316.

HUSTLER ENTERS 220-MHZ AMATEUR BAND WITH INTRODUCTION OF ALL-NEW 1¼-METER 7-DB GAIN VERTICAL FIXED STATION ANTENNA

The all-new Hustler 220-MHz vertical fixed station amateur antenna, designated the Model G7-220, was recently introduced by Hustler, Inc. The G7-220 marks Hustler's entry into the now-popular 220-MHz band and complements their existing base and mobile amateur antenna line. The superior 7 dB gain of the antenna, for both transmitting and receiving, makes it the most powerful omnidirectional 1¼-meter antenna available. The all-new rugged design of the

Hustler G7-220 antenna keeps the signal radiation pattern at the lowest possible angle to the horizon for maximum efficiency and longest range.

The Model G7-220 has an swr of 1.5:1 across its entire 5-MHz bandwidth, with swr at resonance of 1.2:1 at the antenna. The radiating element of the Hustler G7-220 is dc grounded for static discharge and the antenna has a 50-Ohm feedpoint impedance.

This new Hustler 220-MHz vertical combines the latest antenna technology and the best available corrosion-resistant materials for extra-long life. Only Hustler uses all stainless steel hardware in amateur and professional products. Each component is precisely built for quick and easy assembly.

The 122"-long vertical element and four 14¾"-long radials of the G7-220 are made from high-strength heat-treated aluminum. Each radial is 3/16" o.d. The G7-220's N-type connector, used on all new Hustler amateur verticals, provides a tight all-weather seal and virtually perfect rf characteristics under all conditions.

The G7-220 weighs only seven pounds and is easily mounted on any vertical support up to 1¾" o.d. Wind loading of the antenna is only 26 pounds at 100 mph velocities.

For further information on this or other Hustler products, write *Hustler, Incorporated, 3275 North B Avenue, Kissimmee FL 32741.* Reader Service number 305.

HEATH INTRODUCES A NEW AMATEUR RADIO TRI-BAND BEAM WITH HEATHKIT ASSEMBLY MANUAL

Heath Company, the world's largest electronic kit manufacturer, appears to have good news for any amateur who ever tried assembling a beam antenna. The Heathkit SA-7010 triband yagi comes with a step-by-step manual, something the ham community has been asking for.

This 4-element 20-, 15-, and 10-meter beam features three active elements on each band and is said to give 8.3 dB actual gain over a dipole. Front-to-back ratio is listed at 25 dB. A separate reflector is provided for correct monoband spacing on 10 meters. Vswr, according to Heath, is less than 1.5:1 at resonance on each band. The SA-7010 is rated for full legal power.

The boom length of this tribander is 16 feet, with a longest element of 31 feet. Turning radius is 17 feet, 5 inches, and wind surface area is 5.8 square feet.

Because of the detailed instruction manual, Heath expects this new beam to be popular not only with individual hams, but also with amateur radio clubs who seek easy assembly for Field Day use.

Heath Company is a subsidiary of Zenith Radio Corporation. *Heath Company, Benton Harbor MI 49022.* Reader Service number 303.

TE-12P PROGRAMMABLE TWELVE-TONE ENCODER

A new product recently released by Communications Specialists is a programmable twelve-tone encoder, available in either subaudible or burst-tone configuration.

In the subaudible range, this encoder will allow the programming of twelve standard frequencies from 67.0 Hz to 203.5 Hz, and in the audible range, burst tones may be selected in the range of 1600.0 Hz to 2550.0 Hz in 50-Hz increments. Additionally, there are thirteen other frequencies available which may be used for either burst or test purposes.

This encoder is housed in a durable plastic case measuring 5.25" x 3.3" x 1.7" and is complete with mounting bracket and hardware. It may be powered by voltages from 6 to 30 V dc unregulated at 8 mA and provides a low-impedance, low-distortion, adjustable sine-wave output of 5 volts peak-to-peak. Reverse polarity protection is built in.

Programming each channel of this encoder is a simple matter and can be done in seconds. A 5-position DIP switch is furnished for each of the twelve channels. It is merely a matter of setting each switch to the proper ON and OFF positions to achieve a binary-coded frequency.

The output level is flat to within 1.5 dB over the entire range of frequencies selected. In the low frequency range, the frequency accuracy is ±.1 Hz; in the high frequency range, the accuracy is within ±1.0 Hz. Subaudible tones are designated as Group A tones and audible frequencies are Group B tones. No counter or other frequency measuring device is needed to set frequencies.

A full one-year warranty is provided if the unit is returned to the factory for repair. *Communications Specialists, 426 West Taft Avenue, Orange CA 92667; (714)-998-3021 (California); (800)-854-0547.* Reader Service number 15.

REGENCY K500 PROGRAMMABLE SCANNER

Regency has come a long way since the introduction of its "Touch," a programmable VHF/UHF scanner. The K100 was a distinct improvement, and the new K500 has even greater flexibility.

The K500 follows the styling of its predecessors. Two touchpad clusters provide frequency entry, frequency banks, and commands. Frequency range of the K500 is identical to that of previous models: 30-50, 144-174, and 440-512 MHz FM.

The "500" nomenclature refers to the 545 preprogrammed ROM channels. By pressing one of three service-search keys, the listener may scan specific frequencies assigned to police, fire, mobile telephone, and weather.

Additionally, 40 touch-entry RAM channels may be programmed to any frequencies within the tuning range of the scanner. Because they are in five banks of eight channels each, it is possible to switch in and out sets of frequencies at will. This is handy for programming ham repeaters in one bank, ambulance/emergency channels in another, i-f frequencies when using the receiver with an external converter, and so on.

I was pleased to see that the scan and search rate of the K500 was 15 channels per second. One difficult design challenge in scanning receivers is providing good tracking of the rf stages while the frequency is changing rapidly. Coupled with the large burden of commands on the microprocessor in such a sophisticated piece of equipment, rapid scan/search rate is a real bonus.

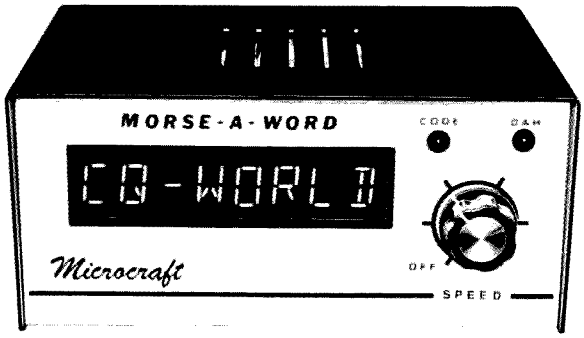
Channel spacing is automatically 5 kHz on VHF, 12.5 kHz on UHF. Fourteen other increasing channel spacing increments up to 75 kHz on VHF and 187.5 kHz on UHF may be commanded at will. Selectivity is a sharp ±7.5 kHz at 6 dB, ±18 kHz at 18 dB.

Scan delay is selectable as either .6 or 2 seconds, while search delay is 4 seconds (nominal delay times).

While the LED display is still small when compared to those on competitive models, it is still clearly visible from the operating position. Including the three different frequency range displays, nearly two dozen types of readout signals alert the user to various programming options and warnings. Power failure, out-of-band entry, low battery voltage for memory, weather channel selected, and many other status signals will appear automatically as appropriate.

The K500 has a built-in clock which can display hours, minutes, and seconds. In addition, an alarm can be activated

Communications Specialists' TE-12P.



New code reader from Microcraft.

by the operator.

A weather alert function is selectable in the scanner; when the National Weather Service broadcasts a warning tone, the scanner will automatically lock on the weather channel to provide the message regardless of the present functional status of the scanner (other than search or time). It is defeatable if not desired.

A priority channel is also available for any local frequency of importance. When the priority function is engaged, the receiver will sample the prioritized channel every two seconds, causing a brief interruption in any transmission to which you are listening. While this may take some getting used to, it is unlikely that any information will be missed during the brief split-second intermission.

During search, active channels will automatically stop the search function and display their frequencies. By pressing the "STORE" key, up to eight of these frequencies may be stored automatically in memory for later recall. This permits the user to leave the receiver unattended, returning later to see what frequencies came up during search. He may further identify the sources of any transmissions by the use of the auxiliary function, an automatic switch for activating a tape recorder any time the squelch breaks.

Search-stored frequencies are automatically written into bank 500. The entire bank may be moved to another bank (100 through 400), freeing up bank 500 for another eight intercepted channels, or the former eight may be written over after reviewing the frequencies merely by reactivating the search/store function.

Another feature of the K500 is its ability to count the number of transmissions intercepted on a channel up to 32,767. For example, if you would like to know whether a local repeater gets much use but don't particularly feel like listening to it all day, let the K500 do it for you.

The count feature is also a handy research tool for determining the activity of assignable channels to determine the one which is least likely to have interference from other users.

One unadvertised advantage of the K500 (and the K100 as well) is its unique ability to be programmed beyond its advertised frequency range. Simply by pressing the decimal key immediately before entering the desired frequency, the lower limit of the tuning range may be extended several megahertz. The upper limit is extended slightly.

For further information, write *Regency Electronics, Inc., 7707 Records St., Indianapolis IN 46226.* Reader Service number 477.

Robert B. Grove
Brasstown NC

MICROCRAFT MORSE-A-WORD CODE READER

An eight-character Morse code reader has been introduced by Microcraft Corporation for SWLs, beginners, and veteran amateur radio operators. It accepts audio signals from a communication receiver's headphone jack or loudspeaker and displays the decoded characters. All text characters—letters, numerals, punctuation marks, special Morse symbols and word spaces—are shown sequentially on the display in moving character fashion. Code speeds of 5 to 35 wpm can be copied depending on the setting of the front panel control. The MORSE-A-WORD also includes a built-in code practice oscillator and monitor speaker for Morse code practice sessions. Complete kits and wired and tested versions are available. It measures 7.37" W x 5.75" D x 3.37" H. Net weight is 4 lbs. For more information, phone or write *Microcraft Corporation, PO Box 513, Thiensville WI 53092; (414)-241-8144.* Reader Service number 50.

Ham Help

I would like to build the 140-Watt solid-state linear amplifier (1.6-30 MHz) described in the 1979 and 1980 *Radio Amateur's Handbook*. If anyone has located the parts to build this unit as described in the book, please contact me.

Most important to find are the Ferroxcube VK200 19/4B, Stackpole and Fair-Rite Products ferrite beads and cores, and the heat sinks: Thermalloy 6153 or Aavid Engineering 60140 extrusion.

If anyone has schematics of this type of amp (broadband, 100-Watt or more), I will pay for copies.

John Pisarski
114 Evans Road
Norristown PA 19403

I'm looking for a Sams' book, *101 Ways to use your Sweep Generator*, TEM-1. I would like to buy or borrow and return.

B. J. Wenner VE6WN
Box 66
Ralston, Alberta
Canada T0J 2N0

I am trying to contact Edward H. Dollar, who operated as KZ5SD (silver dollar). Any information regarding his present address will be greatly appreciated.

Jack C. Petree WB4OVX
3232 West Ridge Road, SW
Roanoke VA 24014

Corrections

In the article, "Lab-Quality Hi I Supply" (March, 1980), the following changes should be made:

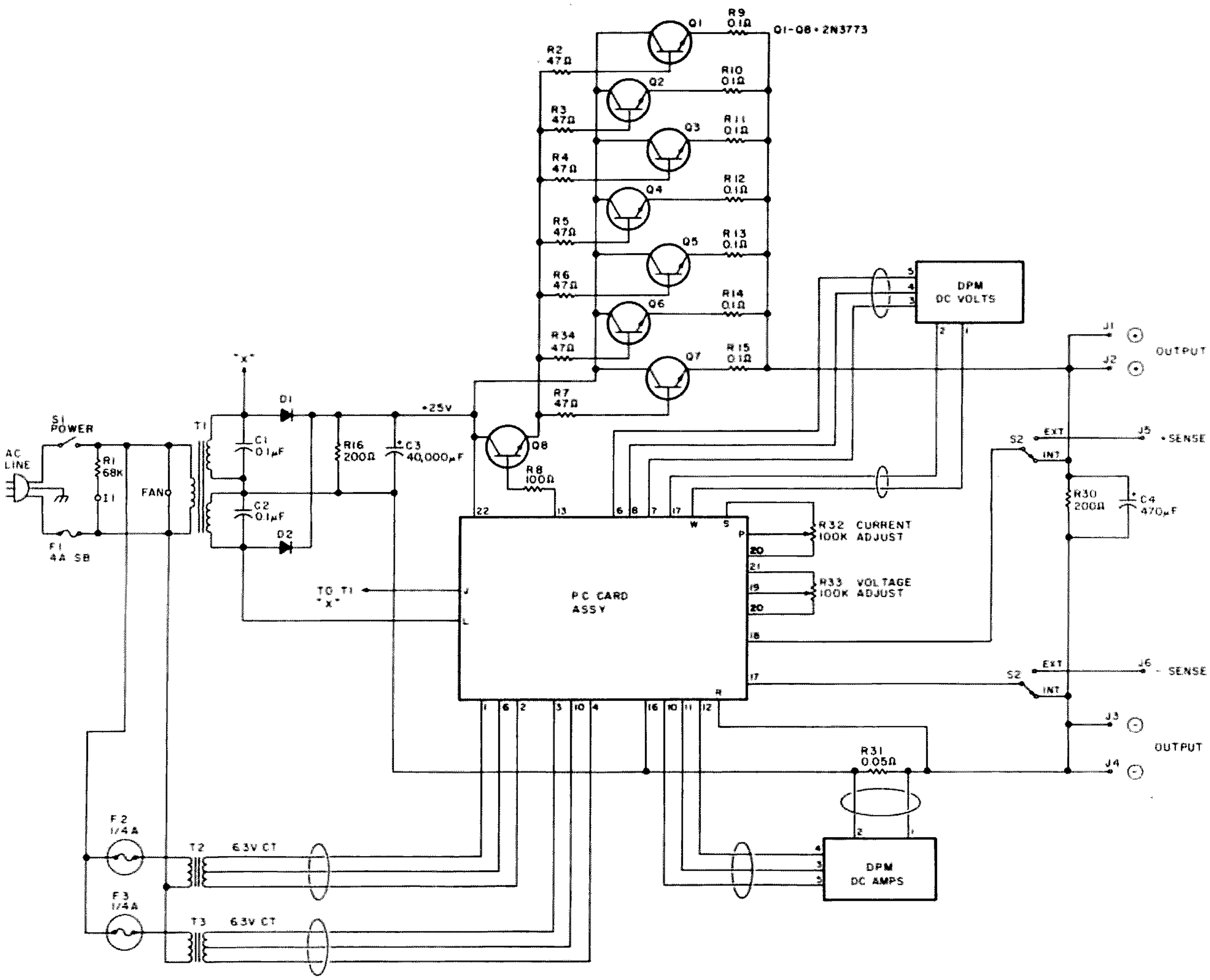
1) In Fig. 3, page 89, the arrow from the anode of D3 should go to R24 only, *not* to R22-R23 as indicated.

2) On page 90, column 1, lines 11 and 12 should read, "those resistors, R2-R6, R34, and R9-R15, are necessary to pre-."

A corrected Fig. 4 also appears here. There is a wiring change at Q8 and the addition of missing pin numbers on the PC card block.

We apologize for the errors and any inconvenience which they have caused.

Susan Philbrick
Asst. Managing Editor



Revised Fig. 4, "Lab-Quality Hi I Supply."

Ham Help

I would appreciate any information I could get on mods for the Kenwood TS-820S, mods to expand the frequency range of the Clegg FM-28, and information to convert the Fanon model IC-5000 or Courier CWT-50 6-channel CB handie-talkies to ten meters. Thank you.

David K. Gordon
WB2YUJ/NNN0WNI
155 Nimbus Road
Holbrook NY 11741

I would like to get in touch with anyone who is interested in improving the Macrotronics M650 RTTY program.

David L. Shiplett WL7ACY
5062F Polaris Street
Eielson AFB AK 99702

I need information on firing up a Globe Electronics transmitter, model HG-303, operating manual or plain-English instructions. I will gladly pay for any reproducing or shipping charges. Many thanks.

Frank E. Jankowski N3AWO
3225 Gaul Street
Philadelphia PA 19134

I desperately need a manual and schematic for an RT-841/PRC-77 field radio. I've tried everywhere, including Fair Radio. I will pay for any shipping or copying charges. Any help would be greatly appreciated.

Tommy Norris
Rt. 1, Box 412
Auburn KY 42206

I would like a mint-condition Wilson 220-MHz transceiver, preferably with touchtone™ pad—cash or trade.

Charles M. White, Jr., M.D.
PO Box 8577-A
Greenville SC 29604
(803)-242-5642

I'm looking for a Collins KWS-1 transmitter, a PTO assembly #70E23, or component parts. Please include description and prepaid prices. Thanks.

Graham G. Kent W7CZL
13387 Lester Road NW
Silverdale WA 98383

Leaky Lines

from page 14

coffin, with a bug under his right hand. A power supply was also interred. Both an ac line and a coaxial cable were to be run from the casket, to be attached to a power outlet and an antenna rigged in a nearby tree.

That is all I know of this matter, but I would dearly love to know whether these arrangements were carried out when they planted this fellow. I don't know how long they maintained a vigil on the appointed frequency, or indeed, whether anyone ever took the thing seriously enough to monitor for the signal of the decedent, whose call letters I can no longer recollect.

But, please, if anyone knows anything about this, I'd be obliged greatly if you would drop me a line about it. Talk about hidden transmitter hunts!

Contests

from page 25

ceived, band used, type of emission, and multipliers claimed. Summary of score and checklist will be appreciated. Mail entry, with a large letter-sized SASE for return of awards and summary, postmarked by June 1st to: Atlanta Radio Club, Inc., c/o Johnny Jones WD4OPT, 1671 Bristol Drive, Atlanta GA 30329. Standard disqualification rules will apply.

WORKED ALL BRITAIN CONTEST—HF CW
Starts: 0900 GMT May 11
Ends: 2100 GMT May 11

There are 5 Worked All Britain Contests during the year. The first was on March 30th, but the information was received too late for publication. The remaining dates are shown in the calendar.

All contacts must be made using CW on the 20- to 10-meter amateur bands. Operating classes include: single- or multi-operator, single- or multi-band, and SWLs. In the case of multi-operator, only one transmitter may be used at any time. There is a special section for mobile operators.

EXCHANGE:

RST, QSO number from 001, WAB area and county. Book numbers and districts may be requested, but are not mandatory as part of the exchange.

SCORING:

Score 5 points for each completed QSO. Stations may be worked on other bands for extra points.

Multipliers for UK contestants are each WAB area and each overseas country (DXCC list). In addition, Alderney, Guernsey, Jersey, and Sark count as separate countries. The remainder of G, GD, Gt, GM, and GW count as one multiplier only.

Multipliers for overseas contestants are each WAB area, county, and each G prefix (G, GD, GM, and GW). Multipliers count on each band, i.e., a station worked on three bands = 3 multipliers.

For mobile entries, every contact made from a different area will count five points, but the multiplier counts once only (for example, mobile station from ten different areas—score is 10 times 5 points, but only one multiplier for the mobile station).

AWARDS:

Certificates for the leading contestant in each class or entry. For awards, each G prefix is separate. There will also be certificates issued to the leading contestants from each DXCC country and also to SWLs. Certificates for 2nd and 3rd will be issued if there are 10 or 25 entries from a particular country or call area.

ENTRIES:

Logs must show the title of the contest, name and full postal address of the contestant, QSO details, total points claimed, multipliers claimed, and the full details of all operators when multi-operator entry is submitted. Logs must be sent to the Contest Manager: R. L. Senter G4BFY, 27 Station Road, Thurnby, Leicester LE7 9PW, England.

Entries must be postmarked not later than one calendar month following the date of the contest and must be received by the contest manager not later than 40 days following the said contest. A signed declaration that the station was operated in accordance with the current licensing conditions must accompany all entries. It is a condition of entry that the decision of the WAB Contest Manager and the WAB Committee shall be absolute in the case of dispute. For SWLs, all stations logged must be participating in the contest and giving serial numbers which must be logged. The results will be reported to the RSGB and the Contest Manager will supply a detailed result sheet on receipt of an SAE on or after November 1st.

DOGWOOD FESTIVAL QSO PARTY
Saturday, May 17
1300 to 2200 GMT

Operating on six amateur bands with the club call WB1CQO, members of the Greater Fairfield Amateur Radio Association will explain the significance of the community-wide Dogwood Festival during QSOs. Contacts will be confirmed with a special commemorative QSL card. Stations wishing to work the Dogwood Festival station, WB1CQO, should check these SSB frequencies: 3975, 7235, 14330, 21420, and 28710. FM operation will be on 146.55 simplex. Special QSLs will be sent upon receipt of an SASE or IRCs to: QSL Manager Grace von Stein WB1GVZ, 248 Euclid Avenue, Fairfield CT 06432.

The Dogwood Festival celebrates the blossoming of 30,000 dogwood trees. Fairfield's original white dogwood trees were planted in 1795, with pink varieties imported from Japan 100 years later. The Dogwood Festival began in 1936 and today thousands of visitors flock to the historic area when the dogwoods are at the height of their bloom.

TRI-STATE QSO PARTY
Starts: 0001 GMT May 17
Ends: 2400 GMT May 18

The Tri-State Amateur Radio Association is instituting a new award to establish an awareness of amateur radio in the Tri-State area. This QSO party is intended to help kick off the new award program. Look for Tri-State activity on the following frequencies: Phone—3935, 7235, 14280, 21380, 28575; CW—3550, 7050, 14050, 21050, 28050.

For the purpose of this award, the Tri-State area will consist of those parts of West Virginia, Kentucky, and Ohio that lie within a 20-mile radius of Huntington, West Virginia.

To qualify for the award, an amateur radio station within the continental limits of the United States must submit proof of 2-way contacts with 10 amateur stations within the Tri-State area, 4 of which must be members of the Tri-State Amateur Radio Association. Stations outside the continental limits of the United States need only 5 contacts within the Tri-State area, 2 of which must be members of the Tri-State Amateur Radio Association. A contact with a Novice station within the Tri-State area will count as two contacts toward the award. Contacts may be made on any amateur band; however, not more than 1 contact can be made through a repeater.

Only contacts made after May 16th may be counted toward this award. As proof of contact, do not send QSL cards. Send a copy of the log listing call letters, date, time, and band. Do not send an SASE. This log must be verified by two other amateurs or an officer of an amateur radio club and mailed to: TARA, Attn: Jim Baker K8KVX, PO Box 1295, Huntington WV 25715.

FLORIDA QSO PARTY
Starts: 1500 GMT May 17
Ends: 2359 GMT May 18

This is the 15th annual Florida QSO Party sponsored by *Florida Skip*. All amateurs worldwide are eligible and invited to participate. All amateur bands may be used. All stations will separate phone and CW logs. A station may be worked once on each band on each mode. Neither crossband nor crossmode contacts will count for contest credit. Florida stations may work other Florida stations, but for contest points only. Out-of-state stations may not work each other for contest credit. Contacts made on repeaters do not count for credit.

Florida stations will be divided into two classes. Class A sta-

tions are those operating portable or mobile on emergency power and running 200 Watts or less inside Florida but outside of their home counties. Class B stations are all other stations operating in Florida.

Each entrant agrees to be bound by the provisions of the contest announcement, the regulations of the applicable licensing authority, and decisions of the *Florida Skip* Contest Committee, which are final.

EXCHANGE:

Florida stations send RS(T) and county of operation. Others send RS(T) and US state, Canadian province, or country.

FREQUENCIES:

Phone—3945, 7279, 14319, 21379, 28579, 50.2, 146.52.

CW—3555, 7055, 14055, 21055, 28055.

SCORING:

Florida stations count one point per QSO with out-of-state or other Florida stations. Multiplier is the sum of states (49 max.), provinces (12 max.), DX countries (25 max.), and ITU regions (5 max.) actually worked; maximum multiplier is 91. Others count 2 points per QSO with each Florida station. Multiplier is the number of different Florida counties worked (67 max.). Final score is the product of QSO points and the multiplier. Class A stations only multiply score by 1.5 to obtain final total.

AWARDS:

Certificates for phone and CW to the top single-operator score in each state, province, DX country, and each Florida county. There are also 5 plaques to be awarded as follows: high single operator in Florida and out-of-state, CW and phone, and the Florida club with the highest

Results

RESULTS OF THE 1979 MICHIGAN QSO PARTY
Sponsored by the Oak Park Amateur Radio Club

MICHIGAN RESULTS

Call	*Score*	*County*
K8RO**	62,560	Oakland
W8PBO*	60,350	Macomb
K8WS	48,000	Saginaw
WA8MAM**	42,768	Houghton
K8OT	40,920	Saginaw
WD8ITS	39,680	Alpena /8†
WD8QOY*	20,856	Bay
W8JKU	18,069	Oakland
K8DD*	17,700	St. Clair
WB8ZJL	12,896	Macomb
WD8QBB*	12,626	Midland
N8AOE	10,176	St. Clair /8
N8AWD	9,840	Macomb
WD8JRL	9,800	Bay
K8AQM*	9,180	Lenawee
WD8NNM	7,568	Macomb
WB8SLQ	6,560	Macomb
WD8JNP	5,680	Saginaw
N8ADW*	5,434	Arenac /8
WD8QXM*	5,280	Otsego /8
N8MK	5,148	Saginaw
W8YL	4,968	Lenawee
W8LDB	4,560	Oakland
K8SJQ*	4,454	Iosco
WD8QVD	4,444	Oakland
WB8ZJI	4,059	Macomb
WB8LWS	3,731	Macomb
K8KIC	3,675	Lenawee
WA8ARS	3,610	Lenawee
AC8A*	3,500	Roscommon
W8ETH	3,404	Oakland
W8WVU*	3,008	Hillsdale /8
AE8D	2,970	Macomb
KB8QC*	2,871	Missaukee
WD8QNM	2,720	Macomb
W8WVU	2,256	Lenawee
W8YY	2,130	Houghton
N8AJA	1,950	Macomb
WA8QAF	1,925	Macomb
WD8KAM*	1,736	Wayne
KB8EU	1,674	Lenawee
K8MAJ	1,540	Macomb
WB8SYA*	1,428	Dickenson
WB8ZME	1,352	Macomb
W8RNY	800	Macomb
KB8AX	798	Macomb
WA8ZTQ*	768	Ingham
N8ABW	480	Lenawee
WD8LBH	435	Oakland
WD8JRU*	420	Tuscola
K8QLM	360	Macomb
W8TWJ	348	Oakland
WA8VEB	260	Oakland
W8WOJ	195	Midland
KB8HS	192	Macomb
WD8AUX	126	Lenawee
WD8LCE	120	Lenawee
W8TVY	77	Macomb
N8APX	66	Macomb
KA8ENF	40	Midland
K8EGG	20	Macomb
WD8QEA	9	Midland

OUT-OF-STATE RESULTS

State	*Call*	*Score*
Arkansas	WD5GZL*	675
	WA5DTK	615
California	N6MU*	1,680
Delaware	N3AHA*	864
Florida	W2HAE/4*	264
Illinois	K9BG**	8,400
	WA9FET	546
	K9CW	240
Maryland	W3PYZ*	2,808
Massachusetts	WB1ANT*	207
Minnesota	WA8RMG*	198
New Mexico	KB5DQ*	35
New Jersey	AJ2X*	918
	WB2YOF	96
New York	N2RT*	2,139
	K2POA	286
North Carolina	WD4JBL*	220
Ohio	WB8YDN*	4,508
Pennsylvania	K3NB*	7,072
South Carolina	WA4YUU*	24
South Dakota	WDØBMS*	250
Tennessee	WD8CKP/4*	455
Texas	WA5OOB*	944
	WD8DKJ/5	96
	W5VD	40
Wisconsin	K9GTQ*	220
Canada	VE3KK*	2,016

CLUB SCORES

1. L'Anse Creuse ARC	255,069***
2. Saginaw Valley ARA	103,668
3. Midland ARC	43,426
4. Adrian ARC	18,865
5. Bay Area ARC	5,280
6. Mich-a-Con	1,428

*Certificate
**Trophy
***Trophy (5th year)
†Multi-op

aggregate score.

ENTRIES:

Phone and CW entries are to be *separated*! Along with legible logs in chronological order, a summary sheet is required with each entry. The summary sheet must contain score, number of QSOs, multiplier, station's callsign, entry class and number of Florida counties, power source for Class A entries; state, province, country, or region of operation; callsigns of all operators/loggers if multi-op; name of club if part of a club aggregate score; name and address typed or printed in block letters; and a signed declaration that all rules and regulations have been observed. Include a 15-cent stamp for contest results from a future issue of *Florida Skip*. At the discretion of the contest committee, stations and/or operators may be disqualified for improper reporting, excessive dupes, errors in multiplier lists, unreadable logs, obvious cheating, etc. Anyone disqualified in this year's Florida QSO Party will be barred from the contest next year. All entries must be received on or before June 15th. Late DX entries will be accepted within reason. Mail all entries to: *Florida Skip* Contest Committee, PO Box 660501, Miami Springs FL 33166.

MASSACHUSETTS QSO PARTY
Starts: 1600 GMT May 17
Ends: 0200 GMT May 19

Sponsored by the Greater New Bedford Contesters. A station may be worked once per band. Phone and CW are considered separate bands. No crossband or repeater contacts are permitted. Mobiles and portables may be contacted each time a county change takes place.

EXCHANGE:

RS(T) and state, VE province, or MA county.

SCORING:

All stations count 2 points for each completed SSB exchange and 4 points for each completed CW exchange. MA stations then take the total QSO points and multiply by the total number of MA counties, states, and provinces worked to compute the final score. Others multiply the total QSO points by the total number of MA counties worked. Add a 50-point bonus to the total score for each sponsor worked; each can be worked only once for bonus points. The sponsors are W1FJI, N1AS, and K1KJT. DX stations count for QSO points only.

FREQUENCIES:

Phone—1820, 3960, 7260, 14290, 21390, 28590, and 50.110.

CW—1810, 3560, 7060, 7120, 14060, 21060, 21120, 28060, and 28120.

Use of FM simplex is encouraged. Please use CW in CW bands only!

AWARDS:

Certificates will be awarded to 1st, 2nd, and 3rd place winners in each MA county as well as each state. Two special awards will be given out: one to the amateur radio club with the highest aggregate score in MA with a minimum of three logs, and one to the station in MA who submits the all-time highest number of QSOs. The current record is held by K1GSK with 1483 QSOs in the 1979 Massachusetts QSO Party. In addition, a certificate will be given to stations working all 3 sponsors.

ENTRIES:

Logs must show date, time, band, mode, callsign, state and province worked, and exchange RS(T). Submit a separate summary sheet along with the logs. Summary sheet should include: name, call, mailing address, club affiliation for aggregate score, total QSO points, multipliers claimed, and total score. Deadline for mailing is June 30th. For awards and results, include 30 cents postage (no envelope). Address entries to: Ed Peters K1KJT, 29 Greenbrier Drive, New Bedford MA 02745.

MICHIGAN QSO PARTY
Contest Periods:
1800 GMT Saturday, May 17 to 0300 GMT Sunday, May 18
1100 GMT Sunday, May 18 to 0200 GMT Monday, May 19

This year's QSO party will be sponsored by the Oak Park ARC. Phone and CW are combined into one contest. Michigan stations can work Michigan counties for multipliers. A station may be contacted once on each band/mode. Portable/mobiles may be counted as new contacts each time they change counties.

EXCHANGE:

RS(T), QSO number, QTH as state, country, or Michigan county.

FREQUENCIES:

Phone—1815, 3905, 7280, 14280, 21380, 28580.

CW—1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125.

VHF—50.125, 145.025.

SCORING:

Multipliers are counted only once. Michigan stations score 1 point per phone QSO and multiply by the total number of states, countries, and Michigan counties. Each CW contact counts 2 points; KL7 and KH6 count as states; VE counts as a country. Maximum multiplier is 85.

Others take QSO points times the total number of Michigan counties. QSO points are 1 point per phone QSO and 2 points per CW QSO. Score 5 points for each club station contact with W8MB. Maximum multiplier is 83.

VHF-only entries—same as above except multipliers per VHF band are added together for total multiplier. Score 5 points for each OSCAR QSO. No repeater contacts are allowed.

AWARDS:

Only single-operator stations qualify. Michigan trophies to high Michigan score, high Michigan (Upper Peninsula) score, high aggregate club score. Plaque to high VHF-only entry and high mobile. Certificates to high score in each county with a minimum of 30 QSOs. Out-of-state high trophy and certificates for high score in each state and country.

ENTRIES:

A summary sheet is requested showing the scoring and other pertinent information, name and address in block letters, and a signed declaration that all rules and regulations have been observed. Michigan stations include club name for combined club score. Party contacts do not count toward the Michigan Achievement Award unless one fact about Michigan is communicated. Members of the Michigan Week QSO Party Committee are not eligible for individual awards. Decisions of the Contest Committee are final. Results will be final on July 31st and will be mailed to all entries. Mailing deadline is June 30th. Send to: Mark Shaw K8ED, 3810 Woodman, Troy MI 48084.

MICHIGAN ACHIEVEMENT AWARD

This will be the 22nd year that hams have had their own program to publicize Michigan and its products. Just as for the past 22 years, the Governor will award Achievement Certificates to hams who take part in telling the world of Michigan's unlimited resources, opportunities, and advantages. Certificates are awarded on the following basis:

1. A Michigan ham submits log information and names and addresses (if possible) of 15 or more contacts made to out-of-state or DX hams with information regarding Michigan.

2. An out-of-state ham, including Canada, submits log information and names and addresses (if possible) of at least 5 Michigan hams who relate facts to him about Michigan.

3. A foreign ham, excluding any resident of Canada, submits the call letters and name/address plus log information for at least one Michigan ham who has told him about Michigan.

Only QSOs made during Michigan Week, May 17-24, will be considered valid. All applications for certificates must be postmarked by July 1st and mailed to: Governor William Milliken, Lansing MI 48902.

HOLLYWOOD ARC ANNIVERSARY QSO PARTY
Contest Periods:
1100 to 1900 GMT May 24
2300 GMT May 24 to 0700 GMT May 25
1500 to 2359 GMT May 25

The purpose of this contest is for HARC members to work as many stations as possible in as many different states, provinces, and countries as possible, and for non-members to work as many HARC members as possible.

EXCHANGE:

HARC members send RS(T) and consecutive serial number; others send RS(T) and state, province, or country.

FREQUENCIES:

Phone—3980, 7280, 14280, 21380, 28580.

CW—70 kHz up from each band edge and Novice bands.

SCORING:

Count one point per QSO. Members multiply QSOs by sum of states, provinces, and countries. Non-members multiply QSOs by sum of different prefixes worked on each band.

ENTRIES:

HARC members should include dupe sheets for entries of over 500 QSOs. Copies of logs should be mailed by June 20th to: Bob Patten N4BP, 2311 Nassau Drive, Miramar FL 33023.

propagation

by
J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21A	21	14	14	14	7A	21	21	21A	21A	21A	21A
AUSTRALIA	21	14A	14	7A	7B	7B	14	14	14B	14B	14	21A
CANAL ZONE	21	21	14	14	7A	7A	14	21	21	21A	21A	21A
ENGLAND	14	7A	7	7	7	14	14	14A	21A	21	21	14A
HAWAII	21	14	14	7	7	7	7	14	14	14	14A	21
INDIA	14	14	7B	7B	7B	7B	14	14	14	14	14	14
JAPAN	14A	14	14	7B	7B	7B	7	7	14	14	14	14
MEXICO	21	14	14	7A	7	7	7A	14	14	21	21	21
PHILIPPINES	14	14	14	7B	7B	7B	7B	14	14	14	14	14
PUERTO RICO	21	14	14	7	7	7	14	14	21	21	21	21
SOUTH AFRICA	14	7	7B	14	14	14	21	21A	21A	21A	21	14
U.S.S.R.	14	7	7	7	7	14	14	14	21	21	21	14
WEST COAST	21	14A	14	14	7	7	14	14	14A	21	21	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21A	21	14	14	14	7A	14	21	21A	21A	21A	21A
AUSTRALIA	21	21	14	14	14	14B	14	14	14B	14B	21	21A
CANAL ZONE	21A	21	14	14	7A	7A	14	14	21	21A	21A	21A
ENGLAND	14	7A	7	7	7	7	14	14	14	14A	21	14A
HAWAII	21	21	14	14	7A	7	7	14	14	14A	21	21A
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	14A	14	14	14	7B	7B	7	7	14	14	14	14
MEXICO	21	14	14	7	7	7	7	14	14	14	14	14A
PHILIPPINES	14	14	14	14B	7B	7B	7B	14	14	14	14	14
PUERTO RICO	21	21	14	14	7	7	14	21	21	21A	21A	21A
SOUTH AFRICA	14	7	7B	7B	7B	7B	14	14	14	21	21	14
U.S.S.R.	14	7	7	7	7	7	7A	14	14	14A	14A	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7A	7	7	7	7	14	14	14	14
ARGENTINA	21A	21A	14	14	14	7A	14	21	21A	21A	21A	21A
AUSTRALIA	21A	21A	21A	21	14	14	14	14	14B	14B	21	21A
CANAL ZONE	21A	21	14	14	14	7A	14	14	21	21	21A	21A
ENGLAND	14	7B	7	7	7	7	7	14	14	14	14A	14A
HAWAII	21A	21A	21A	21	14	14	7A	14	14	21	21	21A
INDIA	14	14	14	14	7B	7B	7B	7B	14	14	14	14
JAPAN	14A	14	14	14	14	7B	7	7	14	14	14	14
MEXICO	21	21	14	7A	7	7	7	14	14	14A	21	21
PHILIPPINES	14A	14	14	14	14	14B	7B	14	14	14	14	14
PUERTO RICO	21	21	14	14	7	7	7	14	21	21	21A	21A
SOUTH AFRICA	14	7	7B	7B	7B	7B	7B	14	14	14	21	14
U.S.S.R.	14	7B	7	7	7	7	7B	14B	14	14	14	14
EAST COAST	21	14A	14	14	7	7	14	14	14A	21	21	21

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

may

sun	mon	tue	wed	thu	fri	sat
				1 G	2 G	3 G
4 G	5 G	6 F/SF	7 F/SF	8 P/SF	9 F	10 G
11 G	12 G	13 F/SF	14 F/SF	15 G	16 G	17 G
18 G	19 G	20 G	21 F/SF	22 F	23 F	24 G
25 G	26 G	27 G	28 G	29 G	30 G	31 G

June 1980 $2.50

73 Magazine for Radio Amateurs

Info

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for 73" guidelines are available upon request.

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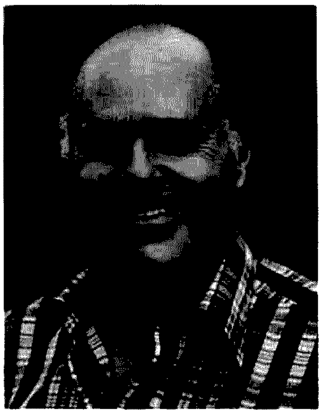
W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



W1HR

Jim Fisk, editor of *Ham Radio*, passed away on April 18th. His name will continue to remain synonymous with ham radio, in the generic as well as the journalistic sense. His tireless efforts to propagate amateur radio will be missed. Anyone who knows anything about hams will say, quite simply, "Thank you, Jim. Your key will never be silent."

TRAVELS WITH WAYNE

With ten meters opening up to Japan, I'm hearing from more and more of the charming people Sherry and I had dinner with in Tokyo . . . members of the Tokyo International Amateur Radio Association.

As a remembrance of the dinner, those present signed a card. If we can get a group together for the electronics show tour this coming October, we'll have a chance again to see the top-notch hams in Tokyo. We might also get a chance to see Yaesu or Kenwood.

Just to give you an idea . . . here's a picture I took of part of the Yaesu new product development labs. I suspect that there are more development engineers and technicians in this one lab than all of the American ham manufacturers have combined.

THE ASIAN CONNECTION

There are several good reasons why you should make the big step and break loose this fall to join Sherry and me on a trip to Asia. The trip, which costs only about $2,000, will include attending consumer electronics shows in four countries—Japan, Taiwan, Korea, and Hong Kong.

If you've ever wanted to get into business for yourself, you may want to look over the electronics shows carefully. You'll find a lot of smaller businesses with products which could be imported and sold in the US. There are a lot of firms smaller than Sony and Panasonic, you know, and many of these don't have the connections to sell over here . . . yet. Owners of ham stores in particular will want to look for interesting ham gear and consumer electronic gadgets which can be imported to give you an edge.

After the first two weeks of the tour, sponsored by the IEEE,

you can add another country or two to your itinerary. I'm planning on getting up to Macao (CR9) and Canton, China (BY), if it is at all possible this time. And you can bet that I'll be getting on the air from Korea (HL9) and Hong Kong (VS6), at the least.

If you'd like to join me on this trip, drop me a line and I'll send you further information. I figure that one or two tables (about 12 to a table in China) of hams will be a lot more fun for a trip like this than traveling with the average businessman. This is an opportunity which comes along rarely, so make your plans now and come on along. It runs from October 2nd to 22nd and you didn't have anything important then anyway.

LINEAR SUIT LOST

While the FCC ban on the manufacture and sale of linear amplifiers capable of being used on the amateur ten-meter band was an excellent example of legislative overkill, that doesn't excuse the blundering amateur representative reaction to the situation. For those of you who are a bit hazy on just who did what to whom, I'll give you a fast reprise.

The FCC, after being plagued by a rising number of TVI and other interference complaints, enacted a law making the manufacture or sale of an 11-meter amplifier illegal. This put all of the "legitimate" makers of these amplifiers out of business and left the field wide open for the fly-by-night operators. Oddly enough, these birds didn't care how clean or dirty the signals from their amplifiers were . . . since they sold mostly by virtue of their price and the buyers were completely unsophisticated.

The result was an ever increasing amount of interference as more and more of the dirty amplifiers were sold. The FCC, lacking money to do much more than grind its teeth over the situation, fumed.

Some of the amplifiers were being peddled as "amateur" equipment, even though the parameters were totally CB-oriented and the products not even advertised or known to the hams. So the FCC decided that it was time to outlaw any amplifier which would be usable on the 11-meter band . . . and that obviously would have to include all designed to work on 10 meters. Such a proposal was made and the public asked to comment on it at an open hearing.

A number of representatives from the Amateur Radio Manufacturer's Association (ARMA) went to Washington to participate. They got together the night before the hearing and developed their approach to the situation. The ARRL counsel, though he refused to cooperate with ARMA, did sit in on the strategy discussions . . . something ARMA was to seriously rue the following day. Due to the heavy support of ARMA by some of the Importers of ham equipment, the major US manufacturers also refused to work with ARMA. The result was an uncoordinated mess when the time came for testimony.

One of the first on the line when the FCC commissioners opened the hearing was the ARRL counsel. He talked at incredible length, putting the commissioners down as knowing little about what they were doing (they were new commissioners, for the most part). He went on to randomly cover virtually every point that the ARMA group had outlined for comments, shooting down the industry group presentation completely. The commissioners took turns leaving the room during the filibuster.

The key to getting cooperation from the FCC Is, as with any other sales problem, looking at the situation from their viewpoint. The FCC was getting heat from Congress over TVI from CB radios with amplifiers. Their engineers had proposed making amplifiers illegal, including ham 10m amplifiers. They were not interested in hearing that this would not work. All they wanted to do Is what any other bureaucrat wants to do: give the impression of *doing* something.

My proposed approach to the situation was to agree with the FCC that something should be done and then come up with some suggestions on other approaches to the solution of their problem. Since amplifiers and the use of them were already illegal, it was more a matter of running down the users and getting them off the air than trying, at this late date, to stop the supply . . . something which I thought was not practical anyway. I tried to get ARMA to support a position of getting the FCC to work with ham clubs to hunt down errant CBers and do the legwork for them. This would do more to solve the problem than any laws. I just couldn't get ARMA to go for the positive approach . . . they insisted on going for the negative . . . telling the FCC that a new law wouldn't work and that banning ham amplifiers was a rotten way to go.

So, after hours and hours of being told that the ban wouldn't work, up popped the Washington lobbyist for the Electronic Industries Association (EIA) . . . a chap who knows how to get the FCC to do what he wants . . . and he told 'em the ban would work wonders. He told them this within five minutes and sat down. And he won the day.

By this time, the commissioners were about ready to vote for anything to shut up the hams. I remember one commissioner getting really fed up with the League counsel. A simple question had been asked and the answer went on for ever. Finally the commissioner broke in and said, "We asked what time it was, not how to make a watch." And that's the way it was.

Still not having learned anything from all of this, the League proceeded to go to court to try to force the FCC to back down on the linear ban. The courts are very reluctant to go against a government agency . . . knowing that it is the government which pays them and holds their promotions in their hands. Further, the general rule in the past on court cases against the FCC has been for the judges to dismiss the case on the basis that the FCC has the technical expertise to deal with technical matters . . . and that these are far beyond the possibility for the judge to understand.

There was also some legal hassle over the failure of the League to raise a "lack of notice" argument in their Partial Petition for Reconsideration and Rehearing before the Commission. This turned out to be a serious oversight and considerably contributed to the loss of the case.

If I wasn't such a known fan of the League, I could be very critical of them in this ten-meter linear ban situation.

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Looking West

Bill Pasternak WA6ITF
24854-C Newhall Ave.
Newhall CA 91321

Over the past nine years, we have written quite a bit about the original Southern California Repeater Association, as well as the two offshoot organizations it fathered: TASMA and 220 SMA. While we have mentioned that two other organizations exist, we have never really gotten involved very much with them. The other two to which I refer are the 10 meter AM/SSB QRP Band Planning Council and the Southern California Repeater Remote Base Association (SCRRBA). Currently, the 10-meter non-FM organization is rather dormant, but SCRRBA is alive, well, and looking with anticipation toward the future.

SCRRBA differs markedly from most other area coordination bodies. First, they hold but one meeting annually, and maybe that accounts for the fact that the get-together is always packed solid with attendees. Second, the political power of SCRRBA is vested in the organization's elected officials. Having recently attended the 1980 annual meeting held in Burbank, California, I can say that I am quite impressed by the direction SCRRBA is taking these days.

For example, they have no intention of waiting for the ax to fall as a result of the reassignment made to the 420-450 MHz spectrum as a result of WARC. SCRRBA officials realize that changes are inevitable, and that the best defense in spectrum preservation is a strong offense based upon careful preparation. Because of this, SCRRBA officials will begin now to develop a dialogue with the ARRL, VRAC, and other concerned organizations with regard to protecting the viability of the current UHF spectrum. Should some other service prepare overtures toward taking spectrum based on WARC decisions, SCRRBA wants to be ready to ward off such attacks.

SCRRBA is also looking for input on the utilization of the proposed 900-MHz band. It is believed that the FCC may be hard put to assign 902 through 928 MHz to any other service in light of Canada's implementation of amateur operation in that spectrum already. If you have any ideas on this topic, you might send them to SCRRBA at PO Box 5967, Pasadena CA 91109.

Unlike most other organizations of their ilk, SCRRBA does not seek widespread recognition for their work. They believe strongly in the concept of regional band planning for spectrum that is not usually utilized by transient operators, and are totally dedicated to advancement of the technical state of the art. They are an interesting organization to watch, and over the years have quietly contributed much to the science of amateur relay technology.

SCRRBA oversees voluntary coordination for FM operations on 10 meters, 6 meters, 420 through 450 MHz, and all spectrum above. They also publish a listing of what they term "Public Repeaters and Simplex Channels" for southern California. The latest list was recently made available to us and is reprinted here for those of you who might wander out to this region carrying equipment for the bands listed.

There are two things to remember in relation to this list. First, it is probably the most accurate listing of its type. Also, do not be deceived by the small number of UHF listings. Again, the ones listed are the "open" systems—available for use by any amateur. It is no secret that between 300 to 400 other systems are operational In the UHF spectrum in this area, but all others are categorized as "private." Happy QSOing.

SOUTHERN CALIFORNIA PUBLIC REPEATERS AND SIMPLEX CHANNELS

Location	*Call*	*Input*	*Output*	*Access*
Sierra Madre	WR6BDG	29.52	29.62	107.2 Hz
Mt. Wilson	WR6AAK	29.54	29.64	107.2 Hz
Palos Verdes	WR6AQS	29.56	29.68	107.2 Hz
		6 Meters		
Mt. Wilson	WR6AAK	52.76	52.525	carrier
Johnstone Peak	WR6AAJ	52.76	52.525	carrier
San Miguel	N6AEG/R	52.76	52.54	carrier
Baldwin Hills	WR6AQR	52.90	52.68	carrier
Santiago Peak	WR6ADP	53.38	53.72	carrier
		3/4 Meters		
Palos Verdes	WR6AKU	440.500	445.500	131.8 Hz
Catalina Is.	WR6AAA	442.000	447.000	carrier
San Diego	WR6AFE	442.025	447.025	carrier
Sulphur Mt.	WR6AOX	442.325	447.325	carrier
Table Mt.	WR6AZN	442.325	447.325	carrier
Monrovia	WC6AAD	442.575	447.575	carrier
Crestline	WR6ANP	443.350	448.350	carrier
Palomar Mt.	WR6AII	444.425	449.425	carrier
Santa Monica	WA6RJG	444.425	449.425	carrier
Mt. Otay	WR6ACF	444.500	449.500	107.2 Hz
		ATV		
Johnstone Peak	W6ORG	434.000	1265.00	15,750 Hz
		Simplex		
		29.50		
		29.60		
		52.525		
		446.000		
		446.500		
		439.500 (ATV audio channel, ±5 kHz deviation)		

Notes

1. SCRRBA believes the above data to be correct, but is not responsible for its ultimate accuracy.
2. No impression is intended or implied that the amateur frequency bands which SCRRBA coordinates are devoid of activity except for that listed above. These listings represent in actuality only a very tiny percentage of the total southern California activity. Repeaters and remote base stations not listed above are coordinated as private (i.e., closed) systems; such systems generally do not welcome visitors.
3. Errors in the above listing should be reported to the SCRRBA Technical Committee.

PLUGGING VIDEOTAPE DEPARTMENT

How would you like to have your very own copy of the new Dave Bell film, "The World of Amateur Radio"? The film is available for direct sale in four formats, at a price which is close to "cost plus shipping." The idea is to get as many prints into circulation as quickly as possible, and to do this it was felt that videotape might be the best way to go. The price schedule is: ½" VHS (SP speed only)—$30; ½" Beta (Beta I or II only)—$30; and ¾" U-Matic—$55.

Videotapes are available from me directly on a prepaid basis only. Checks or money orders should be made out to William M. Pasternak, and all videotape orders sent to me in care of Westlink, 7046 Hollywood Boulevard, Suite 718, Hollywood CA 90028.

In addition, 16mm sound film prints are available directly from Dave Bell for $95 each. Film orders should be made payable to Dave Bell Associates, and sent to 3211 Cahuenga Blvd. West, Hollywood CA 90068. Mark film orders for the attention of Theresa Modnick, and allow 4 to 6 weeks delivery on all orders (film or tape). Then, once you have enjoyed it yourself, take it out and show it to civic groups, church groups, CB clubs or whatever. The purpose of the film is to introduce amateur radio to the rest of the world, and a film or tape is of little value sitting on your library shelf. Each of you has the ability to become a spokesperson for amateur radio. The tools are available and the audiences await you. The best public relations corps we in amateur radio have is ourselves.

GOING TO THE AIRPORT CAN BE HAZARDOUS TO YOUR HEALTH DEPARTMENT

Rob Diefenbach WD4NEK had a rather unpleasant experience not long ago. He had taken his wife to Atlanta's Hartsfield Airport, and like most devoted amateurs, he was carrying an HT with him. That's when the problem began, and at this point we will let Rob tell the story:

"Despite what overzealous rent-a-cops at America's second busiest airport may try to tell you, there is no prohibition against carrying or using amateur transceivers in the gate areas there.

"When I was told recently that I must remove the batteries from my 2-meter handie-talkie before passing a security checkpoint at Atlanta's Hartsfield International Airport, I complied without argument. 'If you don't, you'll be in a lot of trouble,' a smartly-uni-

Continued on page 169

RTTY Loop

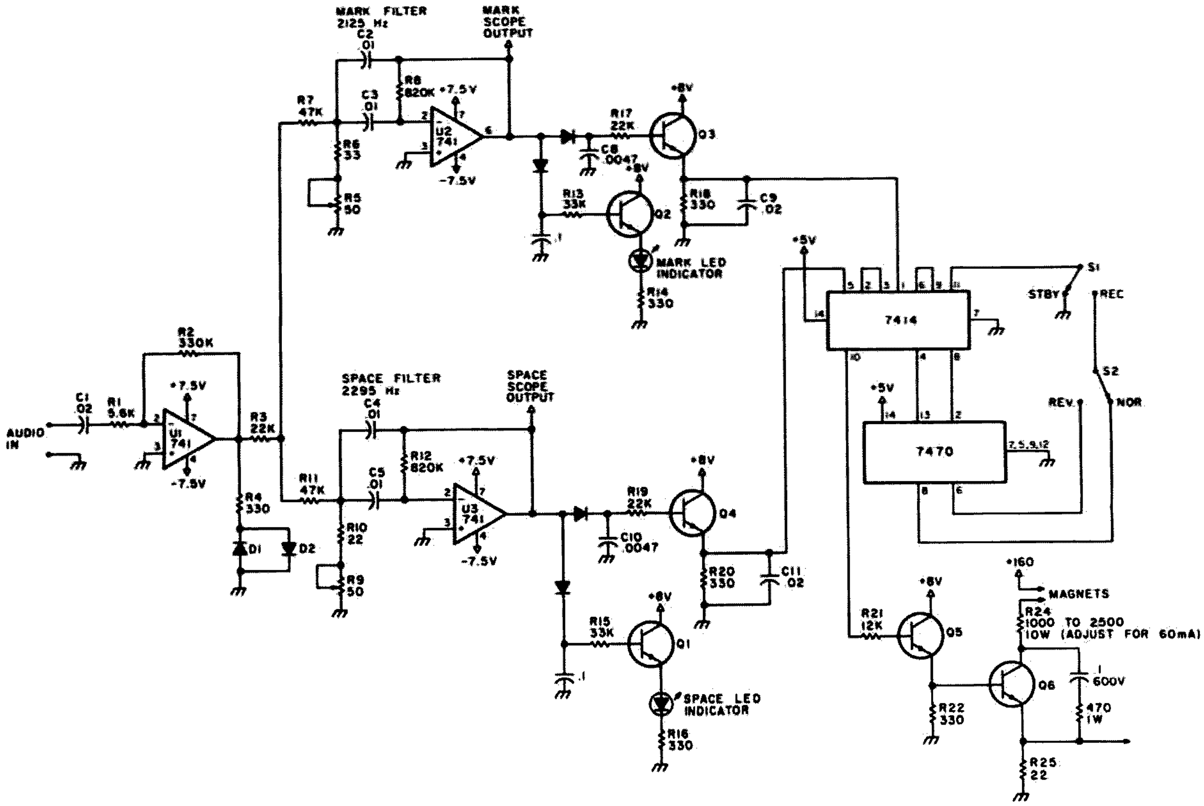
Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

This month marks the beginning of the fourth year of RTTY Loop. Several of you have asked how this whole thing got started, and it occurred to me that I never really told that story, so here goes. As they say (whoever "they" are), there's a lesson in here for you!

Several years back, our local ham club, the Baltimore Amateur Radio Club, was in the process of expanding and improving its journal, *The Modulator.* Knowing that I was a RTTY buff and that I had written many articles for *73* (thus presuming literacy, I suppose), I was asked to write a column for the "new" *Modulator.* After some mulling over (must have taken all of thirty or forty microseconds), I agreed and a column was born. Titled "Tele-Tips," the articles were about half the length of a typical RTTY Loop and dealt with radioteletype basics.

After writing the first few columns, it became evident that the material being presented had a far wider appeal than the club newsletter afforded, and

Continued on page 176



RTTY Demodulator Parts List

C1, C7, C9, C14	.001 disc ceramic
C2	.005 disc ceramic
C3, C4	500 pF 5% polycarbonate or mylar*
C5	.01 disc ceramic
C6, C16	2 uF 25 V dc electrolytic
C8	.01 uF 5% polycarbonate or mylar*
C10	.47 uF mylar
C11, C15	.1 uF disc ceramic
C12	6.8 uF 25 V dc electrolytic
C13	680 pF disc ceramic
C17	500 uF 25 V dc electrolytic
C18, C19	100 uF 25 V dc electrolytic

*to limit the amount of drift due to heat.

All resistors ¼ Watt 10% except as noted.

R1, R5, R17, R20	4.7 megohm
R2, R18, R21	2.2 megohm
R3	1.0 megohm ¼ Watt 5%
R4	2.2 megohm ¼ Watt 5%
R6	7.5k Ohm ¼ Watt 5%
R7, R13, R22, R23	10k Ohm potentiometer, printed circuit type
R8, R9, R15, R30 R31	10k Ohm
R10, R11	4.7k Ohm
R12	12k Ohm ¼ Watt 5%
R14, R37, R38	1k Ohm
R16	3.3k Ohm
R19	150k Ohm
R24, R25, R26, R27 R32, R33	1 megohm
R28	100k Ohm potentiometer, printed circuit type
R29	15k Ohm
R34, R35	3.9k Ohm
R36	10k Ohm ½ Watt 10%
CR1, CR2, CR3, CR4	1N34A germanium diode
CR5, CR6	1N914 silicon diode
CR7, CR8, CR9, CR10 CR11	1N4007 rectifier
CR12	12 volt 1 Watt zener diode
LEO	light emitting diode
IC1, IC3	LM3900 CN (National)
IC2	LM565 CN (National)
Q1	MPF 102 or equivalent N-channel FET
Q2	High voltage silicon NPN transistor (Sylvania ECG 228 or equivalent)
T1	1.2k Ohm center-tapped to 8 Ohm transistor type output transformer used backwards.
T2	115 V ac to 12.6 V ac ½ Amp filament transformer
F1	½ Amp fast blow fuse and holder
S1	SPST on-off switch
S2	SPOT sense switch

Miscellaneous

5 x 7 chassis, terminal strip, #6-32 nuts and bolts, insulated spacers for #6-32 to mount boards on chassis, holder for LED

Fig. 1.

DX

James D. Cain K1TN
306 Vernon Avenue
Vernon CT 06066

73 Magazine is unique in many respects, not the least of which is that we can publish color photos in columns such as this; witness the DXers pictured herein. This should be encouragement enough for you to send in your favorite snapshot for these pages. Please do so. US and Canadian hams, when you work a DX station, ask him to send a photo to the above address or direct to you for forwarding to this column. Thanks!

While this is a DX column, not a contesting column, it seems prudent to discuss the ARRL DX Contest briefly. The League has given until June 15 for interested parties to express their opinions regarding new rules which went into effect this year. A little background is in order. The ARRL International DX Competition began in the 1930s as a marathon affair. It was always a "world works the US and Canada" activity. Through 1978, the Competition was two weekends for CW and two weekends for phone; in 1979, the format remained unchanged but the schedule was cut to one weekend per mode. Then, late in 1979, despite reservations of the League's Contest Advisory Committee, the format of the Competition (and its name) was changed. The 1980 ARRL DX Contest was run by a set of rules closely paralleling those of the *CQ* Worldwide DX Contest. Everyone was allowed to work everyone (except within one's own country) with a point structure just slightly favoring the rest of the world working W/VE stations. Still with me?

Well, it has really hit the fan. It seems that those responsible for the changes *thought* that the rest of the world's amateurs, contesters in particular, didn't like spending an entire weekend working just the US and Canada. Something of the "Ugly American" mentality was at work here, only it was the American sponsors of the operating activity who were in that mode. They don't seem to have reminded us anywhere that the ARRL DX Competition has grown in number of entries steadily through the years. They were concerned that the *CQ* Worldwide DX Contest touts having more entries, which is true. But the real truth is that the *CQ* Contest, due to its format, results in hundreds of entries reflecting Europeans working each other on 80 and 40 meters (same continent, two points each), with nary a "DX" contact in the log. That is perfectly reasonable within the rules of the *CQ* Contest, but it is no reason to make the ARRL Competition into a poor carbon copy.

We have letters from European amateurs who have gone so far as to boycott the 1980 ARRL DX Contest because of the new rules. Unbelievable as it may seem to the Newington promulgators of the new rules, many of the contesters around the world absolutely love the two weekends of the year working W/VE. There are parallels to that format: The All Asia Contest is the world working Asia, and then there's the Worked All Europe every summer and the Bermuda Contest in March.

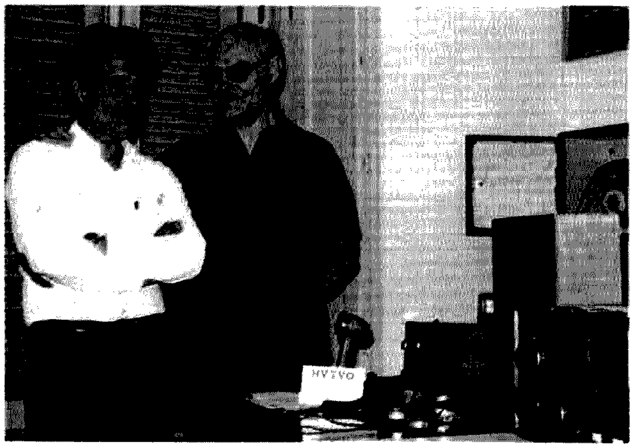
So what's the connection to pure DXing, which is what this column is about? Presently, the United States is undergoing one of its recurring periods of patriotic fervor. Nothing wrong with that, and the concept can extend to amateur radio. After all, we have more amateurs on the HF bands than the rest of the world and we are omnipresent. That is exactly why the old ARRL International DX Competition "world-works-the-US/Canada" format was so popular. Just as many of us enjoy working scads of Japanese stations once a year in the All Asia Contest, much of the world participated in the ARRL Competition for the pleasure of logging 100-contact hours. That's what DX contesting is for. That's why European DXers put up special low-band fixed antenna arrays toward North America—to work us during the International DX Competition.

If you agree with this point of view, send a letter to the Chairman of the ARRL's Volunteer Contest Advisory Committee: Jim Stahl K8MR, 3592 Atherstone Road, Cleveland Heights OH 44121. Of course, if you like the *new* rules, they would like to hear from you, too.

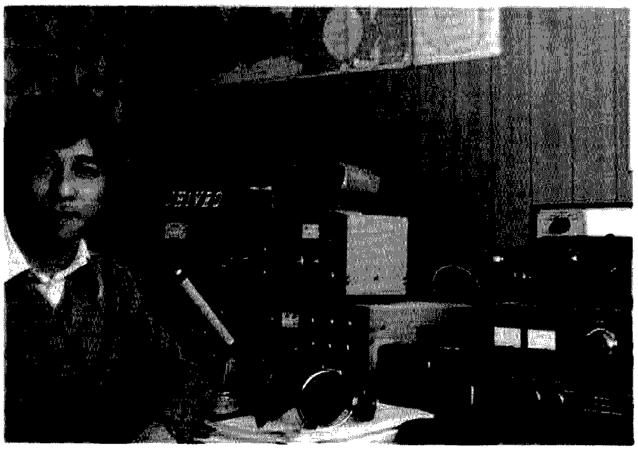
Summertime propagation conditions are in full swing now, and if you are not familiar with the consequences, maybe a few words are in order. The low bands (160, 80, and 40 meters) propagate just as well now as they did in the winter. The problem is, of course, static masking the weaker signals. On quiet summer nights, the signals will come through just fine, so don't give up on these bands. 20 meters will be open round-the-clock, with openings to Asia from North America lasting later into the evening than they do in winter. Long-path openings will occur earlier in the morning than during the winter.

15 meters can be fascinating during the summer. Look for weird openings to unexpected spots. Last July, during the IARU Radiosport Championship, 15 meters opened from the US to Japan at 1300 UTC and stayed open until after 1800 UTC! Both days of the contest, no less. On the other hand, at the same time that 15 was open to Japan, 10 meters was dead as the proverbial doornail. 15 is not normally good on the North Pole path in summer, and 10 meters can die for days at a time. 10 will, during these sunspot-rich times, occasionally stay open from North America as late as 0000 UTC into western Europe.

The various magazines are full of articles on the malicious interference problem these days. While it is easy to take the attitude that the good old days were better (in many ways they were!), there are pros and cons to DXing and HF operating in the 1980s. On the positive side, more rare stations are using better equipment and beam antennas, and the AM carriers are gone from the bands. Yet, as Larry Brockman N6AR stated in a recent article in *CQ Magazine*, ten years ago there was definitely less of the ugly nonsense con-



Father Edmund HV2VO (on right) and Tony Privitera, I0IJ (photo courtesy K3ZJ).



Nao Akiyama JH1VRQ, Overseas Liaison Officer of the Japan DX Radio Club and active DXer.

nected with HF operating, especially DXing. If some nerd breaks up your rag chew, you can just change frequencies or bands, but if deliberate interference voids your QSO with a new country of expedition, there may not be a second chance. Brockman asserts that some of us have lost our manners; maybe some of us just never had any in the first place. Peer pressure seems the only answer, although most of us are hesitant to apply it. But good operators are still in the vast majority.

And now for a wrap-up of February and March DX happenings . . .

TZ4AQS finished his operating from Mali, topped by a two-week stint of heavy guest operating by his QSL manager, ON6BC.

Fred Laun HS1ABD leaves Thailand this August. His 80-meter aspirations were thwarted by terrible power-line noise, although he managed to work W8AH, N4AR, and K4DY on 3.5. He was very active on 40 meters, reporting that the "gray-line" path on that band paid off. It didn't work on 80. HS1WR will try to take up the slack which will come with Fred's departure.

Toshio Yai EP2TY continues active from Iran, despite internal problems there. QSL him direct only, not to any Japanese manager. He is on 15 and 20 SSB regularly and on 10 meters occasionally.

At press time, Peter S2BTF was back home in Germany and it is not known if he returned to Bangladesh. He had been active on the controlled operation by W7RQ and W7PHO every evening at 0045 UTC on 21340.

March saw FR7AI operating /T from Tromelin Island for about two weeks. The proposed Indian Ocean Union operation of N2KK, N5AU, and K5CO was scuttled and thereby went the hopes of those needing Glorioso and Europa, among others.

TN8AJ, in the Congo Republic, was workable on 15 meters via a weekend list operation at 21210 or so on CW. His manager is WB9TTM.

As for China, ZL1ADI had some plans in the works, but they fell through. In March, at least one American amateur was in Peking, and he was listening, but without hopes for a license to transmit. There is talk out of Yugoslavia of a license for China operation sometime this year.

Jim Smith P29JS got around; he operated VK9NS from Christmas Island in February. Karl Geng DL2AA/W1 operated as VK8GK/Lord Howe, also in February.

28750 became a favorite spot for DXers this past winter; a group run by DK2OC attracted considerable quantities of rare stations, many of them being Europeans operating from African countries. The group met at 1200.

Mike Smedal, formerly EP2LI, continued active from Qatar (A7XD) and was found regularly on the Afrikaner Net (1800, 21355), as well as on 20 and 10 meters. A7XE was workable from lists on 15 meters.

YI1BGD continued to be difficult to work for those who can't get to their radios Monday-Friday. The Kansas City DX Club donated 500 QSL cards to the Iraquis to send to the lucky ones who have worked the club station.

By the time you read this, the country of Burma will either be off most DXers' need lists or it won't. How's that for hedging? George Collins VE3FXT/HS4AMI purportedly has permission to operate as XZ0ONU 15 April to 15 June, in conjunction with UNICEF (United Nations Children's Emergency Fund). We'll see.

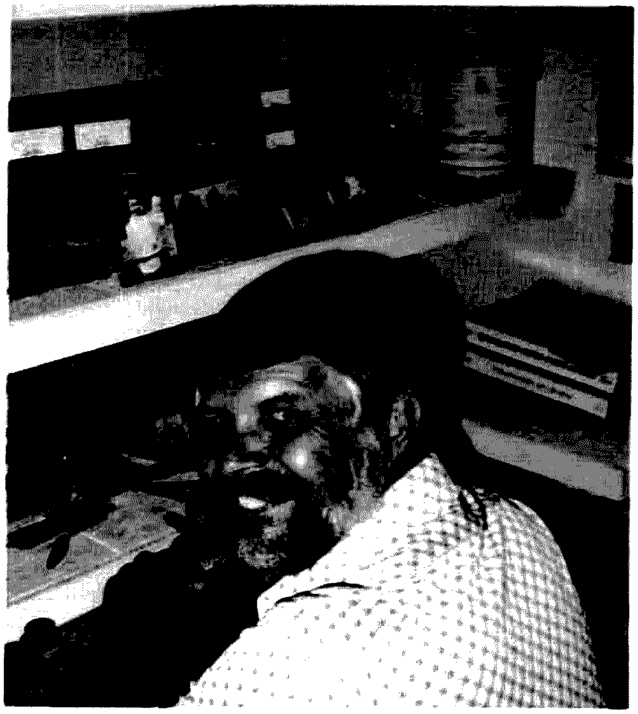
If you're trying for a TZ QSL card from a VE3HRS/TZ contact in September or October of 1979, forget it. You worked a bootlegger. Same for 5X1AA and any BYs.

I8KDB reported in late March that they were 3,000 QSLs through the 5,000 requests resulting from the TL0BQ operation last December.

PP0MAG came on from Trinidade Island in February and March, working CW only with plenty of 40/80-meter activity. He was there a full two months, awaiting the next boat out.

Sri Lanka became easier and easier to work as John Ackley KP2A spent several weeks operating as 4S7DX. He then spent two weeks on the Maldives as 8Q7AR, followed by stops at East Malaysia, Thailand, Nepal, and Macao.

Eric Sjolund SM0AGD began an African safari in Guinea Bissau, operating as J5AG. He was scheduled to be in 9Q5, ZS, A22, and others, with operating permission for most pending. All QSLs for his activity go to SM3CXS.



Chet Lambert KX6PP, Marshall Islands.

March's big event was the operation from Heard Island by VK0RM. Here it is, as published immediately afterward in *The DX Bulletin*.

HEARD ISLAND VK0RM, MARCH, 1980

A scientific expedition to Heard Island left Australia about 1 March 1980, intending to operate on the amateur bands with a Kenwood TS-120 when time permitted. En route, expedition leader Con Veenstra and radio operator Bob McManama operated VK0RM/MM to familiarize themselves with the radio. During the boat trip, the receiver in the TS-120 failed (switching diodes), but McManama repaired it. On Wednesday, 12 March, seven members of the crew were helicoptered to McDonald Island, west of Heard, for a two-day stay; Veenstra and McManama stayed aboard ship. The crew was reunited on 14 March and arrived in the cove at Heard Island on Saturday, 15 March. A handful of amateur-band contacts were made from the ship.

Ashore on Heard at daybreak on Sunday, 16 March, the group was maintaining twice-daily schedules with OZ8AE/MM, and at 0900 UTC on the 16th, P29JS began taking a list of stations to be worked by VK0RM. Listed were two from each South American country, three from each JA and W/K call area, two from each major European country, three from each VE call area, and 108 VK/ZL stations. At 1200, VK0RM came on the frequency of P29JS and announced that the TS-120 receiver had failed, but that they would attempt operations the next day.

Some stations were worked on Monday, 17 March; VK0RM showed at 1200, extremely weak, with transmitter problems. Many VK and ZL stations on the original list were worked along with a couple of JAs. The operation was moved above 14200 in an attempt to work North Americans, but without success. Jammers aggravated the situation.

Further attempts were made on Tuesday, 18 March; OZ8AE/MM reported that the TS-120 had been taken back to the ship, were the final amplifier transistors were found to be destroyed, probably due to power-supply problems (overvoltage or spikes). While some spare radio parts were kept on the ship, the Kenwood could not be repaired. A few stations were worked on Tuesday, but all of these had

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Leaky Lines

Dave Mann K2AGZ
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Kinnelon NJ 07405

Question: What, precisely, is an S-meter, anyway?

Answer: Nothing more than an extremely erratic, undependable instrument frequently used when giving signal reports.

I attempted to deal with this before, but to little avail. The erroneous practice persists, and it would take an earthquake, a tidal wave, a volcanic eruption, and a Kansas cyclone to bring home, finally, to the adamant ones who insist upon continuing with this meaningless exercise in futility that an S-meter report has about as much validity as a message from a Ouija board. Maybe even less!

The problem arose years ago when someone mistakenly concluded, because there are nine "S" units on the meter and nine gradations on the signal strength chart, that Eureka!, this must mean that there is some correlation between the two. Balderdash! There is none!

Properly calibrated, an S-meter is supposed to read S-9 for an incoming signal of 50 microvolts. That some contemporary manufacturers have seen fit to adjust their meters to 100 microvolts has no more significance than the fact that some car manufacturers install speedometers that go up to 140 mph in cars that can't exceed 90 or 100 mph. The important thing to know about S-meters is that apparently no two of them give the same reading on a given signal. Even the meters on two identical rigs made by the same manufacturer will vary.

Granted that the signal report represents a piece of useful, valuable information to the transmitting operator, how can he make use of the data if it is rendered inconclusive by broad variations in accuracy? The answer, of course, is that he cannot make use of it.

Signal reports should not be based on the S-meter reading for the simple reason that they happen to be the least standardized item in your ham shack and can't be depended upon for accurate measurements.

If you bought a frequency counter or a signal generator that operated with as much inaccuracy as your S-meter does, you would take it around to the guy who sold it to you and bust him over the head with it!

Just to refresh the memory of anyone who doesn't happen to have an ARRL logbook around (the R-S-T System of Signal Reports is reproduced therein), here is the table which represents the accepted standard:

1. Faint signals—barely perceptible
2. Very weak signals
3. Weak signals
4. Fair signals
5. Fairly good signals
6. Good signals
7. Moderately good signals
8. Strong signals
9. Extremely strong signals

As you can see, there is nothing here to indicate any meter readings. The report is based upon a judgment call . . . a conclusion.

But it has now gotten so out of hand that if the incoming signal makes the meter needle deflect to only S-5 or 6, the guy is embarrassed and tells the transmitting station, "You're only showing a 6, but my meter is 'Scotch.' You sound like an S-9." Well, for Pete's sake, if he sounds like a nine, that's what you're supposed to give him. Never mind what the blasted S-meter says!

Only a couple of days ago, I heard a fellow give a report of 2 and 1. He didn't miss a single word of the other guy's transmission, yet he gave a report that indicated that the other station was practically unreadable. It was obvious that he was using his S-meter. How can you give an S-1 report when you copy solid, without losing a single syllable?

I wish I had a buck in my pocket for every time I've copied solid signals from someone whose S-meter reading was zero . . . the meter didn't even deflect. And I needn't remind anyone that there are times when 9-plus signals are creamed by atmospherics, QRM, impulse noise, and the like. Even worse, you may hook up with one of those people who never learned how properly to modulate a mike and his audio is so damned confidential that you can't understand a blasted thing he says. The needle of your S-meter may be deflecting pretty vigorously, but his audio sounds like loose cowflop . . . no definition, no diction, no highs . . . nothing but a super-saturated glob of soft glop that sounds as though he's got his head down in the toilet bowl! Readability, zilch! Strength? Stength of what? If there's little or no intelligibility, how in the hell can you assign him a reading of any kind? Yet your stupid S-meter is showing a good reading.

The only time I've found a fairly useful application for the S-meter would be when two stations, operating at roughly the same power from the same general location, were to run a test to see who had the relative advantage. This might reflect many things—antenna performance, transfer of power, audio frequency response with higher audio peaks, and so forth. The meter would show the difference.

The most reliable way to give a signal report is by using the ears that the good Lord gave you. Use the R-S-T system (or the old and very reliable QSA system) and forget about the S-meter.

Now, about the phenomenon sometimes called "one-way skip," another pet bete noire of mine. Is it possible for two stations to copy each other at varying levels? Well, maybe . . . and then again, maybe not. Suppose that one of them doesn't know how to use his receiver properly . . . doesn't take advantage of his notch filter, his noise blanker, etc. Suppose one is using a beam and the other a simple wire.

Here's an example. Some of us decided to go down to 40 meters to see if there were any Pacific stations lurking out there in the middle of the night. Since I happened to own a beam for that band, we decided that I would call CQ DX Pacific. Quite a few Oceania stations responded. All the other guys were on dipoles and inverted V antennas. The DX stations were giving these jokers 5/7, 5/8, and 5/9 reports, but they couldn't even hear them! I copied every word due to the beam, of course, but although they were evidently putting good signals out into the Pacific, they couldn't hear their own reports. Said one of them, "Sorry, old man, but would you mind repeating my report? We have one-way skip."

One-way skip, hell! He simply had a lousy receiving antenna, that's all. It operated fine on transmit, but on receive, it was the pits!

So there you have it. My recommendation for this month is that you replace the S-meter on your front panel with a clock or a photo of the presidential candidate of your choice . . . and please, the next time you work a guy with fairly good signals, give him the 5/7 he's entitled to instead of a crummy 5/2 that you'd report if you were relying on your stupid meter! And string up a good aerial instead of complaining about one-way skip.

Ham Help

I need a service manual or a schematic for a Harrison Laboratories model 855B power supply (0-18 V, 0-1.5 A).

**H. Wade Krizan W5GHQ
4801 Goldfield, Space 46
San Antonio TX 78218**

I am in need of any info at all on what appears to be a digital-data cassette recorder. It is identified as a Compucord 1210, a product of Compucord, Inc., of Waltham MA. Unfortunately, as far as I can find out, this company no longer exists, at least not under that name and/or not in Waltham. Any info on this device or the whereabouts of the manufacturer would be greatly appreciated. Of course, I will copy and return any material or pay, for copying and postage. Thank you.

**Fred Goldberg WA2BJZ
29 Clearview Road
E. Brunswick NJ 08816**

I would like to start a singles net: divorced, widowed, never married—any age. Let's get together and share our common situation. Women are encouraged to participate. An SASE would be appreciated.

**Tim Skoning N9ASI
800 Water Street
Dundee IL 60118**

LETTERS

NBVM PRO

I got a real kick out of the staff article about NBVM (*73*, January, p. 30). It reminded me much of the articles and comments in the '50s about SSB vs. AM.

You old-timers will remember: "SSB sounds bad," "SSB is too expensive," "SSB is incompatible with AM—you need special equipment to receive it," "SSB is hard to tune and drifts too much," and "SSB requires constant readjustment of rf and af gain controls." Well, we all now know that this was like arguing "apples and oranges."

True, on the equipment of the '50s, SSB was pretty strange sounding, required some calisthenics with the gain controls, was hard to tune, and, while *it* didn't drift (usually), many of the receivers we used back then *did*!

If your current "Super Dumafligit" transceiver isn't far more stable, with far better agc action and better sideband detection capability than the one you used in the '50s, you're probably *still using* the one you used in the '50s!

Just one example: N8RK talks about problems of fooling with gain controls using the amplitude expandor.

I've used the same expandor circuit as contained in the VBC 3000 (using my own NE570 purchased from Jameco) and once I got the hang of where to set the basic level controls, I find I only have to use the receiver af gain control on my Argonaut, KLM Force Five, Echo II, Echo 70, or my SBE Sidebander III converted CB set. On the lower HF frequencies, some improvement can be gotten by reducing the rf gain control when talking to strong stations, but that is normally the case with or without the expandor.

As expanding the signal causes a change of 2 dB for each change of 1 dB of incoming audio, agc overshoot and agc level changes, etc., will be expanded by the same amount. Obviously, a properly designed, tight agc with fast attack (5 ms), delayed decay (hang time), and a one-half to one second decay time is more compatible with amplitude expansion than the usual simpler agc circuits found in many ham rigs. (The audio-derived agc chip sold by Plessey as the SL620 should work well.)

Rather than go into a long technical treatise into the many presumptions and misunderstandings concerning NBVM that make N8RK's review marginal, at best (I've given Wayne Green much of the data and technical papers concerning the FCC tests, plus offers of tapes of my own data and experience—no response—"too busy," he says), let me throw out a few questions, instead:

1) How many years and how much flak came about before SSB got the bugs worked out? 2) How good did early units sound compared with the better AM rigs of the day? 3) How long did it take for operators to learn proper use of the mode? 4) How much modification of agc techniques and audio shaping was required to bring SSB up to current levels of performance?

Along the political lines:

1) Do you agree with N8RK's evaluation that the 2100 Hz position (1800 Hz bandwidth) is *only* a 33% savings? Seems to me that 33% out of 100 possible stations on a given band would allow *33* additional stations!

2) Has the editorial policy of *73 Magazine* ever left you with the feeling that if the ARRL came out *for* something (especially *strongly for* something) that *73* would take a negative viewpoint concerning it? Admitting that *QST*'s editorial was overzealous (a common failing in that magazine . . . all magazines?), is that sufficient cause for *73* to "drive a stake into the heart" of a small *American* company? I think Wayne ought to reread his own "the Japanese are ahead of us, U.S. business is falling behind" editorial in the same issue as N8RK's attack on VBC and see if there isn't a bit of inconsistency there!

I'd be the first to admit that NBVM is not yet perfect. It is, after all, the first product of a small company which is involved in larger, more complicated research. VBC has also presumed that hams can make appropriate adjustments to properly interface with unit with their rigs (apparently not the case at *73*, if they couldn't find *any* improvement under *many* circumstances).

I've used the system at various times and found QRM-free capability vs. heavy QRM, depending on conditions. It doesn't always help, but many times it does.

Slams like that in *73* are unwarranted.

Jim Eagleson WB6JNN
Watsonville CA

P.S. I'll happily correspond with any interested amateurs on this subject and record demonstration tapes for anyone supplying a cassette with mailer, assuming Wayne "finds time" to publish this letter.

If Mr. Eagleson would carefully reread the NBVM article, he will find that a number of good things were said about NBVM. In particular, we noted "at least 12 dB of improvement" when the amplitude compandor was used. The NE570 chip is a very effective speech processor and had been covered in electronic publications before NBVM arrived on the scene. If the VBC unit is marketed as being compatible with current ham rigs, then it should be mentioned that agc problems exist. Of course, the user can modify his radio to have a "properly designed agc," a topic that is not mentioned in the VBC owner's manual or QST *articles.*

Mr. Eagleson claims that the 73 report contained presumptions and misunderstandings about NBVM. However, the theoretical portions of the article were based on information provided by VBC and what is in the ARRL Radio Amateur's Handbook. *Is that information "marginal," too? The 73 viewpoint is not a solitary one. The July, 1978, issue of* Spectrum, *a publication of the Institute of Electrical and Electronic Engineers, included an article about SSB NBVM and its possibilities as a replacement for the land-mobile FM service. Because of widespread disagreement over NBVM, a dissenting view was published alongside the favorable article. The disagreement over NBVM is also found in the December, 1978,* Spectrum, *where several letters raise questions about NBVM.*

The 73 Magazine *review was written after a thorough on-the-air testing and correspondence with communications specialists. Electrical engineers, the VBC Corporation, an ARRL technical staff member, and perhaps most importantly, a number of NBVM users were consulted. If NBVM or any other possible technological advance is going to reach its full potential, it must be able to withstand and benefit from an open and, if necessary, critical evaluation of its merits and downfalls. Would the readers of* 73 Magazine *want it any other way?—Tim Daniel N8RK.*

Jim, there was no one more anxious than I to have NBVM be a winner. There may have been people more disappointed by it than me, but my disappointment resulted from giving it a real solid try. Harking back to the early days of SSB is an unfair parallel. And trying to discredit me as a reactionary fighting new ideas and techniques must strain all but Bill Orr's credulity.

I can answer your questions about SSB for you. I was there and I was one of the pioneer users of SSB.

1. How long before the bugs were worked out of SSB? There were no serious bugs. The early ham SSB equipment worked just fine. Old-timers with investments in AM equipment felt threatened by it and fought back emotionally over it. The use of AM receivers for tuning in SSB was not the best, but it worked well enough after about two minutes instruction on turning down the rf gain control. I visited many DX ham shacks and showed them how to tune it in . . . only to hear the chaps appear on SSB a few months later.

2. The early SSB rigs sounded fine . . . little different from those we hear today. AM rigs sounded okay if you had a clear channel . . . but with the bandwidth and QRM, we did not often have clear channels and the resulting sound was deafening as the carriers created a sea of heterodynes up and down the

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Contests

Robert Baker WB2GFE
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Atco NJ 08004

MYSTERY HILL DXPEDITION

Starts: 1800 GMT June 7
Ends: 1800 GMT June 8

The Mount Moriah Repeater Society will hold a DXpedition at Mystery Hill, North Salem NH, on the dates/times shown above. Mystery Hill is a 4000-year-old astronomical observatory and prehistoric temple presumed built by Celtic and Iberian cultures. It is the "stonehenge of America" and has been defined as potentially the most important archaeological find in the Western Hemisphere. It is most likely the oldest man-made structure in the United States. An attractive certificate will be awarded for all contacts with K1MDX, the DXpedition station. Send a legal size SASE to: K1RCT, PO Box 123, North Salem NH 03073.

FREQUENCIES:

Phone—3980, 7280, 14280, 21380, 28580, 146.52.

CW—3550, 3710, 7050, 7110, 14050, 21050, 21110, 28150.

ARP CONTEST

Starts: 0000 GMT June 7
Ends: 2400 GMT June 8

Sponsored by the Associacao de Radioamadores Portugueses. Only CT1 and CT4 stations will count for this contest. Please note CT2 and CT3 stations are excluded. Fixed stations can be worked once per band, independent of mode. Mobile stations can be worked once per band and per county. Use all bands 80 through 10 meters on SSB, CW, or AM.

EXCHANGE:

RS(T) and serial number starting with 001. CT1/CT4 stations will indicate their county by a 3-letter abbreviation.

SCORING:

QSOs with stations located in the county of Porto count 2 points, while QSOs with stations in other counties count 1 point each. The multiplier is the number of Portuguese continental counties worked, 275 maximum per band. Multiply the QSO points on each band by the number of counties worked on that band and add the band totals to compute the final score.

LOGS & ENTRIES:

The following information must be stated in the logs: call, name and address of applicant, call of station contacted, QSO number, abbreviation of county and report, points per QSO. New multipliers must be underlined. Use a separate sheet for final score calculations. Log sheets and county lists may be obtained from ARP or from WB9RCY. Send $1.00 US for postage and printing. Log sheets must be mailed not later than July 30th to: ARP Contest Committee, PO Box 1245, 4021—Porto—Codex, Portugal.

Certificates will be awarded for highest general classification, highest score from each DXCC country, and highest YL score from each DXCC country.

VK/ZL/OCEANIA RTTY DX CONTEST

Contest periods:
0000 to 0800 GMT
Saturday, June 14
1600 to 2400 GMT
Saturday, June 14
0800 to 1600 GMT
Sunday, June 15

This contest is now being organized and conducted by the Australian National Amateur Radio Teleprinter Society, PO Box 860, Crows Nest, N.S.W., Australia. Entry classes include: single-operator, multi-operator, and SWL. Each station may be worked only once per band, but may be worked on another band for further multipliers.

EXCHANGE:

Serial number consisting of RST, zone number, and time in GMT.

SCORING:

As per CARTG Zone Chart, multiplied by the number of countries worked, multiplied by the number of continents worked (6 max.). After the above calculations, world stations add 100 points for each VK/ZL station worked on 20 meters, 200 points for each on 15 meters, and 300 points for each on 10 meters. Countries count as per the ARRL list of countries, except that each VK, ZL, JA, VO, and W/K district count as separate countries. Contacts with one's own country count as zero points for multipliers.

AWARDS:

Awards will be issued for 1st, 2nd, and 3rd on a world basis and also on a country basis.

ENTRIES:

Logs must show in this order: date and time (GMT), callsign of station worked, serial number sent and received, points claimed. Logs of multi-operator stations must be signed by all operators, together with a list of their callsigns. Logs of SWL listeners must contain both numbers sent and received by the station logged. Incomplete loggings are not eligible for scor-

Calendar

Jun 7-8	Mystery Hill DXpedition
Jun 7-8	ARP Contest
Jun 14-15	ARRL VHF Contest
Jun 14-15	VK/ZL/Oceania RTTY DX Contest
Jun 21-22	All Asian Contest—Phone
Jun 22	Worked All Britain Contest—LF Phone
Jun 28-29	ARRL Field Day
Jun 28-29	QRP ARC International QRP Field Day Contest
Jul 1	Canada Day Contest
Jul 12-13	IARU Radiosport Championship
Jul 19-20	Maine QSO Party
Jul 20	Worked All Britain Contest—LF CW
Aug 2-3	ARRL UHF Contest
Aug 9-10	European DX Contest—CW
Aug 23-24	All Asian DX Contest—CW
Aug 31	Worked All Britain Contest—VHF
Sep 13-14	European DX Contest—Phone
Sep 13-14	ARRL VHF Contest
Sep 13-15	Washington State QSO Party
Sep 14	North American Sprint
Sep 27	DARC Corona 10-Meter RTTY Contest
Oct 4-5	California QSO Party
Oct 4-5	ARRL Simulated Emergency Test
Oct 11-12	ARRL CD Party
Nov 1-2	ARRL Sweepstakes—CW
Nov 8-9	European DX Contest—RTTY
Nov 8-9	IPA Contest
Nov 9	International OK DX Contest
Nov 15	DARC Corona 10-Meter RTTY Contest
Nov 15-16	ARRL Sweepstakes—Phone
Dec 6-7	ARRL 160-Meter Contest
Dec 13-14	ARRL 10-Meter Contest

Results

RESULTS OF THE 1979 VK/ZL/OCEANIA RTTY OX CONTEST
(Number ol QSOs in parentheses)

1.	G3HJC	319,700	(100)
2.	HB9AVK	317,804	(84)
3.	JA6ADQ	295,580	(92)
4.	SM6ASD	284,998	(104)
5.	F6ECI	280,742	(91)
6.	VK2CBW	273,420	(60)
7.	EA4XW	252,375	(103)
8.	W7DPW	223,750	(64)
9.	DJ6JC	216,635	(78)
10.	VK3KF	194,724	(49)
11.	F8XT	146,920	(71)
12.	WD8IUP	144,400	(44)
13.	JE2JWK	120,375	(41)
14.	VK4AHD	119,424	(48)
15.	ZL2BR	115,668	(41)
16.	W4YZ	114,480	(38)
17.	VE2QO	107,725	(44)
18.	VK2ATQ	93,345	(31)
19.	VK2AJT	78,320	(29)
20.	OZ2X	75,400	(49)

MULTI-OPERATOR STATIONS

1.	I5MYL	1,156,744	(184)
2.	VK2TTY	381,780	(62)
3.	DK6MM	269,525	(79)
4.	VK2WG/P	164,788	(47)
5.	VK2BYI	138,360	(38)

SWL *STATIONS*

1.	Horst Ballenberger	DL SWL	333,764	(91)
2.	Hans Norbert Sokol	DL SWL	115,155	(84)
3.	Kurt Wustner	DL SWL	95,450	(77)

ing. Logs must be received by the Contest Committee by September 1st. Address all logs to: W. J. Storer VK2EG, 55 Prince Charles Road, Frenchs Forest, 2086, N.S.W., Australia.

Summary sheet must show callsign of station, name of operator(s), address of same, bands used (a separate log is required for each band), the points claimed for each band, number of VK/ZL stations worked, total points claimed, and signature(s).

The judges' decision regarding the placings in the contest will be final and no correspondence will be entered into regarding the same. The logs become the property of the Contest Committee on completion of checking.

ALL ASIAN PHONE CONTEST
Starts: 0000 GMT June 21
Ends: 2400 GMT June 22

The purpose of this contest is to enhance the activity of radio amateurs in Asia and to establish as many contacts as possible during the contest periods between Asian and non-Asian stations. Please note that the contest periods have been extended, scoring methods have been changed, and awards have been added for US stations.

Entry classifications include single-operator/single-band (160-10 meters), single-operator/multi-band, and multi-operator/multi-band. For single-operator classes, never transmit two signals or more at the same time. Only one signal at all times should be used. For multi-operator entries, never transmit two signals or more on each band at the same time. Only one signal per band should be used. In all cases, no crossband contacts are allowed.

EXCHANGE:

OM stations send RS(T) plus two numbers representing operator's age. YLs send RS(T) plus "00".

SCORING:

Non-Asian stations score 3 points per Asian QSO on 160 meters, 2 points on 80 meters, and 1 point on all other bands. The multiplier is the number of different Asian prefixes worked on each band, according to the WPX rules. Please note that JD1 stations on Ogasawara (Bonin and Volcano) Islands belong to Asia. JD1 stations on Minami Torishima (Marcus) Island belong to Oceania. Do not count US military radio stations in the Far East (KA) as being in Asia.

Asian stations use same contact scoring but for contacts with non-Asian stations. The multiplier is the number of different countries worked on each band according to the DXCC Countries List.

The sum of the contact points on each band times the sum of the multipliers on each band will give the final score.

ENTRIES & AWARDS:

Contest rules recommend using a summary and log sheet format similar to those shown. Please use separate sheets for each band and keep all times in GMT. Show each multiplier only the first time on each band. Both logs and summary sheet must arrive in JARL, PO Box 377, Tokyo, Japan, on or before September 30th. Entries can be disqualified for violation of the contest rules, false statements in the report, or taking points from duplicate contacts on the same band in excess of 2% of the total.

Certificates will be awarded to those having the highest score in each entry in proportion to the number of participants from each country and also those from each call area in the United States. Only highest score if 10 or less entries, second place if 11 to 20 entries, third place if 21 to 30 entries, fourth and fifth places if 31 or more entries. In addition, the highest score in each continent of the single-operator/multi-band and multi-operator/multi-band entries will receive a medal and certificate from the Minister of Posts and Telecommunications of Japan.

WORKED ALL BRITAIN – LF PHONE
Starts: 0900 GMT June 22
Ends: 2200 GMT June 22

This is the 4th of the five Worked All Britain contests for this year. The remaining contest is on August 31st.

All contacts must be made on phone using the 160- through 40-meter amateur bands. There must be a one-hour break shown in the logs. The maximum operating time is 12 hours of the 13-hour period. Operating classes include: single- or multi-operator, single- or multi-band, and SWL. In the case of multi-operator, only one transmitter may be used at any time. There is a special section for mobile opera-

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ALL ASIAN DX CONTEST

Year ________

☐ PHONE ☐ CW

☐ Single Band (______MHz) ☐ Single operator

☐ Multi Band ☐ Multi operator (Multi Band Only)

COUNTRY ________ CALL SIGN ________

BAND	QSOs	POINTS	MULTIPLIERS
1.9MHz			
3.5MHz			
7 MHz			
14 MHz			
21 MHz			
28 MHz			
TOTAL		x	=

OPERATOR'S CLASS ________

FINAL SCORE

ADDRESS ________

NAME ________

SITE OF STATION IF MOBILE OR PORTABLE ________

TX ________ LICENSED POWER ________ W

ANT ________ POWER SUPPLY ________

COMMENTS ________

I DECLARE, ON MY HONOUR, THAT I HAVE OPERATED IN COMPLIANCE WITH THE J.A.R.L. CONTEST RULES AS WELL AS WITH ALL REGULATIONS FOR THE AMATEUR RADIO OF MY COUNTRY, AND THAT MY SUMMARY AND LOG SHEETS ARE CORRECT AND TRUE TO THE FACT.

DATE ________ SIGNATURE ________

LOG SHEET No.________

ALL ASIAN DX CONTEST

☐ PHONE ☐ CW

LOG FOR ____ MHz BAND CALL-SIGN ________

DATE	TIME (GMT)	STATION WORKED	CONTEST NUMBER (SENT)	CONTEST NUMBER (RECEIVED)	MULTIPLIERS	POINTS
	TOTAL			TOTAL		

New Products

REVIEW OF THE MORSEMATIC™

I never thought I'd be excited over an electronic keyer again. Like many other hams, I built a WB4VVF Accu-Keyer several years ago and was perfectly satisfied with it—until a few months ago. The happy relationship with my old keyer was upset by the arrival of the MorseMatic, a remarkable little black box produced by Advanced Electronic Applications, Inc., of Lynnwood WA.

The MorseMatic has so many features that it's hard to know where to start. There are four basic modes of operation: Keyer, Memory Keyer, Beacon, and Morse Trainer. These four modes are selected via the rotary switch on the right side of the unit's sloping control panel. Once a particular mode is selected, control is transferred to the keypad. By entering two-, three-, and four-key sequences, the many options of the MorseMatic can be programmed to do your bidding. Now, don't be concerned that you'll need a degree in computer science to operate the MorseMatic. To the contrary, AEA has taken pains to provide a good, clear instruction manual, with examples. In addition, a chart containing a summary of the various commands is permanently affixed to the control panel of the keyer.

Let's take a closer look at each of the four modes of operation.

Keyer

On power-up, the MorseMatic is ready to go as a 20 wpm automatic keyer, with dot and dash memories and a 500-Hz sidetone. From that point onward, you are in control. Is 20 wpm a bit too fast for you? If you tap out "*615" on the keypad, the keyer will be set to 15 wpm. "*635" sets it to 35 wpm. Speeds from 2 to 99 wpm can be selected.

If you type an asterisk and hold down the "1" key, the pitch of the sidetone will begin to rise. When it gets to a pitch you like, releasing the "1" will keep it there. Two asterisks and the "1" key will lower the tone.

For those who like to customize their CW, both the dot-space and dash-space ratios can be changed from their customary 1 and 3 to other values. Other simple commands allow the dot and dash memories to be disabled and enabled at will.

Perhaps the ultimate in keyer customization occurs when you type "*5" on the keypad. Believe it or not, this converts the MorseMatic into a semi-automatic keyer, or "bug." Look out Vibroplex!

Memory Keyer

The memory feature of the MorseMatic is, quite simply, outstanding. It's easy to use, extremely flexible, and makes CW operation, be it contesting or rag chewing, much, much easier.

The MorseMatic™ keyer from AEA.

There are 10 memories available, up to a maximum of 500 characters. Thus you can store one message of 500 characters, 10 messages of 50 characters each, seven 50-character messages and one of 150 characters, etc. The optional memory expansion boosts total capacity to 2,000 characters.

Loading a memory keyer is sometimes a trying experience, but AEA seems to have perfected it. Once you've placed the rotary switch in the "memory load" position, it's a matter of selecting a memory (pressing one of the number keys) and sending with your paddle the message you wish to store. The normal "automatic" loading mode even allows you to take long pauses while loading a message without having the pause show up when that message is played back. This works out great for those of us who can't always remember what we wanted to say. A "real-time" mode is available for those who are a bit more sure of themselves. Messages are conveniently erased and edited.

When you've loaded your messages, the main switch is turned back to the "keyer" position and you can send from memory or from the paddle, at your option. To send from one of the memories, you just tap the appropriate number key. The message will be sent immediately, at whatever speed you have set on the keyer. Herein lies a nice feature of the MorseMatic: You can record messages at one speed and play them back at another. This is a real convenience. For example, when I begin a session of CW work with the MorseMatic, I usually set up the first four memories as follows. Message 1 is a CQ; message 2 is my answer to someone else's CQ; message 3 contains information on my location, name, and weather; message 4 tells about my rig, my job, my age, and any other "standard" information I wish to pass along. Once these four memories have been set up, about 75% of my sending has been eliminated for the remainder of the operating session. I can talk to Novices or Extras and merely change the keyer speed to match the skills of the other fellow. It quickly becomes natural to intersperse material sent from the paddle with messages from the keyer memory. An added plus is that a memory message can be interrupted at any time, either by hitting the "#" key or by tapping the paddle.

The MorseMatic has come in handy when operating CW on the OSCAR satellites. With two antenna rotators to operate, along with transmitter and receiver tuning, it's great to have the keyer do most of the sending.

CW contesters were among the first to use the MorseMatic. One of the reasons they were so eager to get their hands on it is the provision for automatic generation of contact serial numbers. With this feature, a contester can load his exchange into a memory, programming the MorseMatic to insert the serial number in the proper place. Thereafter, each time the exchange is sent, the keyer will automatically increment the serial number. It's a simple matter to repeat the serial number or the whole exchange if the other station misses it the first time around. Without a MorseMatic or similar keyer, it will be difficult to remain competitive in CW contesting.

Beacon

I'm told that the fellows who are experimenting with some of the more unusual types of propagation really appreciate this feature of the MorseMatic. In this mode, the keyer sends a message for a given length of time, then remains silent for another period of time before sending the message again. The guys who operate moonbounce and meteor scatter, for instance, often find it necessary to alternate sending and receiving in this way in order to establish contact.

With the proliferation of propagation beacons on 10, 6, and 2 meters, I suspect someone will put a MorseMatic to work at this job. Now *that* would be a classy beacon.

Morse Trainer

A great number of optional functions are available in this mode, making the MorseMatic an outstanding gadget for teaching and learning Morse code. Two features of the Trainer mode deserve special mention.

First of all, the Trainer can be programmed to gradually increase the code speed during a given practice session. It works

this way: You begin by entering the starting speed, let's say 7 wpm. Then you enter the finishing speed, say 13 wpm, followed by the duration of the practice session, perhaps 15 minutes. When the keyer is activated, it then begins a 15-minute practice session of random five-letter code groups, starting at 7 wpm and gradually increasing the speed to 13 wpm by the end of the 15-minute session. The practice sessions can be as long as 59.9 minutes, with code speeds from 2 to 99 wpm, same as the regular keyer.

The second feature of note in the Trainer mode is its use of the Farnsworth method of instruction. In the practice session described above, for example, the actual characters would be sent at 13 wpm throughout the entire 15-minute practice session. However, the inter-character space would be adjusted to make the starting speed equal to 7 wpm. As the session progressed, the inter-character space would be gradually shortened, so that by the end of the 15 minutes, both the characters *and* the spacing would be at the 13-wpm rate. The *73 Magazine* code tapes have used a similar method for years. It works so well because the brain gets used to the sound of the letters sent at the higher speed.

Getting on the Air

Some of the newer solid-state rigs are a bit particular about the method used to key them. The Icom 701, for instance, has problems with some electronic keyers. By the same token, an older transmitter, with fairly high voltage at the keying jack, can zap the keying transistor of some units. The MorseMatic, though, seems to be immune to these problems. I've used it to key all types of rigs without a hint of trouble. The rear panel has two keying outputs, one for grid block (rated up to −300 V and 30.0 mA) and a second for cathode or transistor keying (+300 V, 300 mA). That should handle whatever you have lying around the shack.

Aside from a lead to your keying jack, the MorseMatic requires only a source of 12-V dc power and a paddle. The sidetone volume is adjustable from a front-panel control that also serves as an on-off switch. By the way, any messages you've stored in memory will remain intact as long as the 12-V supply to the keyer is not interrupted . . . even when the front-panel control is turned off.

AEA has taken all the best features from the many previous electronic keyers on the market and combined them into one easy-to-use unit. In five months of use, it's been 100% reliable, something one can't say about some memory keyers. If you operate CW, this may be the ultimate accessory. Besides, Father's Day is coming up; do you really need another tie?

AEA, Inc., PO Box 2160, Lynnwood WA 98036. Reader Service number 483.

Jeff DeTray WB8BTH
Assistant Publisher

GLOBAL SPECIALTIES CORPORATION INTRODUCES WIRE KIT FOR BREADBOARDS

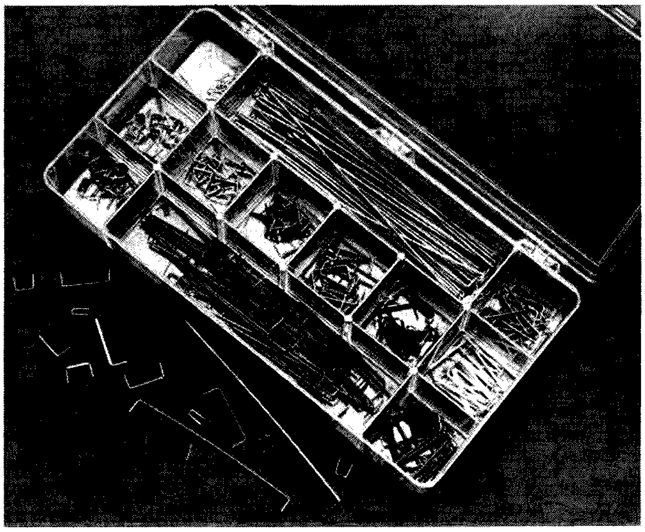
Global Specialties Corporation, world leader in solderless breadboards, has added to the extraordinary utility of these products with the introduction of Model WK-1 Wire Jumper Kit, a fully prepared assortment of insulated solid hookup wire in fourteen discrete, color-coded lengths.

While ordinary hookup wire can be and usually is used for terminal-to-terminal connections in preparing a circuit on a solderless breadboard, it is nevertheless necessary to cut, strip, and bend the leads. This task is accomplished for the breadboard user with the WK-1.

AWG #22 solid hookup wire is precut, prestripped, and the ends bent 90 degrees. Lengths are coordinated with insulation color to provide standard color-code jumper length identification. The fourteen lengths and their codes are as follows:

0.1-inch (no insulation), 0.2-inch (red), 0.3-inch (orange), 0.4-inch (yellow), 0.5-inch (green), 0.6-inch (blue), 0.7-inch (violet), 0.8-inch (grey), 0.9-inch (white), 1.0-inch (brown), 2.0-inch (red), 3.0-inch (orange), 4.0-inch (yellow), 0.5-inch (green). The above lengths are exclusive of the ¼-inch stripped ends.

Twenty-five pieces of each of these fourteen lengths are sorted into compartments in a hinged-lid plastic case. For more information, contact *Global Specialties Corporation, 70 Fulton Terrace, New Haven CT 06509; (203)-624-3103.* Reader Service number 477.



Wire Jumper Kit from Global.

UNIBOX ELECTRONIC PACKAGING COMPONENTS

Unibox is a versatile line of packaging components designed for industrial, OEM and experimenter use. Composed of a series of attractive enclosures and a wide selection of accessories, the components may be custom assembled to meet the user's specific requirements.

Enclosures are available in six sizes and five color combinations. Manufactured from a tough engineering-grade thermoplastic, the enclosures may be readily customized with hand tools. Enclosure sizes range from 1¼" × 2" × 2¾" to 2" × 4" × 5¼".

For circuitry construction, custom epoxy-glass gridboards are available for horizontal and vertical mounting in the enclosures. The gridboard hole pattern accepts IC sockets and other standard lead configuration components.

Two sizes of transparent red and smoke-grey windows are available for use with LED or incandescent readouts, indicators, etc.

Also available are two sizes of opaque grey panels for mounting switches, potentiometers, connectors, etc.

Resilient, non-marring feet, which fit all enclosures, may be utilized for bench or desk-top applications.

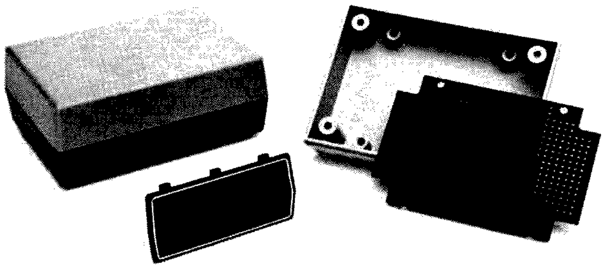
For more information, contact *Amerex, PO Box 2815, Riverside CA 92516; (714)-686-1414.* Reader Service number 479.

NEW FREQUENCY DIRECTORY FROM GROVE ENTERPRISES

The first comprehensive printout of official government radio communications frequency listings has just been released by Grove Enterprises.

The *Federal Frequency Directory* features more than 100,000 discrete listings of frequencies, agencies, and locations of US

Continued on page 166



Unibox electronic packaging components from Amerex.

Awards

Bill Gosney WB7BFK
2665 North 1250 East
Whidbey Island
Oak Harbor WA 98277

Traveling to Scandinavia, we find our friends in Norway offering amateurs worldwide a special achievement award for having made contact with amateurs in their country. Here are two awards that are sponsored by the Norwegian Radio Relay League and the Larvik Society of NRRL, respectively.

WORKED ALL LA AWARD

The WALA Award is available to any amateur who can provide evidence of having filled the following requirements of the award:

Applicants in Denmark, Finland, Sweden, and Norway must have two contacts on separate bands with a total of 20 counties of Norway.

Applicants outside Scandinavia must work 20 different LA/LB stations on any amateur band. At least 6 of these stations must be located north of the Arctic Circle. Contacts with stations from JW (Svalbard), JW (Bear Island), and JX (Jan Mayen) count for this award.

All contacts must be made after January 1, 1950. Usual logbook information is required for claiming your contacts, along with the exact QTH of the station worked. Award fee is Nkr. 10, or 10 IRCs mailed to: NRRL Award Manager, Alf Almedal LA5QK, N-4052 Roeyneberg, Norway.

WORKED NORWEGIAN CITIES AWARD

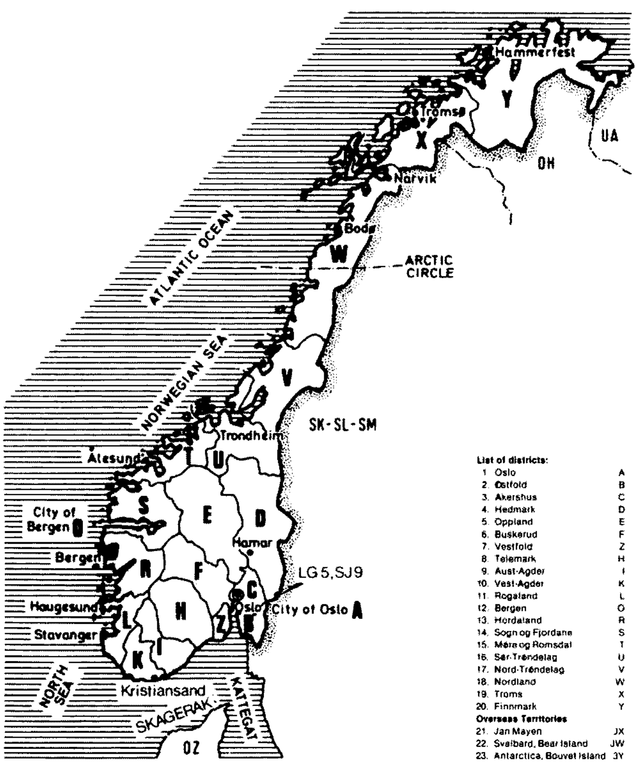
This award requires applicants to work a minimum of Norwegian cities with no limit to date, band, or mode. It should be noted this award will not recognize contacts with LJ, LF, or LH stations. The three award classes are: Class 3—DX stations work 5 cities, Europeans must work 10 cities; Class 2—DX stations work 10 cities, Europeans must work 20 cities; Class 1—DX stations work 15 cities, Europeans work 30 cities.

GCR apply. Send your completed list of contacts and application along with the award fee of $1.00 and 2 IRCs or a total of 10 IRCs to: Larvik Society of NRRL, PO Box 59, N-3251 Larvik, Norway.

Valid Norwegian cities are:

Arendal, Bergen, Bodo, Drammen, Egersund, Fredrikstad, Gjovik, Hammerfest, Halden, Hamar, Harstad, Haugesund, Horten, Kongsberg, Kristiansand S., Kristiansund N., Kragero, Larvik, Lillehammer, Mandal, Molde, Mosjoen, Moss, Mo i Rana, Namsos, Narvik, Notodden, Oslo, Porsgrunn, Sarpsborg, Sandnes, Sandefjord, Stavanger, Skien, Steinkjer, Trondheim, Tonsberg, Tromso, Vardo, Aalesund.

WORKED ALL LA AWARD



From the Vadso Society of the Norwegian Radio Relay League comes details about the worked all "communes" award for this Scandinavian country.

WORKED ALL NORWEGIAN COMMUNES AWARD

Licensed amateurs and SWLers worldwide are encouraged to pursue the requirements of this very challenging awards program. This award is issued for contact with 25 different Norwegian communes and endorsement stickers recognize additional communes in increments of 25 each. At present there are over 454 communes and 5 Norwegian arctic/antarctic areas which qualify for contacts. A special award will be issued to those who can work all communes and all arctic/antarctic areas. Only contacts on or after January 1, 1975, will count for WANCA.

All bands or modes may be used; no crossmode contacts or contacts via repeater will be allowed for credit. QSOs via OSCAR satellites do count. Minimum reports in all cases must be RST 338 or RS 33. Mobile or portable contacts count, but QTH must be stated on the QSL card.

QSL cards are not required. GCR apply. Award fees: Nkr. 30 for the basic award (10 IRCs) and Nkr. 10 (3 IRCs) for endorsement stickers. No fee for handicapped amateurs/SWL stations.

A record book listing all Norwegian communes and areas for 15 Nkr. (3 IRCs) is available from the Award Manager.

Certificates are issued for mixed mode, CW only, SSB only, all RTTY, all SSTV, Novice, Mobility (only contacts with mobile or portables), and All WANCA.

All fees are contributed to the LA5LG Fund for Norwegian Blind-Handicapped Amateurs. All inquiries should be accompanied with at least 2 IRCs for an expected reply.

All applications should be forwarded with the appropriate fee to: WANCA Award Manager, Sverre J. Schmidt LA1QK, PO Box 3, N-9801 Vadso, Norway.

DX AWARDS FROM NEW ZEALAND

I just received a very informative packet of information from Jock White ZL2GX representing NZART, the national amateur society in New Zealand. Jock, as Awards Manager, indicates all NZART awards are available for a very nominal fee and QSL cards are not required where verified lists can be provided as an alternative. To qualify, all contacts claimed for NZART awards must be made on or after November 1, 1945. Special endorsements are given for single band or mode accomplishments. Send all applications to ZL2GX, 152 Lytton Rd., Gisborne, New Zealand.

WORKED ALL PACIFIC AWARD

To qualify for the WAP Award, an applicant must confirm two-way contact with 30 different Oceanic countries from the WAP list below. The cost of this award is 2 IRCs or US $.60.

Eligible Oceanic contacts: Port Timor, Philippines, Adelie Land, New Caledonia, French Oceania, Wallis Island, New Hebrides, Baker/Howland/American Phoenix Islands, East Carolines, West Carolines, Mariana Islands, Marcus Island (Minami Torishima), Guam, Hawaiian Islands, Johnston Island, Midway Island, Palmyra Island, American Samoa, Wake Island, Marshall Island, Java, Sumatra, Borneo, Celebes, West Irian, Australia, Lord Howe Island, Willis Island, Macquarie Island, New Guinea, Norfolk Island, Papua, Nauru, Christmas, Cocos, Gilbert, Ellice, British Phoenix Islands, Fiji, Fanning and Washington Islands, Solomon Island, Tonga, Pitcairn, Sarawak, Brunei, North Borneo, North Cook Islands, South Cook Islands, Samoa, Tokelau Islands, Kermadec Islands, Niue Island, New Zealand, Chatham Island, Auckland and Campbell Island, Antarctica (ZL5 only).

Continued on page 179

One Step at a Time: Designing Your Own Ham Gear

—part I

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Knoxville TN 37914

One of the most difficult steps to take in our growth as radio amateurs is the one that carries us from building to designing. The engineer has learned, through his intensive college training, complex mathematical ways to design circuits and equipment. The experienced technician seems intuitively to know what to look for and what to do. What they do seems a mystery, but they do it well and their equipment works.

But what about the ham who has just received his General class license? He has built a kit or two, and therefore is familiar with components, soldering, and adjustment of equipment. He has even built a device or two, perhaps a keyer, by reproducing the circuit and layout he saw in *73*. Now he has been looking at some of the home-brew designs and wishes he could tackle something that complex. He does not exactly like what he has seen, however. Some of it is too complex for his needs; some is too simple. He has some parts on hand which none of the designs uses. But all he knows about ham radio is what he has learned from his fellow hams, his club's radio classes, and the books published especially for hams. As a salesman, school teacher, carpenter, or whatever the profession, he feels unprepared to tackle the big task of designing his own gear.

If this description fits you, even if only loosely, this article is written for you. There is a way to go about designing, even though you are treading on new ground, which will maximize your chances of successfully building a piece of equipment that suits your specific needs—and which works.

Designing, for the beginning designer, requires a step-by-step process to rely upon for the journey from thinking to operating. Fortunately, the process is not long or involved in its main steps. In fact, there are only seven major steps, along with a couple of smaller ones. Here are the steps which you should use as a checklist for any building projects, the first three of which will be covered in Part One of this two-part article:

1) Setting down design *objectives*.

2) *Blocking out* circuitry by stages.

3) *Circuit* research and selection; circuit interaction: drive, matching, and switching.

4) *Parts* acquisition.

5) *Layout* planning; circuit interaction: shielding and isolation.

6) *Building*, one stage at a time.

7) *Testing* of each stage as completed, and circuit interaction: spurious oscillations and emissions.

That is the entire list. The key words are italicized. Let's take a closer look at each of the items on the list and see how it fits into place as we design a piece of equipment. I hope that by the time we have finished at least one doubtful builder will have been encouraged to step into the workshop as a novice designer.

Setting Down Design Objectives

For any human endeavor,

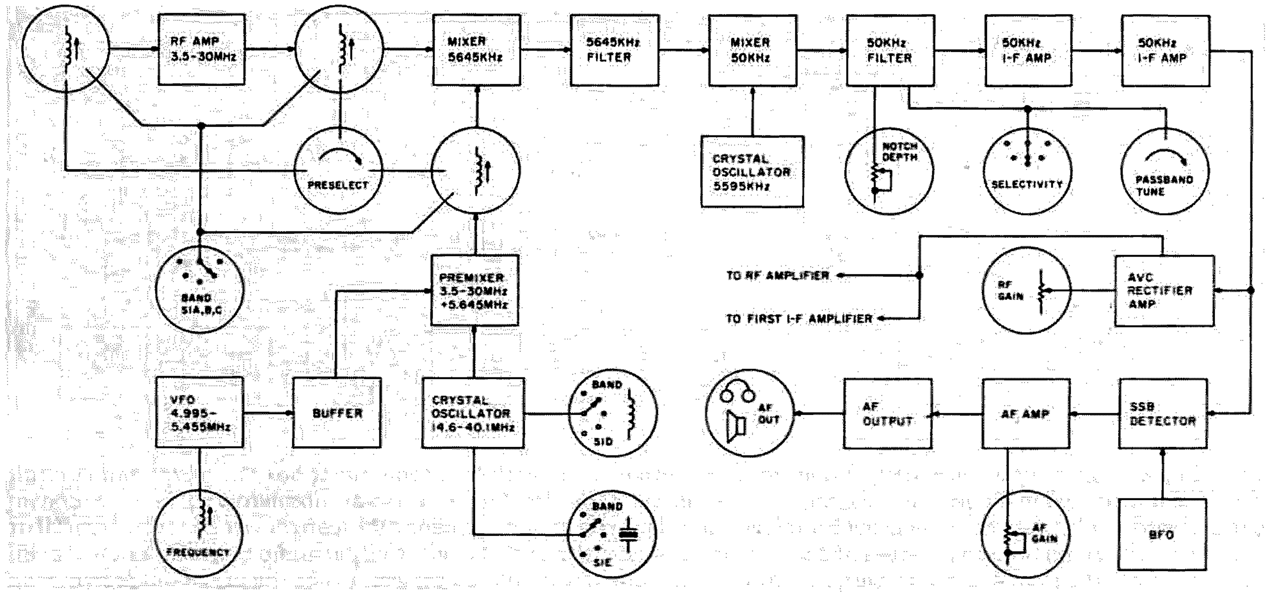

Fig. 1. A block diagram of a 3.5-30-MHz SSB receiver showing electronic stages in squares and control/mechanical elements in circles. This diagram—simplified from the Drake R-4B—is presented to show the techniques of embodying design objectives in a function diagram. It provides the designer with a general view of the stages through which the signal is processed and the switching and other control mechanisms, either necessary or available. Note, for example, that a five-section bandswitch is needed. Controls such as the notch depth and passband tuner are available, but the designer may later choose to include or delete them from the final design. The diagram also provides the elements of the conversion scheme—one of several possible schemes as shown in Figs. 2 and 3. Diagramming commercial and home-built equipment as presented in amateur journals can assist you in deciding the functional details of the unit you want to build, as well as helping you to understand the equipment you have diagrammed.

success demands that we set forth our objectives. Only when we are clear on what we are aiming for do we have any good chance of achieving it. Designing a piece of ham equipment is no exception.

The task of getting our objectives down on paper is not too difficult if we ask ourselves the right questions. Here are some good starters: 1) What *can* this equipment do (and what can it *not* do)? 2) Why do I want to have it? 3) What features or characteristics do I want it to have?

The first question—what can the equipment do and what can it not do?—provides a very important review of the basic purposes of electronic gear. It is not enough to think that a receiver just receives rf energy and converts it to audio (or some other form of) energy. We must think in more precise terms. A high-frequency receiver for SSB and CW is a more exact description. This sets limits to what we can put into it and what we cannot get out of it. It tells us that we are limited to the ham bands between 3.5 and 30 MHz, and that we should not expect good AM reception from the unit. Every piece of equipment we can think of will have some limits, and it is important to be aware of them.

Knowing why you want to build the piece of equipment is equally important, since it allows you to note all the functions you want it to fulfill. If you want to build an OSCAR receiver, then perhaps coverage of all of the ham bands is not necessary. Converters placed ahead of a receiver for 28 MHz might fulfill your needs. Now ask what the receiver has to do to the OSCAR signals. Besides converting them to audio, it has to provide selectivity. And because OSCAR signals near the horizon are likely to be weak, the receiver must be sensitive. Now the list of objectives is beginning to move away from the abstract and into the realm of the concrete. The next step is to refine further these objectives. How selective? 2 kHz for SSB and .5 kHz for CW. How sensitive? Less than a microvolt.

The third question—concerning the main features and characteristics desired—includes many different kinds of concerns. First, it can refer to operating ease or complexity—lots of adjustments or few. Second, it can refer to building ease, e.g., use of circuit boards or perfboards, metal work and cabinetry, tricky circuits or reliable ones. Third, it can refer to the nature of the item. Is it to be an experimental unit under constant revision, or a reliable piece of operating gear? Is it for your own use or for use by others? Is it to be a finished unit or a breadboard item? Even if you see an item in a handbook or article that seems to have just the features you think you want, it will pay to make a list of its advantages and disadvantages in light of just why *you* want to build it.

In order to keep track of your answers, you should make a list, and as you proceed with the design process, add to the list. In your reading, you will find new possible uses for a piece of equipment. For example, you may discover that a frequency counter might be used as a station read-out for both transmit and receive. If you decide you want the device to fulfill that function, be sure to put it on your list, since that decision will make a difference in the specific design of the gear. As your list grows, you also will find yourself becoming more precise in knowing what you want. The design objectives will eventually form a list of specifications for the

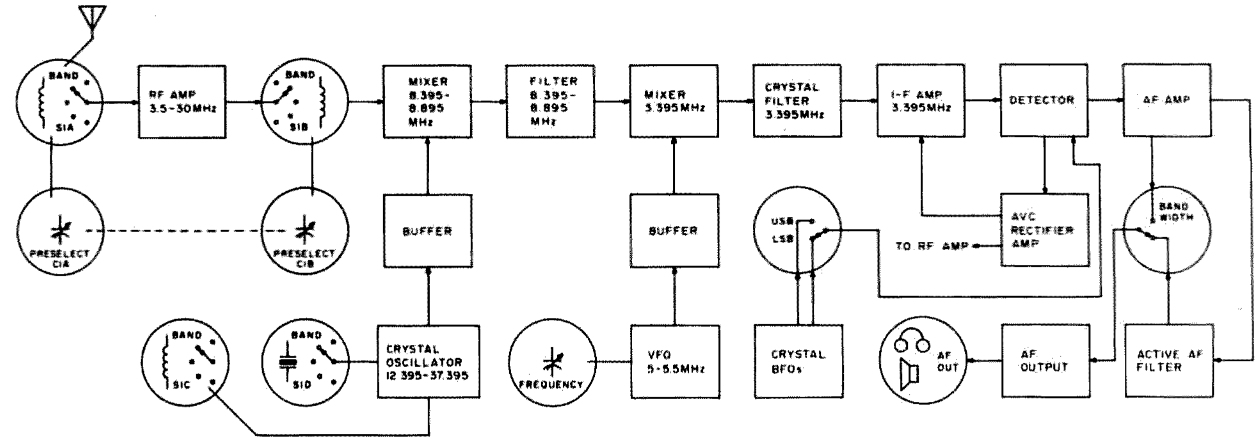

Fig. 2. Block diagram of a somewhat simpler receiver design, again with electronic functions in squares and control/ mechanical functions in circles. This diagram—based upon Heath's HR-1680—shows an alternative conversion scheme to that shown in Fig. 1. Rather than provide all levels of selectivity at one frequency through the use of several crystal or mechanical filters, this design provides SSB selectivity at 3.395 MHz and CW selectivity at audio frequencies. As shown, the switching in the front end is complex, but the manufacturer has simplified the process by the use of diode switching techniques. Rf and af gain controls have been omitted, since they occur in the same points of the circuit as in Fig. 1. Notice that this circuit uses fixed adjustments in its filter circuits, thus providing less flexibility than the receiver of Fig. 1 (a much higher-priced receiver). For the home designer, there is often a trade-off until considerable experience is obtained. Simplicity of design with less flexibility is often the price of successful design and construction. With care, however, one can design a simpler unit both electronically and mechanically so that circuit refinements and additional features can be added later. If you have this in mind, special planning will be needed in the circuit selection and layout (both mechanical and circuit) phases of your design work.

equipment you want to build. Clear thinking here will save many a headache later on.

Blocking Out Circuitry By Stages

Because many equipment articles begin with a schematic diagram of the unit, we can easily be tempted to make a mistake at this point. It seems natural to leap from our objectives into trying to find circuits which will achieve them. We quickly get lost in the maze of bypass capacitors, coil winding instructions, and coupling methods; our objectives soon take a backseat to the intricacies of components. As a result, when we do get the equipment working (if we get it working), it does not do what we hoped it would.

To avoid this problem, we need to put a step between our objectives list and our individual circuits. We need to *block out* the circuitry which will achieve these objectives.

But first, let's make another set of lists. There will be two, one for the electronic functions and the other for the mechanical functions. As you will readily see, these two lists will overlap in a number of places, and that is important, too.

On the electronics list, you should enter all of the functions you can think of that go into the unit you wish to build. Some of them will be taken from your objectives list and others will come from your knowledge of what goes into a unit like the one you have in mind. Here, handbooks and articles can help. For example, suppose you want to build an HF receiver. Most such receivers will have the following stages: an rf amplifier, a mixer and heterodyne oscillator, another mixer and vfo, SSB and CW filters, i-f amplifiers, a detector, audio amplifiers, agc, and methods of tuning, adjusting gain, switching bands, and metering signal strength. This is your starting list.

On the mechanical list, you should enter all of the mechanical functions that are part of a piece of equipment. This includes variable controls, switches, and tuning devices, as well as plugs, jacks, cables, and other appendages. For the HF receiver referred to above, we will need a tuning mechanism and dial, rf and af gain controls, an on-off switch, a fuse, a line cord, an antenna jack, a speaker jack, a phone jack, an agc on-off switch, and a band switch. Like the first list, this is only a starter.

The next step is to make a diagram of what is on your lists. The block diagram of these lists will differ somewhat from those block diagrams that appear in equipment articles; they are designed to show only the functions which the author thinks are important. The one made from your lists is for design, so it must include both electronic and mechanical blocks. The easiest way to accomplish this is to choose different shaped blocks for electronic stages and mechanical stages—say a square for one and a circle for the other. (It does not matter whether professional diagrams use this method. As long as a diagram makes something clear to you, it is a good one.) Notice Fig. 1. It sums up the entries on our list so far.

Ah, but notice Fig. 2! It also sums up the entries. The point is that there are always going to be alternative ways to accomplish your objectives. Just as your reading and your conversations with other hams gave you alternatives for your objectives, so, too, your reading will show you different ways to accomplish your selected objectives, and so will manufacturers. Drake uses the premixing system in Fig. 1; Heath uses the system of Fig. 2. Which, if either, will you use? Notice the complex switching system common to both; that is hard to build and may lead to alignment difficulties. Fig. 3 shows still another alternative: separate converters for each band. Although

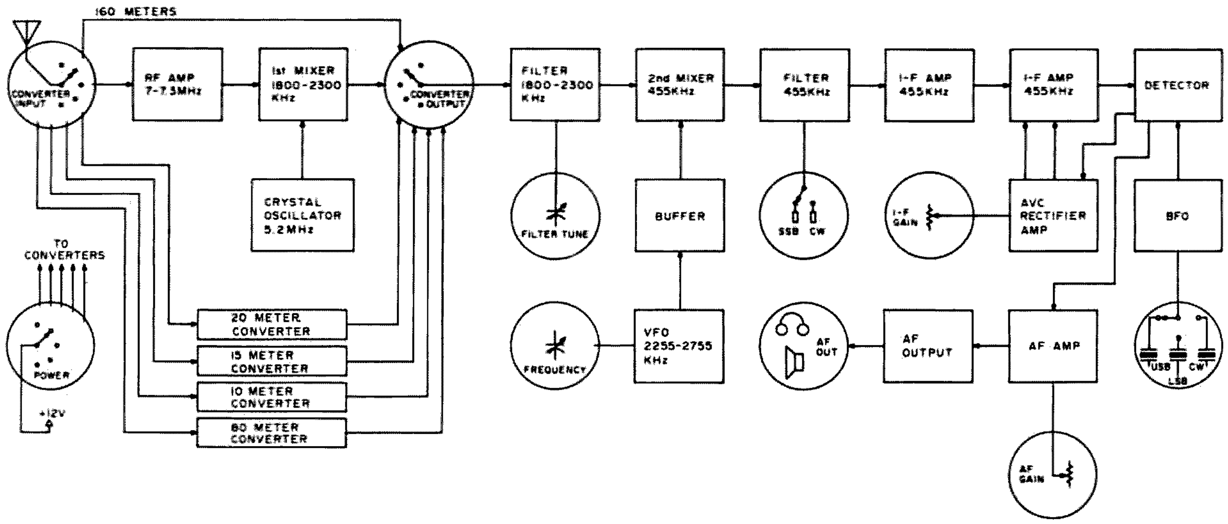

Fig. 3. This shows a third block diagram of a receiver design, this one based on a receiver in the 1978 ARRL Handbook. *The design uses a common conversion scheme, although in the past, many receivers omitted 160 meters and designed the basic receiver around 80 meters. Some of the design strategies are aimed at the home builder. Notice the use of separate converters for each band, which simplifies switching and permits optimizing performance for each band. The use of a 455-kHz i-f allows the use of easily obtainable components, such as the filters. With proper selection of circuits, one might add other operating aids, such as an ultra-sharp audio frequency CW filter. Combining ideas from all three design philosophies, as well as others, can produce as simple or complex a receiver as one wants or needs; the point is to design to your objectives and within your construction skills.*

this may mean a few more parts and active devices, the switching is so much easier that the increase in size may be worth it. And it does make home construction easier, especially for the beginning designer.

The block diagram, therefore, is a good decision-making aid. By exploring the alternatives in block form, we can make basic decisions about what means we will use to accomplish our objectives. At the same time, we also can think through a number of important questions, such as what circuitry schemes will be the easiest to produce with the methods I have of building and with the test equipment I have or will have?

It is not necessary to make final decisions at this point. Having two or three alternative block diagrams will not hurt as you move to the next stage, as long as you remember the overall objectives and as long as you keep in mind that you are moving toward decisions which will result in spending money. On the other hand, every decision you can make at this level will be one more out of the way at the next level. That is why making lists and notes next to your diagrams is so important; they help you keep your place.

The process, as described generally and with examples, sounds a good deal more complex than it is in reality. We do part of this work in our heads whenever we read through an article that attracts us. All these procedures call for is to write on paper some of what we do in our heads. Paper-and-pencil is cheaper than burned-up or unused components. The Wright brothers are reputed to have said that they spent time with design drawing because what would work on paper would work when built. The same thought applies here. And even if we never went a stage further, think of the advantages. First, we would have spent no money, and second, we would have learned a great deal about the workings of equipment like the item we wanted to build.

Circuit Research and Selection

Now is the time for more reading and writing, for now the time has come to fill in the blocks of stage 2 with actual circuitry. Sometimes we will see an article which shows circuits that are perfect for several of the blocks in our diagram. But let's not count on it. Even if it does happen, it pays to look at several alternative articles. Comparison of circuits for each stage and function can teach us a great deal about what is going on in each circuit and about what we should expect in the way of performance and difficulties.

By now it should be clear that you are developing a fairly extensive file or notebook in the process of designing the piece of equipment you have in mind. Loose-leaf binders, spiral notebooks, or just a file folder all work well to keep your notes and plans together. And the notebook will grow as you get to the layout-planning stage and to the test stage. Keep it. Besides being a virtual textbook on the type of equipment you are designing, it also will be useful after the equipment is built. More about that later on, but for now, here's just one hint based on personal experience.

Although Xerox®-type reproductions are speedy for filling up the notebook, they are not the best planning device. Instead, draw out the circuit you are evaluating. In the process, you can think through the function of every component and the original author's rationale for choosing particular values. Understanding a piece of equipment means, ideally, understanding its overall function, understanding the function of every electronic and mechanical circuit block, and, finally, understanding the function of every component. Rarely does anyone ever reach this ideal, even for relatively simple pieces of equipment, but in our research and selection of circuits we have a perfect opportunity

to approach one part of this ideal. Thinking in this detailed way about what we see in articles and handbooks reveals all sorts of things we do not know, and that leads to reading other materials or asking questions in order to find the answers. You will be surprised how quickly you learn to figure things out for yourself and how much easier the Advanced and Extra class tests become after practicing this for a while.

Research into circuits is not just reading, but reading with specific questions in mind. Here are some useful starters.

1. What drive level is required for this circuit? Does it require driving voltage only, or driving power? The answer to this question often will determine what the circuit for the preceding stage must be like. Of course, most low-level tube and FET circuits require only driving voltage, whereas power stages and most transistor circuits require that both voltage and current be supplied to the signal input of the stage. Except for rf power amplifiers, however, articles and their associated schematic diagrams rarely give anything more than the signal voltages at certain points in the circuit (if they give anything at all). So you may have to do some additional reading in order to make good educated guesses.

2. What device is used in the circuit? The type of device—e.g., MOSFET, JFET, transistor, tube, etc.—tells us much about other circuit requirements such as drive, output, power-supply voltages, possible operational and adjustment difficulties, and cost. For example, we quickly learn to think in terms of 12 volts and careful handling while soldering for MOSFETs, ±15 volts for op amps, and possible spurious oscillations and extra bypassing for power transistor circuits. Knowing what device the author used can also tell us about expense, our ability to substitute more readily available devices, and the ease with which we can reproduce the circuit.

3. What voltages are needed for biasing, and what current levels are required for each bias point? The answers to this question, considering the entire block diagram of the equipment, tell us the total power requirements and hence what will have to be in the power supply. Holding down the number of different voltages needed by the entire unit simplifies power supply design and, in turn, helps us make decisions as to what circuits we ought to use. Here we have to compromise between the best circuits for the job and the complexity of power needs. Biasing requirements also tell us much about what we may need in the way of filtering and regulation.

4. What output level will the circuit provide? Again, the level may be specified in terms of either voltage or power, and we may have to reinterpret what is given, depending upon what the next stage requires.

5. What are the input and output impedances? For many circuits, just the notation "high" or "low" may suffice; for others, careful matching is a must. Reading the text accompanying the schematic can often provide much of this information.

6. Are there any specialized components in the circuit? *Specialized* components may be a relative term. Toroid inductors are special for some builders, natural for others. Crystal or mechanical filters may be thought of as specialized in the sense that they will be a major expense. Evaluate the circuit in terms of the accessibility or affordability of specialized components: Can you find and afford the components, or can you substitute something more accessible?

7. How rigidly are components specified? Be sure to note components specified as to type as well as value; it may make the difference between a circuit that operates as in the original and one that fails. For example, builders of vfos often specify polystyrene capacitors for the feedback voltage divider, as these capacitors have excellent temperature stability. Those who use toroids in power amplifiers, especially in solid-state designs, may be depending on the "self-shielding" property of the toroid in order to build the unit compactly; another builder may only have used them because they were on hand, without really needing them. In short, evaluate the types as well as the values of components given.

8. Are buffer or isolation stages associated with a given circuit? If they are, do not omit them without first examining their function and necessity. Transistors and resistors are generally cheap, and an additional buffer stage can prevent problems of stability, especially with oscillators. Or, the buffer may provide impedance transformation. In general, design thinking has changed with the transition from tubes to transistors. Given the heat, size, and power requirements, the minimum number of tubes used to be better for the home builder. Transistors are cheap, small, low on power drain, and cool devices; thus, we have begun to think more in terms of circuit performance. Rather than operate them at maximum gain, we use combinations of transistors to ensure that a circuit operates over the needed range (of frequencies, avc voltages, or whatever) and is reliably reproducible with minimum "twiddling." Tube circuits used to employ diode-derived avc directly applied to amplifier grids. In solid-state receivers, it is not uncommon to use a diode, IC, and a 2-transistor dc amplifier. Thus, you should select a circuit because it will work in the intended function, not because it is necessarily simple in terms of the number of components. By the same token, do not choose an excessively-complex circuit for a simple piece of equipment.

These are not all the questions we can have in mind as we research circuits, but they will help us formulate others specific to the stage we are working on at the moment. It may be helpful to copy each circuit candidate in the center of a single sheet of paper in your notebook. Then you can use the surrounding space for notes taken either from the source of the schematic or from your thinking on how this circuit will interact with others. Fig. 4 shows a sample page from one of my notebooks. I like to ask my questions in the margins and then write down answers as I find them, even if I find the answer after I have tried to build the circuit. Although I rejected this circuit, it proved helpful in designing the amplifier I did build. On pages of schematics which entered into the final design, I also list (in circles) test values of voltages, rf and dc, as well as current drawn.

The process of research is also the process of selection. Circuits that are too uncertain in repeatability or for which components are too expensive or hard to get find their way naturally into the reject pile. You may get specific ideas, e.g., on biasing or bypassing, from one of the rejects, but the page ends up in the back of the notebook. That's right, in the back of

the notebook, not in the wastebasket. You never know when a new project will make a reject into just the right circuit.

With this reduced number of circuits—no more than two or three for each stage, and often only one—the final selection takes place. But not quite yet.

Questions:
1. Would a JFET or MOSFET be stabler and easier to use?
(probably easier to use with changes in circuit values)
2. How can switching of tuned circuits be avoided?
(use mixer with xtal oscillator and 5-MHz vfo—see next two pages)
3. Will surplus—e.g., 2N2222 or 2N4124—work as well as the HEPs?
(probably)
4. Note problem of keying with a CW transmitter.
(need a keying transistor a la ZOI or use a keyed mixer with 5-MHz vfo)

Notes:
1. Circuit is high-C Colpitts.
2. Switching occurs outside of tuned circuits to minimize mechanical instabilities.
3. Feedback taken from emitter of HEP55 by tapping above emitter resistor.
4. Ferrite beads and 100-Ohm resistor in HEP55 leads suppress harmonics.
5. 1k resistor in base lead of HEP758 provides loose coupling.
6. Tuned circuit with step-down winding follows .001 uF to amplifier input.,
7. No dc or rf voltages are given.

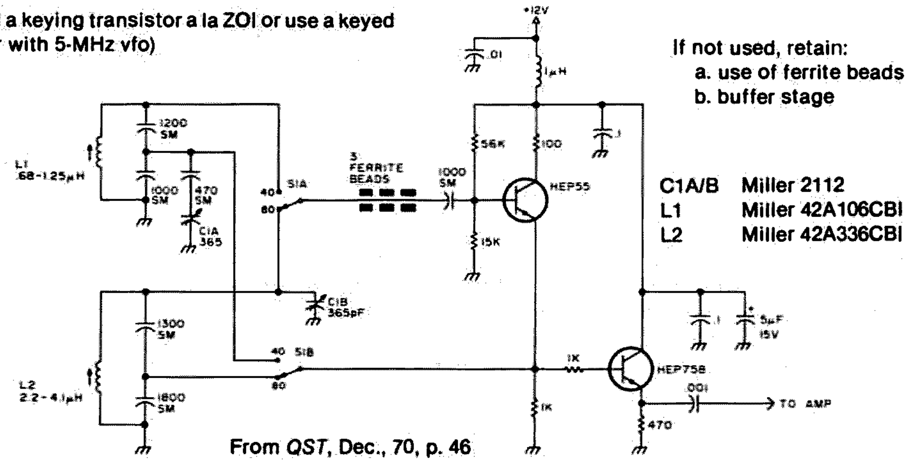

Fig. 4. Sample page from one of the author's notebooks illustrating the method of copying circuits for possible use. The vfo circuit with its buffer stage was not finally used, but much was learned from working with the circuit and the article from which it came. Notice the questions and notes which surround the schematic. Only a few have been included from the original in order to preserve clarity. Answers inserted later have been put in parentheses. This was one of eight pages devoted to vfos alone before selection of the final circuit was made.

Circuit Interaction: Drive, Matching, and Switching

Before we can make a final selection of circuits to go into our equipment, we must evaluate their interaction in at least three main areas: drive levels, impedance matching, and switching. Other interactions will emerge later in the design process, but, for now, these will give you some idea of the process of translating your detailed thinking on individual circuits back into thinking about the organized functioning of the entire piece of equipment.

The reason drive levels were recorded for individual circuits is that each stage must supply signals to some other stage. The exception, of course, is the oscillator. Every other stage will be a mixer, amplifier, or other type of signal processor (e.g., IC divider or latch). In general, we want the drive levels neither too low nor too high. If the drive level is too low, we may need to go to higher gain devices or circuits (especially with tubes) or add another stage (especially with solid state). Drive levels that are too high can be equally troublesome and may even take out the base of a transistor or the gate of an FET. Matching levels for the two inputs to a mixer is also important; sometimes, depending upon circuit arrangement, having the same level at both inputs may be exactly wrong. Thus, the designer must think about getting the right levels. Using transformers, capacitive dividers, or lower stage gain are three handy ways to reduce drive levels.

The digital equivalent to drive is called fanout. For most digital devices, fanout, or the number of stage devices driven by an output, is not a great problem. That does not mean that ICs present no problems, just different ones. If our unit combines different types of ICs—e.g., TTL, CMOS, etc.—we must be sure that the output(s) of one IC is(are) compatible with the inputs of others. Data sheets are often helpful here. Since TTLs are still the main type available for ham use, data sheets for other types specify whether or not they are TTL-compatible. Two other digital interaction questions are these: Is the speed of the devices sufficient for this application? (There are high-speed as well as low-current alternatives to most "regular" TTL ICs.) Will the timing sequence of events create false or irregular operation of any later stage? In short, digital circuitry has analogies with the interaction questions we pose to rf circuitry.

Impedance matching is especially significant with transistors, but does not disappear as a consideration with high-impedance devices. Even tubes and FETs require step-up transformers for linking devices to low-impedance antenna lines. Crystal and mechanical filters usually are critical in matching, whether to tubes or transistors. Transistors have moderate impedances in low-power circuits: Their input and output impedances are high compared with the usual 50-Ohm antenna line, but low compared with corresponding tube or FET values. Thus, when combining circuits from earlier research, one cannot assume that a given rf transformer or coil with link coupling will work with a subsequent circuit when fed a different source. Handbooks can help you estimate values by referring you to tube/transistor charts or to coil-winding formulas. The problem becomes more critical with higher-power transistor stages, since impedances may be exceedingly low. Modern design leans toward the use of baluns, but even the ratio of these must be chosen with care.

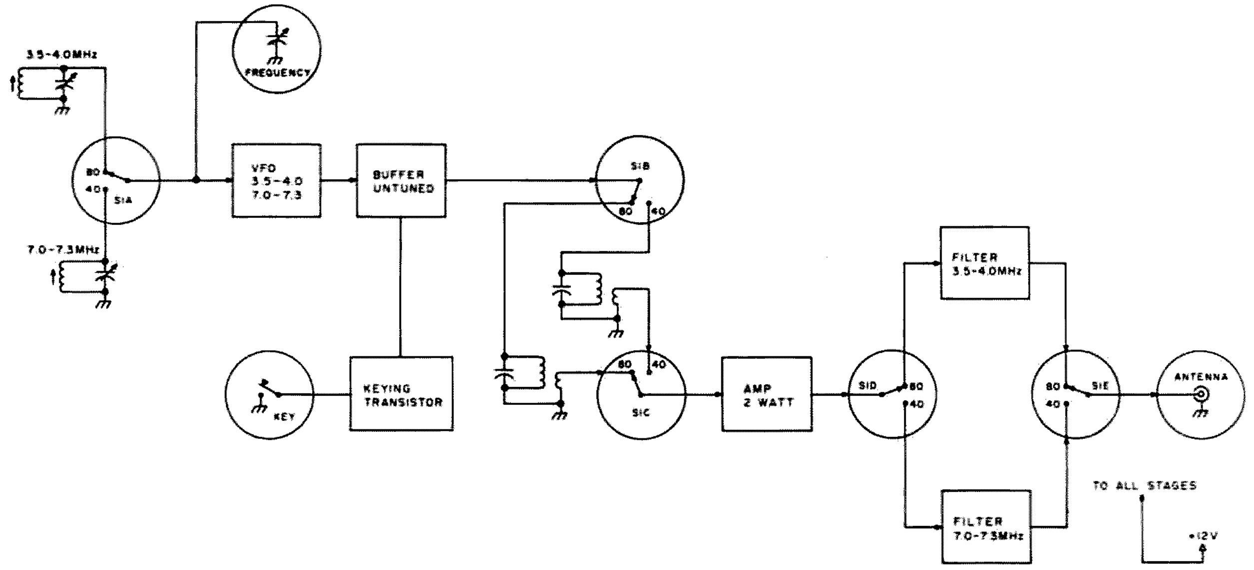

Fig. 5(a). Simplified block diagram of a low-power, two-band transmitter of relatively standard design. Notice that a five-section switch would be required in order to permit switching between bands if the designer's aim is to minimize the number of active devices. Among other considerations for the builder are these: 1. Will switching the tuned circuits in the vfo degrade dial calibration? 2. Can the vfo be keyed without chirp or will the vfo have to run during the entire transmit period? 3. How much will complex switching cost in parts compared to the cost of additional active devices? Compare this diagram with Fig. 5(b).

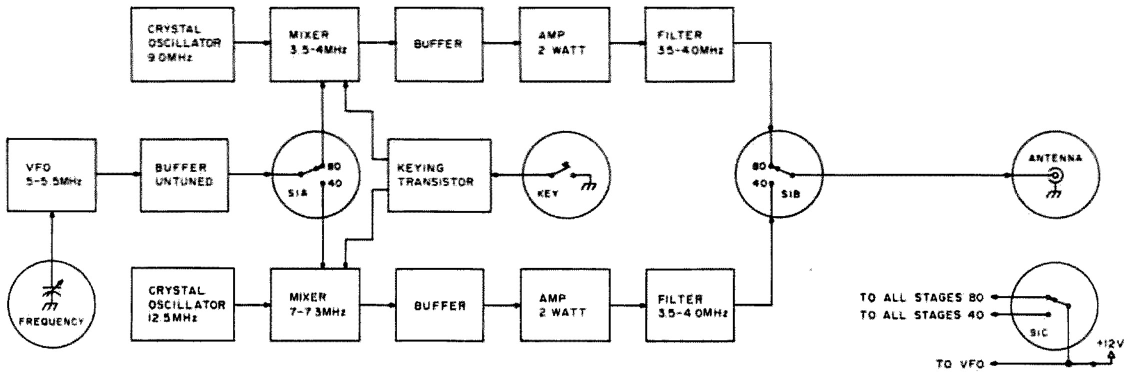

Fig. 5(b). Simplified block diagram of a low-power transmitter performing similarly to the one shown in Fig. 5(a). Separate crystal oscillator-mixer-amplifier chains are run for each band, permitting each circuit to be optimized and simplifying switching. No additional tuned circuits are required over 5(a), only active devices. The cost of the devices is more than offset by the savings on switching. Switching is done at low impedance. Since the vfo operates on a frequency outside the ham bands, break-in keying is possible. Building each band assembly on a separate board provides easier construction with fewer possible problems. The only additional design complexity lies in the need for a mixer for each band. Note that the three major questions raised in Fig. 5(a) are answered by this design.

Switching is not just a mechanical means for changing components in a circuit. Care must be given to what sort of energy is in the switching circuit and how it will interact with other energies in the same or nearby circuits. In general, it is best to switch only dc. If rf must be switched, low-impedance lines should be used to and from the switch. Wherever possible, avoid switching high-impedance rf, especially in oscillators. Not only will the switch introduce mechanical instabilities, but the length of the lines introduces unwanted capacitances. These lines supplement capacitances ordinarily used in fixed components and can produce undesirable coupling to other circuits; an oscillating amplifier is often the result. Where such switching must take place—in a high-power tube amplifier for the HF region, for example—shielding is the main answer, as well as careful routing of rf leads. With transistors at low power, it is often easier and cheaper to build separate circuits for each band. This permits low-impedance switching at only the input and output circuits, along with power. Figs. 5(a) and 5(b) make the difference clear in the simplified drawing of a transmitter design for QRP.

The interaction considerations given here should be enough to let you make the final selection of circuits. If two circuits seem of equal value to you, a simple coin flip will settle the matter of where to start. Remember, you can always change your mind again later in the process. The building part of the process has not yet begun. ■

Down with Interpolation

—a digital display for the Triton and others

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Irmo SC 29063

Although designed for a Ten-Tec 540 or Triton, this readout should be easy to adapt to other transceivers using similar conversion systems. It is a very small unit that sits unobtrusively on the transceiver, costs little, is easy to build, and measures only 5 1/4" × 3 1/8" × 1 1/8" (13.3 × 7.9 × 2.9 cm). With seven ICs, six transistors, four display LEDs, and one voltage regulator, the

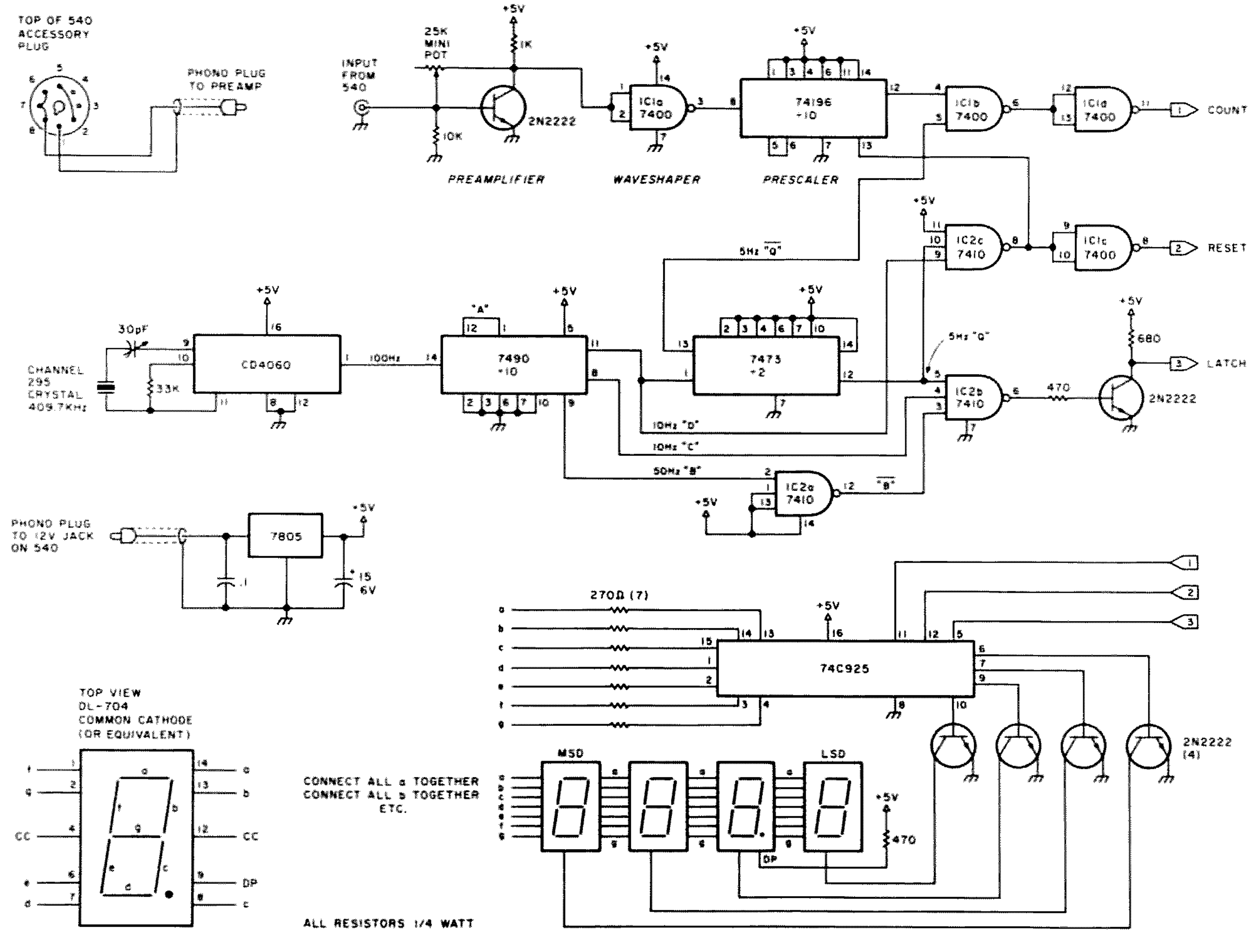

Fig. 1. Readout schematic.

parts cost is less than $20.

The 540 is single conversion, and its vfo operates from 5 to 5.5 MHz on all bands. Vfo output is mixed with signals from a crystal oscillator, with crystals for each band, to produce mixer injection frequencies between 5 and 21 MHz for conversion of incoming signals to 9 MHz. The display reads the mixer injection frequency down to hundreds of Hertz.

Megahertz are not displayed; this would necessitate a complicated switching and diode presetting arrangement and is neither worth it nor needed. As it is, no switching at all is required. Incidentally, the Ten-Tec 544 digital dial also reads the mixer injection frequency, and additional wafers are incorporated in the bandswitch to provide a megahertz display.

Integrated Circuits

Two of the seven ICs serve to eliminate an additional fifteen or more, if conventional TTL circuits were to be used. The CMOS CD4060, plus a 7490, a 7473, and a few gates provide the time base and logic circuits. The 4060 oscillates well with FT-241 surplus crystals, available from Jan Crystals.

Crystal frequency is 409.6 kHz, but a channel 295 at 409.7 kHz will do nicely; the frequency is easily pulled to 409.6 kHz with the 30-pF series trimmer in the crystal circuit. The 4060 can divide by 2^4 through 2^{14} (except 2^{11}). In this oscillator, the crystal frequency is divided by 2^{12}, or 4096, to provide an output of 100 Hz at pin 1. How much simpler this is than a long string of divide-by-ten TTLs!

The 100 Hz is fed to a 7490 to be further divided for outputs of 50 and 10 Hz. The 7473 divides the 10

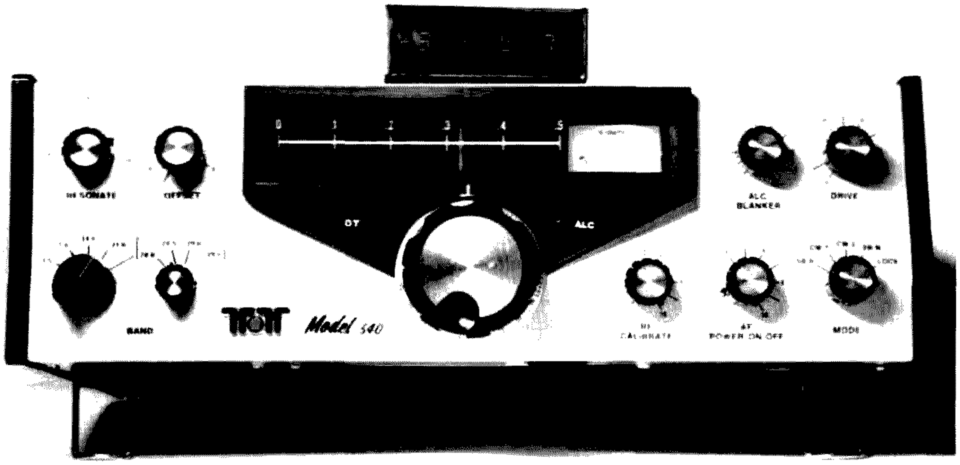

Photo A.

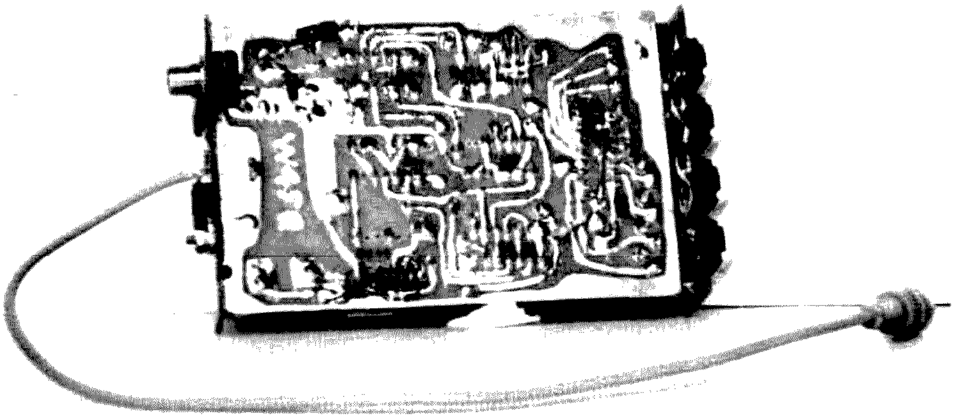

Photo B.

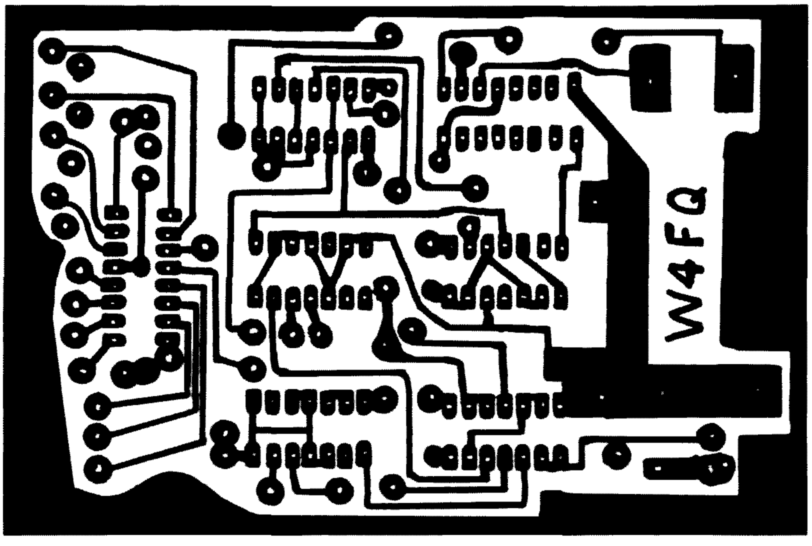

Fig. 2. Circuit board.

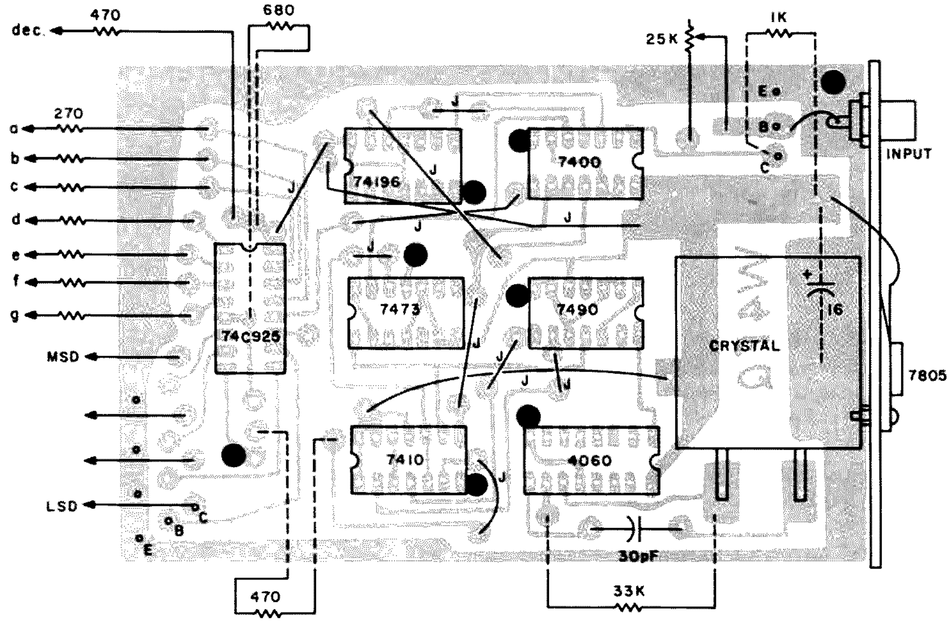

Fig. 3. Parts placement—ground plane side. A ● indicates a connection from etched side to ground plane. There are eight ground connections and 12 jumper wires. Components with dashed leads are mounted on etched side. For brighter display, use 150 Ohms in place of 270. These crystal frequencies may be used: 409.6 kHz with output from pin 1 of 4060, 819.2 kHz from pin 2, and 1638.4 kHz from pin 3.

Hz by 2 and by referring to Fig. 1, you can see we have outputs of 50, 10, 10, 5 and 5 Hz (some inverted) now available for the logic gates for count, reset, and latch pulses.

Gerd Schrick WB8IFM, in his "Universal Digital Readout" in the December, 1978, issue of *Ham Radio*, makes use of the 4060, as does Klaas Spaargaren PA0KSB in his "Drift Correction Circuit" in the December, 1977, issue.

Philip Rand W1DBM's fine article entitled "A Versatile Digital Frequency Display" in *QST* for November, 1977, is the source for part of the time base and logic circuits used here. For easy-to-understand information on logic, read this article. His waveform chart applies here also, except that the negative-going reset pulse must be inverted, as the 74C925 requires positive-going reset and latch. I use a 2N2222 as an inverter rather than another IC with only one section utilized.

John Wolcott W4CCX and Johnny Chestnut WA4PIN use the 74C925 in their "Lunch Counter," described in *73 Magazine* for December, 1978, and that is where I became acquainted with this labor- and parts-saving chip. It contains the equivalent of counters, latches, and decoders for four displays, also internal multiplexing with a free-running oscillator, and four outputs for common-cathode display LEDs.

A 74196 prescaler lowers the 5-to-21 MHz input frequencies from the 540 for the readout to 500 to 2100 kHz for input to the 74C925. The 2N2222 preamplifier has a 25k-Ohm minipot for adjusting bias and the operating point of the 7400 waveshaper. This adjustment is somewhat critical at 21 MHz. If desired, the pot can be replaced by a fixed resistor once the correct value has been determined. Be sure the pot is connected as shown, and not directly to plus 5 volts. A 2N3904 can be used here and throughout as a substitute for the 2N2222s.

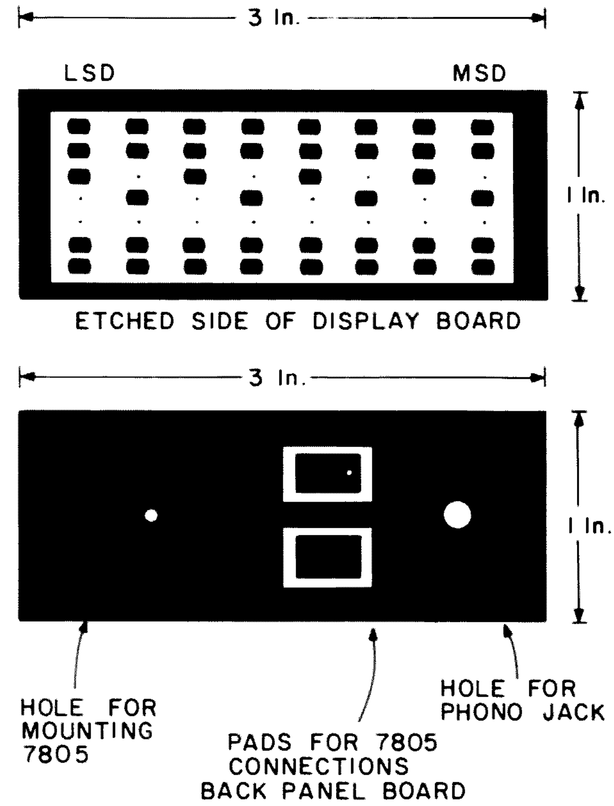

Fig. 4. Display and back panel boards.

Construction Notes

I used double-sided PC board, with the holes for the IC sockets and jumpers reamed slightly on the ground plane side to remove copper which could short pins to ground. Grounds on the etched side were wired through to the gp side. Laundry marking pens make good resist lines for the etched circuit; if you use these, buy two (at 60¢ from K-Mart). If the point dries, it probably will be tomorrow before the ink flows freely again, so keep it capped every second that it is not in use.

A damp rag and kitchen cleanser (Ajax, Comet, etc.) will clean the copper PC board before etching, and will remove the resist after. Ferric chloride is an easy-to-use etchant and takes about 30 minutes. The 1" x 3" board for the display is spaced about ¼" from the circuit board to allow room for wiring, and is fixed in place by soldering

scraps of PC board at each end. A press-fitted enclosure made from PC board and covered with black contact paper is used here to give the unit a finished appearance. A red transparent window is cemented in place, through which the display is viewed. Shielding does not seem to be necessary, so the enclosure can be made of just about anything.

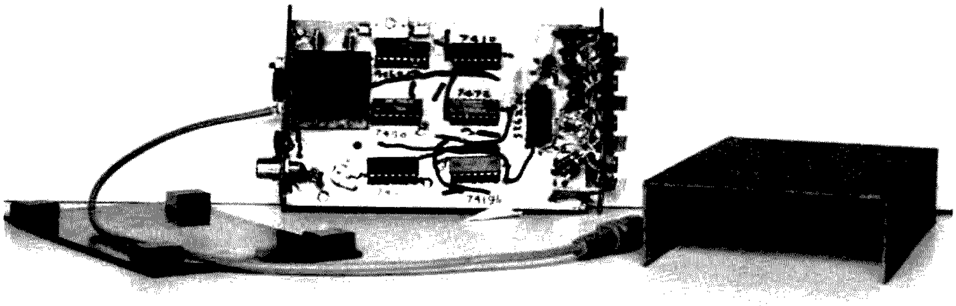

Photo C.

Checkout

When the readout has been assembled, and without ICs in their sockets, check for solder bridges between pins. Almost certainly there will be some; use an ohmmeter—don't depend on your eyes. With the ICs in their sockets and power applied but with no input to the preamplifier, the display should read 000.0 or 000.1. If not, check these pins for fast needle fluctuations on a voltmeter set for 5 volts or more: 7490, pins 5 and 12; 7473, pins 12 and 13; 7410, pins 6, 8 and 12; 74C925, pins 5 and 12 (with input to the preamplifier from the 540, there should also be fluctuations on pin 11). If any of these pins reads a steady voltage, the thing will not work and some checking is in order.

Hash from the readout is completely suppressed by the .1-uF and 15-uF capacitors at the input and output of the 7805 voltage regulator. No other bypassing is necessary. The unit draws 150 mA.

Calibration

Calibration is a snap. Zero beat the 540 with WWV on 15 MHz (bandswitch on 21, dial at 0, resonate between 3.5 and 7) and adjust the crystal trimmer until the display shows 000.0. That's all there is to it. ■

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Hooray! An AFSK Auto IDer!

—a clean and legal ending for RTTY transmissions

Being a RTTY enthusiast of recent vintage, the first thing I do after tearing my latest copy of *73* out of the postman's hands is to screen the issue for articles pertaining to RTTY subjects.

Joe Fox's article, "Dodge That Hurricane," in the January, 1978, issue found me comparing his crystal-controlled AFSK board with my present twin-tee circuit and its wandering space tone. Comparison led to a decision, and a few weeks later I was happily warbling away with tones accurate to a few hundredths of a Hz.

With that project completed, my next improvement was to be an automatic CW identifier to save my tortured finger from the chore of sloppily tapping out my call on the narrow shift button on the rack-mounted TU.

Looking further into Joe's article, his Baudot IDer drew my interest. Since most transmissions end with DE, a call, and KK as the last words typed, it would be convenient to have the IDer send that as well.

Gushing with confidence over the success of my new AFSK generator, the thought of marrying Joe's Baudot generator to a CW IDer thrilled me. Sitting down with schematic and pencil in hand to discover what changes would be necessary, I discovered happily that a couple of inexpensive gates, a single transistor, and a few small parts would do the job just fine.

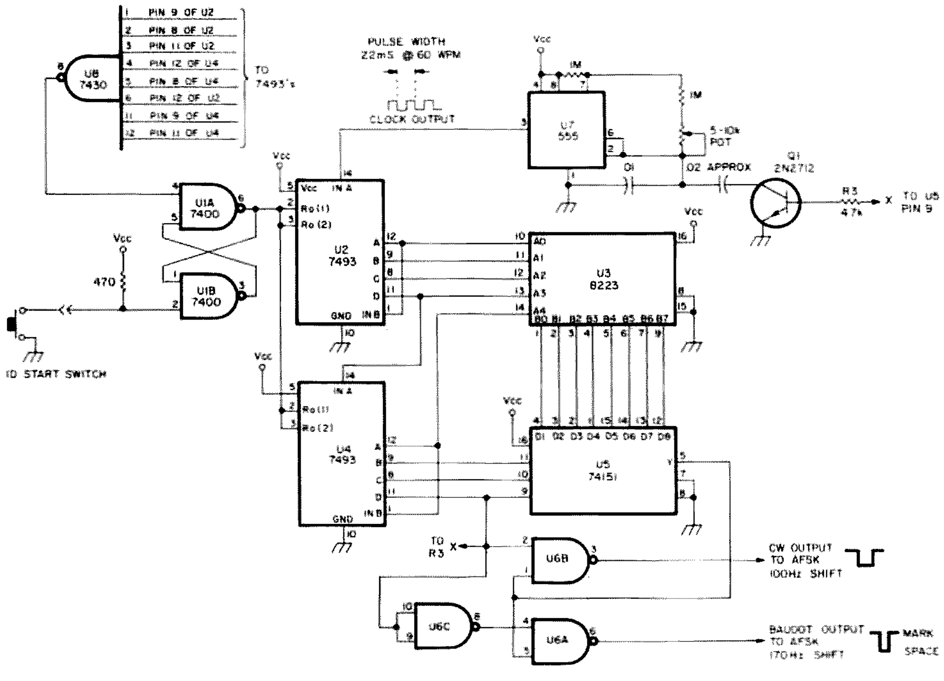

Fig. 1. Baudot-CW IDer schematic.

Theory

A review of the AFSK board revealed that TTL levels were used to sink separate input lines that picked the proper tones. This made it necessary to switch the output of the IDer from the 170 shift line to the 100 shift line midstream in the ID cycle.

Aha! Pin 9 of the data selector IC (U5) goes high halfway through the cycle. This line, therefore, was connected to one input of NAND gate U6B, with the

data output from pin 5, U5, to the opposite input. This routes data contained in the last 16 words of the PROM to the output pin of gate U6B. See Fig. 1.

This same line is inverted in U6C and applied to an input of U6A, whose opposite input receives data from the selector IC. This enables data in the first half of the PROM to be available at the output of U6A. These output lines are inverted data, just right to sink the inputs to the AFSK.

Our dual output problem being solved, attention is paid now to turning the circuit on and off. Neither Joe's use of a timer to periodically start the cycle nor his inhibit circuitry to delay the ID until the completion of incoming traffic was needed, so ICs U1 and U6 on his design were replaced by two NAND gates, U1A and U1B. These are wired in an RS latch configuration, the output connected to the reset input on counters U2 and U4.

With the latch reset, the output is high and holds the counters at zero. By grounding pin 2 of U1B, the latch is set and the output goes low, allowing the clock to step the counters, addressing the PROM and data selector IC.

The 8-input NAND gate, U8, whose inputs monitor all the address lines, senses when the counters are full. When all address lines are high, the output of U8 goes low and resets the latch, completing the cycle.

Checkout of the unit at this point provided perfect RTTY ID, but the CW came forth at blazing speed. A way to reduce the CW speed was deemed necessary. Back to the drawing board.

The only way to slow down the CW speed is to decrease the clock speed. Looking again at pin 9 of U5, this level, high during the last half of the cycle, is used to turn on Q1. This simply switches in additional capacitance across the clock timing circuit just for the duration of the CW ID. Eureka! Slow CW! The value of this capacitance can be selected to produce the speed desired.

Construction

Considering the blood, sweat, and tears that went into the production of the printed circuit board for the AFSK, I conceded that I was not yet ready for the second round, so the ID board was wire-wrapped on a piece of perfboard with an edge connector attached. This system proved convenient in troubleshooting a few gremlins that showed up in the form of a bad counter IC and a mislabeled IC pin on the original schematic.

Parts placement is not critical, but be sure to scatter a few .1-uF disc capacitors around to soak up the spikes. My layout is shown in Fig. 2.

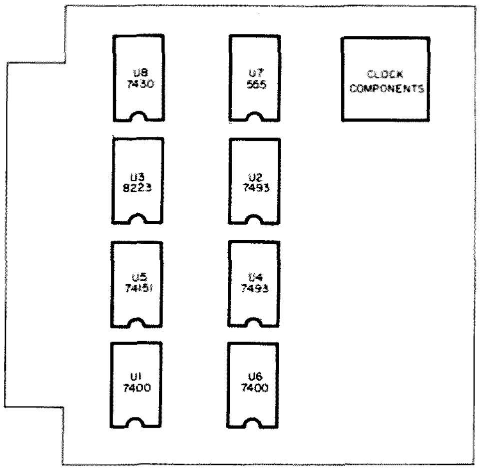

Fig. 2. Suggested component layout.

The PROM

The 8223 or 82S23 is a 256-bit programmable read-only memory. The PROM outputs 32 words of 8 bits each.

In laying out the program for your PROM, a truth table (Fig. 3) should be prepared. This type of device is the fusable-link type where once a bit is programmed, it is irreversible. The truth table will reduce the chance of a misplaced bit. The device is delivered with all memory locations low, and when a bit is "burned" into it, that bit will appear as a logic high output. In our IDer, the low is used as a mark with the high levels indicating a space and CW output.

The IDer described here scans the entire contents of the PROM one bit at a time, starting with output 0. For the first 31 clock cycles, the 74151 data selector selects the PROM output at output 0 and transfers this data inverted to output pin 5. At the 32nd count, the data selector is instructed to select data from the output 1 output. For the following 31 cycles, all output 1 data is transferred to the output, then on to output 2. This sequence continues until all bits of each address are scanned. When the counters are full, the count is sensed by gate U8, and its output pulse resets latch U1, which completes the ID cycle.

Programming the PROM

The first 4 outputs contain the Baudot information, with each character and function occupying 8 bits of data. The first bit, the start pulse, is always a space. Note that PROM address 0 contains all mark levels with the start pulses beginning at address 1; this is necessary to ensure no output from the IDer while being held at zero by the latch.

PROM Address

OUTPUTS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
					space								ltrs								D								E			
0	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M
					space								K								figs								3			
1	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M
					ltrs								I								J								space			
2	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M
					K								K								c/r								l/f			
3	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M	M	S	-	-	-	-	-	M
4						S	S	S		S		S				S							S	S	S		S		S	S	S	
5			S		S		S		S	S	S		S	S	S				S		S				S		S	S	S		S	S
6	S		S	S	S																											
7																																

Fig. 3. PROM Truth Table. M = logic 0, S = logic 1. Unmarked positions in CW portion of program remain marks. Fill in dashed data from RTTY character table.

Following the start pulse are the 5 Baudot-coded bits, and then 2 stop pulses (which are always marks). A total of 16 characters can be programmed—enough for a typical message to read, ltrs, d, e, a two-by-three call with shift functions, space, and K, followed by CR and LF functions.

The remaining 4 outputs contain the CW program using the standard bit-usage of 1 bit for a dot, 3 bits as a dash, 3 bits between letters, and 6 bits between words.

The device I used to program the PROM is described in the article "A Simple PROM Burner," by William Hosking W7JSW, in the December, 1977, *73*. A word of caution, however. The PROM I used was purchased from Quest Electronics, an advertiser in this magazine, and was marked as an 8223. I was unable to get it to accept a program—a problem described in Mr. Hosking's article. Using his advice, the programmer was changed to 82S23 type. The device then accepted the program easily, regardless of its marking.

Operation

For operation, the board needs to be supplied only +5 V, ground, the outputs connected to the AFSK generator, and a push-button switch to momentarily ground pin 2 of U1. The IDer will do the rest.

The clock oscillator must be set to the Baudot frequency used, 22 ms for 60 wpm, 18 ms for 75 wpm, or 11 ms for 100 wpm.

My thanks to Joseph Fox WB4IXK for his excellent article—which inspired me to write this piece for *73*. ■

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Let's QSY to .52

—ah, technology

"So you've got that new two-meter rig you wanted, huh, Joe?"

"That's right, Ernie. A fantastic rig. Fully synthesized, too. Lets you go anywhere you want on the band."

"Fine business, Joe. Hey, let's not tie up the repeater with this QSO. Since you're synthesized, let's go to a simplex channel. What do you say?"

"Right, Ernie. Okay, let's try 146.52. How about that?"

"Well, Joe, they like to keep .52 clear for calling. They get kinda annoyed if you rag chew on .52."

"Yeah, that's right. Okay, how about 146.55?"

"Not a bad idea, Joe, but lately they've been using .55 for RTTY. We could talk on .58, I guess."

"Uh-uh, Ernie. I was just on it a moment ago and there's a bunny hunt about to start on it."

"Yeah, yeah. Say, you can go off on a 5-kHz offset, can't you?"

"Sure can, Ernie. Want to try, say, .535?"

"Naw. Just checked it a few minutes ago. Two guys are chewing the rag down there. How about .565?"

"Just checked it while you were transmitting. Someone's calling CQ DX on it. Must be a band opening tonight."

"Can you go up to 147?"

"Sure can, Ernie, this Hara-kiri-400 goes anywhere. How about 147.51?"

"Sorry, Joe, that's a problem, too. .51 is our club's simplex channel. They like to keep it clear for club business—stuff like that."

"Okay, I can understand that. Let's try .54. What say?"

"Well, they've been using that for highway traffic for the east-west roads. Sort of reserved for mobiles, you know?"

"Yeah, I can see that. Well, how about .57?"

"Well, that's for north-south road traffic. How about 147.525? That should be clear, right?"

"Sorry, Ernie. The Bugville net is passing traffic on it right about now."

"Boy, things are getting tight, Joe. I'd suggest .555 but I'm afraid someone will let me know 'the frequency's in use, old man.' Say, how about going somewhere between 146.40 and 146.60. That's simplex, isn't it?"

"Hold it, Ernie. There are some repeaters in that area, operating on one meg splits. We don't want to go simplex on an input frequency. How about going below 146? That's all simplex, isn't it?"

"No, sir. They've got repeaters there, but I don't know what frequencies are involved. Also, sidebanders, CWers, and AMers are roaming around down there. Say, Joe, just got a real inspiration. Should have thought of it before."

"Well, come on. Where do we go?"

"Joe, 15 meters is dead this time of night. Let's QSY to 21.365 and we'll chew the rag down there."

"Fine business, Ernie, see you on 15. I want to tell you all about this 2-meter rig, especially the synthesizing. Just a super rig. You can go anywhere you want on that band. I'll tell you all about it—we're QSYing."■

Five Test Equipment Bargains from Heath

—the 5280 series features plenty of measuring power per dollar

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At last someone has recognized that there are a lot of electronic hobbyists who do not really want to buy big fancy pieces of test equipment for the few times they might use them. Heath has the answer with its line called the 5280 series, at an affordable price and just the ticket for those of us who are part-time test equipment users. And, best of all, no longer will it be necessary to either hunt down a friend to borrow from or visit or pay through the nose a high hourly rate for a professional to do the job for you. Each piece is just $37.95, and there are five of them in the series plus a power supply for those who prefer not to use battery power. So far, I've built the signal generator (Heath calls it an rf oscillator) model IG-5280 and the RCL bridge model IB-5281. They work just great and are extremely easy to build and to use. They also have available an audio frequency generator, a great-looking volt/ohm/mil multimeter and excellent ranges, and a signal injector.

The rf generator is very impressive to use for its low price. While not exactly precision calibrated, its inaccuracies can be very easily accommodated during use once you know what they are. The unit covers the spectrum from 310 kHz to 110 MHz on fundamentals, and it goes beyond that with harmonic output to 220 MHz. All that in five bands with adjustable output up to 100 mVrms. The unit also has its own audio oscillator with a pleasant 1000-Hz tone that can be switched to modulate the rf oscillator (a great help for identification in a band full of signals) or can be used as an audio signal generator. It, too, has a variable output of up to 2 volts rms.

The RCL bridge is something I should have had many years ago as I recall the many resistors, capacitors, and inductors that were discarded because they were unmarked. In these days of low-priced kits of assorted parts, many of them unmarked, comes a reasonably priced kit from Heath making it possible for you to know as much about the parts as the guy who made them and forgot (?) to put the size mark on them. To determine the value of an unknown resistor, capacitor, or inductor with this unit, one simply sets the selector switch for the type of item to be identified—there are several ranges for each of the categories. The item is attached to the test clips, the meter is adjusted, and the dial is slowly rotated until the needle on the meter reaches its lowest reading (null). The dial pointer will indicate the value of the formerly unknown item. The unit has three ranges for each of the three categories, i.e., 10 Ohms to 10M Ohms, 10 pF to 10 uF, and 10 uH to 10 Henries. It may also be used for exact matching of any two or more items.

Power for these kits is provided by a power supply ($24.95) or each of the units may be powered by two nine-volt "transistor-radio-type" batteries. I chose the latter and regretted it the second time I wanted to use the RCL bridge. The batteries were dead; I had neglected to turn the thing off! This prompted me to devise a very simple "power on" indicator by adding a small red LED to the front panel just above the "Power ON/OFF" switch. I drilled a hole just large enough to accommodate the LED and wired it from ground to the "ON" side of the power switch with a small current-limiting resistor in series with the positive lead. That red glow is a sure reminder, costs only a few pennies and a few moments of time, and consumes little energy.

In these days of small-sized equipment, I am not impressed with the large cabinet for these kits. They all use the same type case, but it does have a lot of convenient storage space. Don't overlook the great advantage of portability of these units when battery powered. Field days, emergencies, vacations, or work time on the mobile rig finds these units perfect, rugged, and portable. The kits build easily; the instructions are about the most extensive I have seen from Heath, or anyone else for that matter. They include many illustrations, circuit drawings (some greatly enlarged), and a very explicit discussion of exactly how the circuit works and what it does when testing parts. ■

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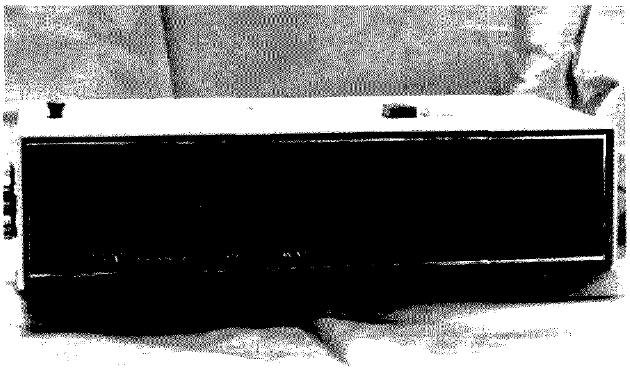
The Phoenix Fix

—an alarming analog-to-digital conversion for out-of-time clock-radios

In mythology, the Phoenix was a great bird from which, upon its death, was born a new Phoenix. How many times have you wished you could do that with electronic equipment? This article describes just such a transformation.

There can be little doubt that one of the most widely-owned pieces of consumer electronics is the clock-radio. Almost everybody has one, and many have several. Certainly one of the most common types of clock movements is the "flipping card" display, as in the pictured Sony Digimatic. In this clock, a cylinder turns and sequentially exposes cards with the digits printed on them to display the time. After a while, however, the movement becomes erratic as the motor seizes, and it eventually stops. Suggestions for re-starting a stuck clock abound, from spraying the gears with silicone to popping it in the oven. This article describes a better way.

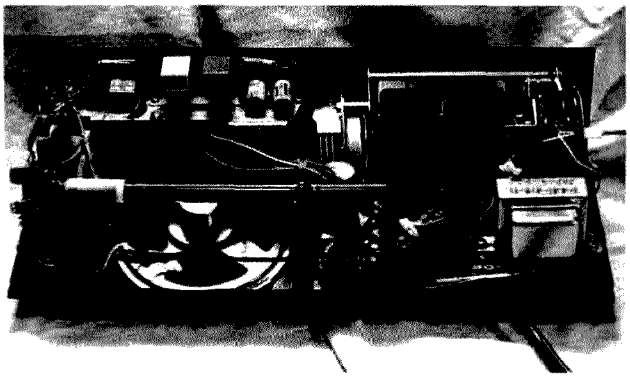


The front of the clock-radio before modification.

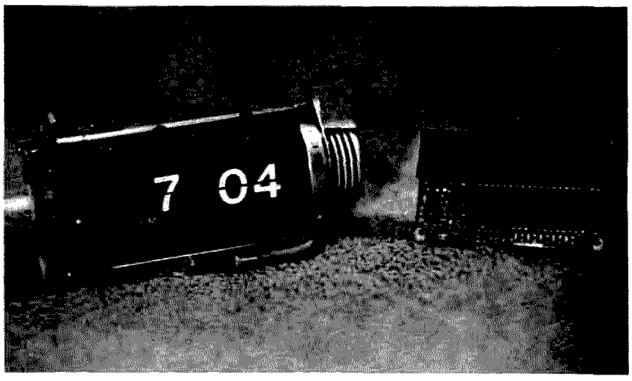
The MA1001-A digital clock module has become available lately from several suppliers and is regularly featured in their advertisements. For around $10, this module has all the features one could want in a clock-radio (time, sleep-radio, snooze-alarm, etc.) in a tiny package. With just a little work, this module, transformer and all, will fit easily into the space vacated by the old flipping card display.

Fig. 1 diagrams the connections to the module. Note the rather unusual voltage requirements, rather neatly supplied by the special transformer available from the dealers. Note also that the alarm output is not a tone, but a positive voltage intended to activate an external signaling device or tone generator. The LED display at 1.22 cm (0.5 inch) is quite readable, and no RFI is generated since direct drive rather than multiplex circuitry is employed. This eases the marriage with a radio.

The actual conversion is relatively straightforward. After removing the radio from its case, identify the microswitch connected to



An open view of the clock-radio before modification.



The old and the new side-by-side.

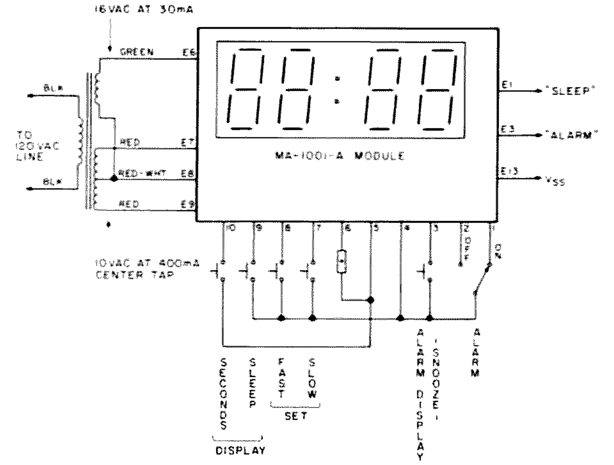


Fig. 1. MA1001-A connections. Use wire jumper at pin 6 location (*) for full brightness of LEDs, or a resistor and switch for variable brightness.

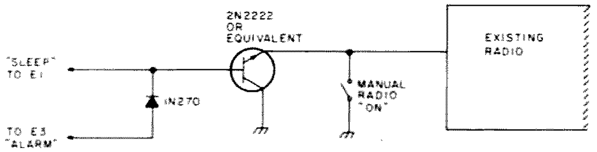


Fig. 2. Connecting MA1001-A to existing radio.

the Sleep lever. The contacts of this switch, when closed, enable the radio. If there is a separate manual radio switch, leave it alone! It will still work when the conversion is completed.

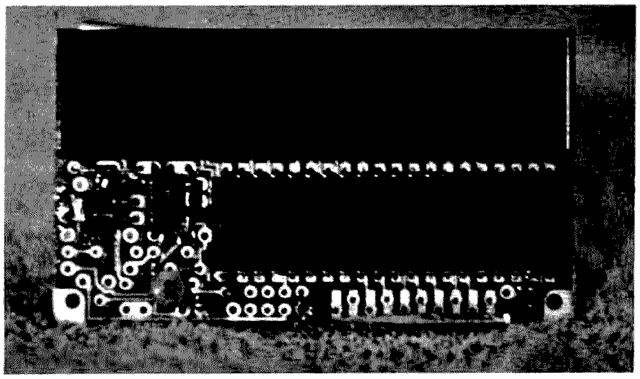
Put a tag on the enable line, remove the entire clock movement from the case, and discard it. Position the MA1001-A behind the panel opening. It was necessary to enlarge the opening in the prototype by removing a partition between the old display opening and the alarm set-wheel. Decide on a location for the six required switches and transformer. In the prototype, the two control switches (Fast and Slow) were mounted underneath to prevent accidental use, and the Sleep, Snooze, and Seconds push-buttons were mounted on the top. The old Alarm/Radio switch existing on the chassis was used to enable the alarm mode.

Interfacing between the clock module and the radio is diagrammed in Fig. 2. With this arrangement, either activation of the Sleep mode or Alarm output will enable the radio. If untimed radio activation is desired, the original manual switch retains control.

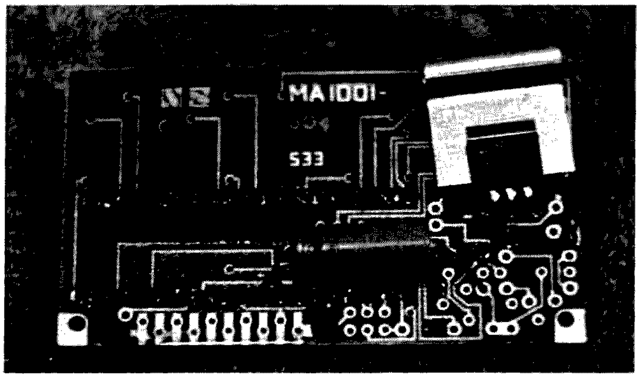
A great deal of information is available from the four-digit display. Two LED "dots" note pm (vs. am) and arming of the alarm.

Some may find this display too bright for bedside use at night. A potentiometer, resistor-and-switch, or photocell arrangement can be inserted at the indicated point to effect brightness control of the display, if desired.

By means of this conversion, a useful piece of equipment can be returned to active duty. Besides being gratifying in its own right, this is one project that even the XYL will appreciate. Who could ask for anything more? ■



A front view of the MA1001-A module.



A rear view of the MA1001-A module.

QRQ, QRS—By the Numbers!

—a digital CMOS code-speed indicator

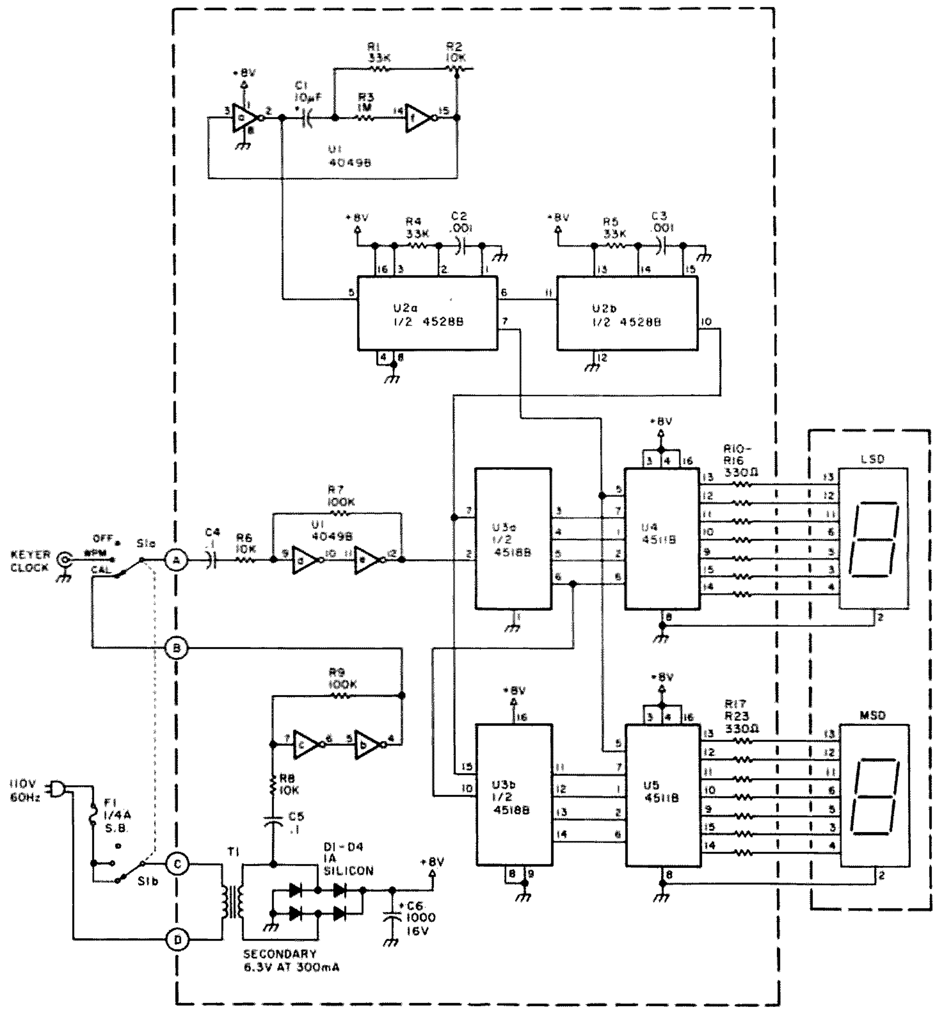


Fig. 1. Schematic diagram.

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With many electronic keyers and a wide variety of do-it-yourself circuits now available,[1,2,3] this direct-reading code-speed indicator calibrated in words per minute should find its way into a good many shacks. Whether used for code practice or on-the-air operation, now you can tell your sending speed easily at a glance. In addition, this versatile unit can be used as an accurate event counter for a range of about 5-99 counts per second.

Since the unit also has an input waveform conditioner, it has a high degree of noise immunity; the input keyer clock waveform which is counted may be sinusoidal, square, triangular, positive or negative-going pulses, or complex combinations of these, with

a peak-to-peak amplitude of from about 3½ to 20 volts. Being fully CMOS, the two 7-segment readouts are the only real contributors to current drain. But the best part is that the entire unit uses a minimum number of readily available parts, and it can easily be constructed for about $25 if all parts are purchased new.

Fig. 1 shows the complete schematic for the code-speed readout. The circuit is basically a CMOS adaptation of an earlier TTL version described by Jones,[4] but with many fewer components and a significantly smaller current requirement. For most electronic keyers which use a flip-flop dot generator,[5] the code speed in words per minute is equal to the number of keyer clock pulses which occur in 1.2 seconds. With S1 in the WPM position, the keyer clock pulses are led from your electronic keyer to J1, conditioned by U1d and U1e, and fed to U3, a dual BCD counter. Each half of U3 drives a combination latch-decoder-driver for each digit. By this process, the number of clock pulses occurring in the 1.2-second interval (f = 0.833 Hz) generated by U1a and U1f are counted and displayed. Additionally, the readout display will be updated automatically every 1.2 seconds.

U1a and U1f are configured as an astable multivibrator with a period of from 0.8 to 1.05 seconds, the period being adjustable by R2. This multivibrator has a 50% duty cycle, and its frequency is very stable with large power supply fluctuations. The multivibrator output is taken from U1a pin 2 and fed to a dual monostable multivibrator (one-shot). With each falling transition of the U2a pin 5 input, a positive-going pulse of about 20 microseconds is generated at U2a pin 6, and its complement at pin 7. When pin 7 of U2a goes low, the BCD count from both halves of U3 is latched into U4 and U5 where it is decoded into 7-segment format and displayed.

When pin 7 of U2a returns to a logic 1, pin 6 of U2a returns to a logic 0; this transition triggers U2b, and a 20-microsecond positive-going pulse resets both U3 counters to zero. As long as you continue sending, a synchronous keyer clock will continue to generate pulses and the count-latch-reset sequence of U3, U4, and U5 will update the display; when you stop sending, the keyer clock input also stops and 00 will be displayed on the readout. If your keyer has an asynchronous clock, it will continue to generate clock pulses whether you are sending or not; in this case, the speed at which the keyer is set will be continuously displayed.

C4 provides ac coupling from the keyer clock to the input conditioner R6-R7-U1d-U1e. This configuration of inverters is actually a high input impedance Schmitt trigger. The amount of hysteresis of the Schmitt trigger is determined by the ratio of R6 to R7, in this case, 10% of Vcc or about 0.8 volts.[6] See Fig. 2.

Power is furnished to the entire circuit by a conventional full-wave rectifier bridge (D1-D4) and filter capacitor C6. One side of the transformer secondary is ac coupled to a second Schmitt trigger by C5. This Schmitt trigger, R8-R9-U1b-U1c, samples the T1 secondary voltage and produces a 60-Hz square-wave output at pin 4 of U1b. With S1a in the CAL position, the 60-Hz square wave is again conditioned by U1d-U1e and then counted and displayed by U3, U4, and U5. This provides a means of calibrating the U1a-U1f oscillator to 0.833 Hz, or a period of 1.2 seconds; simply adjust R2 for a reading of 72 on the display (60 if your ac-line frequency is 50 Hz) and return S1 to the WPM position for direct calibrated readout of the keyer speed in words per minute.

The values of C1, R1, and R2 have been chosen to allow a U1a-U1f oscillation of 1.0 Hz, as well. With R2 set to display 60 on the readouts in the CAL position (50 if your ac-line frequency is 50 Hz), U3 is now being reset each second; therefore, when S1 is returned to the WPM position the readouts will display the number of input pulses per second (up to 99, directly).

The frequency-determining components R1, R2, and C1 can be adjusted as necessary to cover the range of 0.95-1.25 seconds, or other suitable intervals as desired. If your display will not read up to 72 when calibrating, increase either R1 or C1; if your display will not go down to 60, try de-

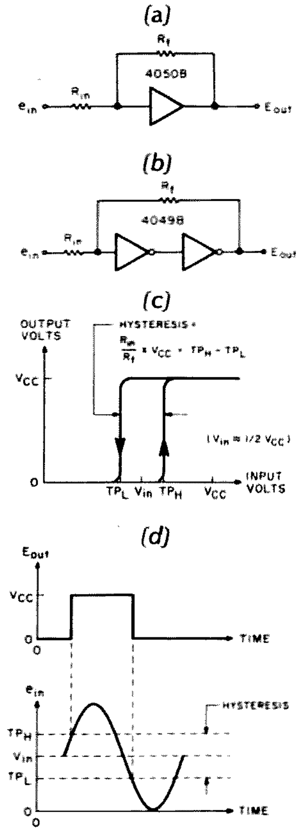

Fig. 2. CMOS Schmitt trigger characteristics. (a) Basic CMOS Schmitt trigger. (b) CMOS Schmitt trigger using inverters. (c) Schmitt trigger transfer characteristics. (d) Sinewave response.

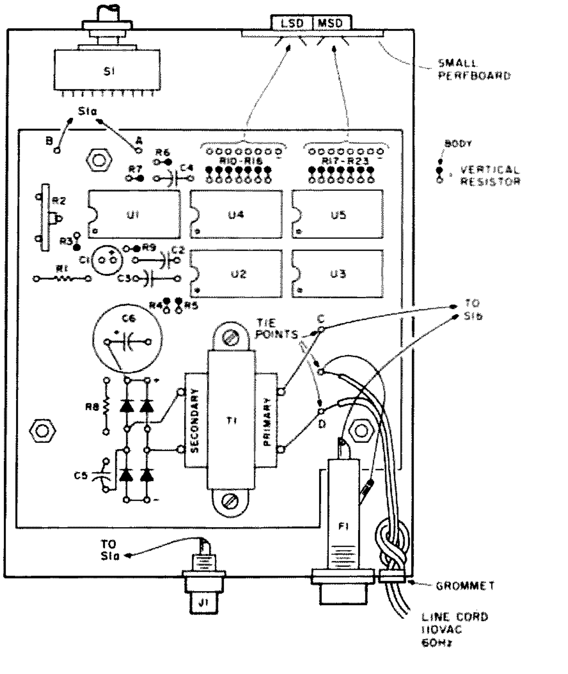

Fig. 3. Perfboard parts layout.

creasing R1 or C1 until both 60 and 72 can be displayed within the range of R2.

The entire unit, including T1, was wired on a 3¾" × 4" perfboard and installed in an Archer cabinet (see parts list). A cutout was made for the two readouts, which were temporarily held to a smaller 1¼" × 1¼" perfboard by bending the readout leads through the perfboard. Press-on dry transfer labeling was applied, and the front panel sprayed with a light coat of acrylic spray before mounting S1. The small perfboard with readouts attached was then epoxied to the inside of the front panel. The larger perfboard containing the counter was mounted on #6 bolts, 1¼" long, with three nuts under the perfboard on each bolt to provide adequate clearance from the chassis. R2 was mounted near the edge of the perfboard and a hole was drilled in the side of the cabinet to permit calibration with a small screwdriver without removing the cover. J1, an RCA phono jack, the panel-mounted fuse holder, and a rubber grommet for the line cord are mounted on the rear panel. A suggested parts layout is shown in Fig. 3.■

References

1. Howard Batie W7BBX, "A Programmable Contest Keyer," *Ham Radio*, April, 1976, p. 10.
2. James Garrett WB4VVF, "The WB4VVF Accu-Keyer," *QST*, August, 1973, p. 19.
3. S.M. Allen K4JEM, "The New, Improved 'Best Keyer Yet,'" *73*, March, 1978, p. 22.
4. William Jones W7KGZ, "A Digital Speed Readout for the Electronic Keyer," *QST*, July, 1978, p. 11.
5. *The Radio Amateur's Handbook*, 55th Edition (1978), p. 356.
6. Don Lancaster, *CMOS Cookbook*, Howard Sams & Co., Inc., 1977, p. 222.

Parts List

Component	Description	Archer Part No.	Qty.
C1	10-uF electrolytic	272-1025	1
C2, C3	.001-uF disc	272-126	1
C4, C5	0.1-uF disc	272-135	1
C6	1000-uF electrolytic	272-958	1
D1-D4	Si 1A diode	276-1101	2
F1	¼-A Slo-Blo fuse	270-1288	1
J1	RCA phono jack	274-346	1
R1, R4, R5	33k, ¼-Watt resistor	271-1341	1
R2	10k PC-mount trimmer	271-218	1
R3	1M, ¼-Watt resistor	271-1356	1
R6, R8	10k, ¼-Watt resistor	271-1335	1
R7, R9	100k, ¼-Watt resistor	271-1347	1
R10-R23	330-Ohm, ¼-Watt resistor	271-1315	3
S1	2P3T rotary switch	275-1386	1
T1	6.3-V ac/300-mA transformer	273-1384	1
U1	4049B CMOS IC	276-2449	1
U2	4528A or 4528B CMOS IC		1
U3	4518A or 4518B CMOS IC	276-2490	1
U4, U5	4511B CMOS IC	276-2447	2
	common-cathode 7-segment readout	276-062	2
Miscellaneous			
Cabinet		270-252	1
Line cord		278-1255	1
Panel-mount fuse holder		270-364	1
Perfboard		276-1394	1
#6-32 1¼" bolts			3
#6-32 ¼" bolts			2
#6 lockwashers			12
#6-32 nuts			14
Rubber grommet			1

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Adding a Scanner to Your 2m Rig

—here's a method that works with many scanner/transceiver combos

Using a scanning monitor receiver along with a two-meter transceiver will add a new dimension to your mobile or base installation. It lets you keep track of which frequencies are in use, increases the chance of getting the traffic report that you need, betters your chance of receiving a page while listening on another frequency, and permits you to eavesdrop on out-of-band transmissions such as NOAA weather broadcasts, police and fire dispatchers, etc., just to name a few.

Adding a scanner can be as simple as installing another antenna and turning it on. This has several disadvantages which become apparent very quickly—such as: having to shut off the scanner before transmitting in order to eliminate feedback, possible destruction of the scanner rf input transistor, and the additional cost of another antenna.

In this modern, push-button age, there must be a better way to accomplish our goal, and there is. By taking a systems approach to the problem, the second antenna was eliminated and the scanner is muted automatically whenever the PTT switch is activated. When the PTT switch is released, the scanner resumes normal operation.

Although this article is written with specific references to the Realistic PRO-40 scanner and Kenwood TR-7500 transceiver, the principles are described so that other combinations of equipment may be used. In fact, another system was built for a base station using a Realistic PRO-7B and Standard SRC-826MA, with excellent results.

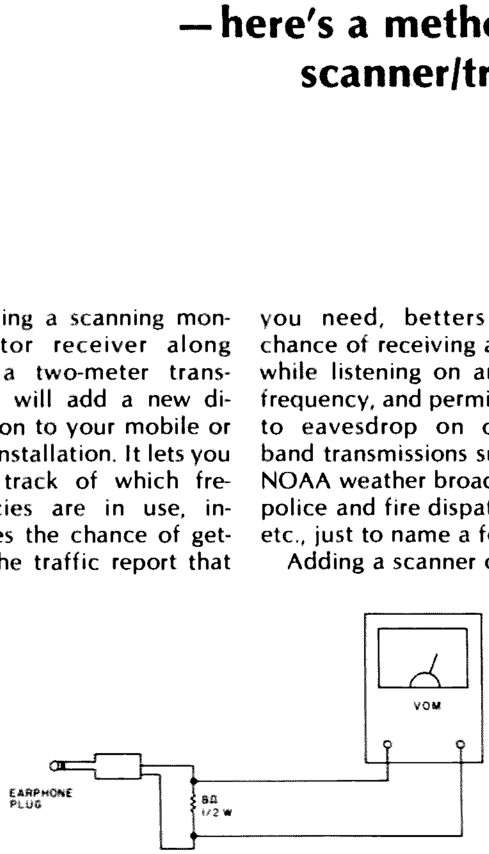

Fig. 1. Test circuit for scanner front-end alignment. Set VOM on decibel or low ac voltage range.

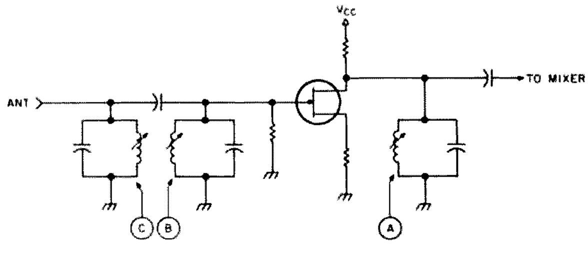

Fig. 2. Typical scanner front-end circuit. Alignment sequence is A, B, then C.

Scanner Modifications

If you use the scanner on the frequencies for which it was designed, alignment of the front end is not required. For reception of two-meter signals, however, some alignment of the tuned circuits will usually be required. This is easy if the circuit shown in Fig. 1 is used.

With no signal applied to the scanner and the squelch open, adjust the volume control so that the VOM indicates about 80 percent of full scale. The exact voltage is not important and will fluctuate with random noise. Most scanners have a front end similar to the illustration in Fig. 2. Apply a weak signal on the frequency of interest. Notice that the VOM reading will be less than before. This is caused by the limiting action of the receiver. Carefully adjust the tuned circuits in the order shown in Fig. 2 until the lowest VOM

reading is obtained, i.e., maximum quieting is achieved. In most of the scanners, the dips are quite sharp and usually within ±2 turns of the factory settings.

This completes the alignment phase. Disconnect the test circuit. With an antenna connected, the scanner should now receive signals on two meters.

The final scanner modification consists of adding an electronic switch to mute the scanner while transmitting. It consists of adding a resistor and transistor and changing a second resistor. Before going ahead blindly, refer to Fig. 3 to see how the muting is accomplished.

The partial schematic shows a typical, series-type voltage regulator. The zener diode establishes a constant base voltage for the pass transistor. The pass transistor has unity voltage gain but provides current gain. As a result, whatever voltage applied at the base of the transistor appears at the output of the regulator but at a higher current-sourcing capability.

In the case of the PRO-40, +13.6 volts from the automobile battery drives the regulator. The zener diode holds the base of the pass transistor at +9.1 volts, and the output of the regulator is about +9.8 volts. In case you are wondering where the additional 0.7 volts came from, it is the diode drop between the emitter-base junction in the pass transistor.

It is obvious then, that if the base voltage of the pass transistor could be reduced to zero during periods of transmitting, the output of the regulator would be zero for all practical purposes and the scanner would be muted. The electronic switch will do just that.

By adding a garden-variety NPN transistor such as a 2N3904, as shown in Fig. 4, the pass transistor base voltage will be at ground potential whenever a mute signal is present. The mute signal turns on the switching transistor which effectively shorts out the zener diode. When this occurs, the input voltage is shunted to ground through the current limiting resistor, R1. Since this resistor was not rated for the extra current, it must be replaced with a larger wattage resistor having the same resistance as the former resistor. The power dissipated in the resistor can be calculated from $P = E^2/R$, where E is 13.6 volts and R is the resistance in Ohms.

The exact value of resistor R2 is dependent upon the mute voltage. It should be selected so that the Q2 base voltage is between +0.7 and +1.0 volts when Q2 is turned on. In the example, a value of 12k provides satisfactory performance with a mute control voltage of +9 volts.

The mute control voltage originates at the transceiver and must be applied to the scanner over a wire. A convenient way to do this is to rewire the earphone jack to accept the mute signal. This negates the use of this jack for its original purpose, but since the internal speaker is used exclusively anyway, the jack would serve no useful purpose in our system. Use of the jack also avoids the need for another hole in the scanner.

Note that if the mute plug is removed, the scanner will operate normally. The scanner thus may be used apart from the transceiver.

Transceiver Modifications

The transceiver requires two modifications: An antenna lead must be brought out to drive the scanner antenna jack, and the mute control voltage must be generated.

The TR-7500 has an accessory jack on the rear panel which may be used for all connections if you can compromise one of the functions provided for at this point. Fig. 5 shows the functions available at this jack. The T9 output provides +9 volts during transmit only. Since this is just what is needed for the mute control signal, it can be used directly. The center-meter (CM) output would not normally be used, so it can be unsoldered and taped. This pin may then be used for the scanner antenna lead.

The antenna lead for the scanner must come off the receiver side of the antenna relay. In the TR-7500, antenna switching is done electronically, so the antenna lead was picked off the receiver printed circuit board and brought to the accessory jack with RG-174/U miniature coaxial cable. The receiver board can be removed quite easily by removing a few machine screws and unplugging the interconnecting harnesses. It is much easier to solder the coax to the board when it can be supported in a vise or on a table.

After all connections have been made, reassemble the transceiver and construct an interconnect cable to run from the transceiver to the scanner (See Fig. 6).

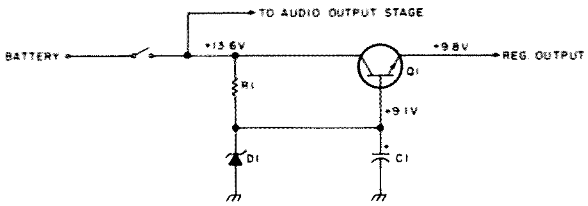

Fig. 3. Original voltage-regulator schematic.

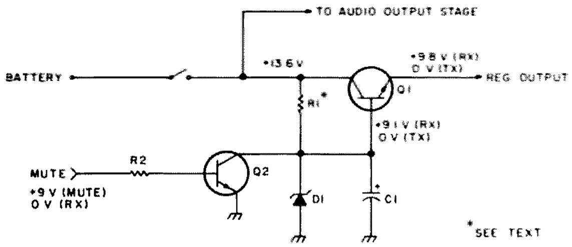

Fig. 4. Modified voltage regulator showing the electronic switch. R1 must be replaced with another resistor having the same resistance but a higher power rating.

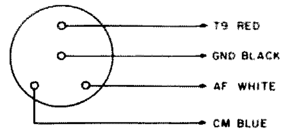

Fig. 5. Wiring of the TR-7500 accessory jack on the rear panel. The CM wire is removed and taped. The scanner antenna lead is then connected to this pin.

Testing

Connect the scanner and transceiver power leads to the power supply and the interconnect cable between the units. Connect the antenna to the transceiver.

Turn on the scanner and the transceiver. Each should operate normally, as before the modifications, with the sole exception being a slight loss in sensitivity on the part of the transceiver. This is not significant, since it is less than a 0.1-microvolt degradation.

Depress the PTT switch. The scanner should be disabled, as evidenced by the LED indicators being off. Normal scanner operation should resume when the

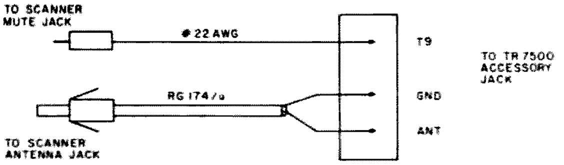

Fig. 6. Wiring of the interconnecting cable used between the scanner and the transceiver.

PTT switch is released.

Operation

Besides being able to scan several channels for activity, there are a few unique ways to benefit from this combination. For instance, the transceiver can be set to a frequency you wish to monitor fulltime, and the scanner will allow you to monitor the others. Or, you can "lockout" all channels but one and listen fulltime on two frequencies simultaneously. This comes in handy particularly for monitoring a repeater and a simplex frequency during emergencies.

If you have a TR-7500, and duplicate this system, you might want to program the six available channel-selector switch positions to correspond to the first six scanner frequencies. This is really handy in mobile operation.

Whatever your desire is, I am sure that once you've teamed a scanner and a transceiver with the automatic switching described, you will wonder how you ever got along without it. ■

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Digital Transistor Checker

—a "hands-on" project

Most of us are familiar with the method of checking transistors for shorts and opens using the x100 ohmmeter scale. Now you can check for amplifying action as well, using just your ohmmeter and your digits (fingers).

In the case of an unknown transistor, first determine which is the base lead by checking for diode action: Put one probe on any transistor lead and check for continuity to each of the other two leads. It usually will be between 200 and 2000 Ohms. Reverse the meter leads and check again. It should read an open circuit. The base lead is the one which reads like a diode to both other leads (see Fig. 1).

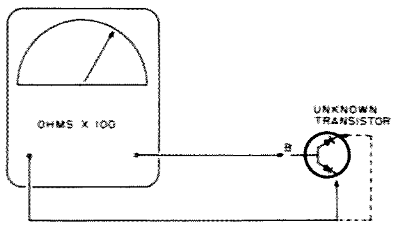

Fig. 1.

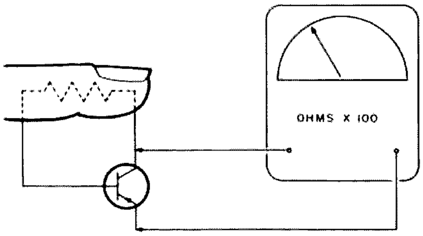

Fig. 2.

Next, connect the ohmmeter prods to the collector and emitter leads. We don't know which is which, but it doesn't matter yet. Now moisten your index digit and touch it to both the base lead and either of the other leads. If you've hit it right, the meter will show a lower resistance. If nothing happens, touch your still wet finger to the base and the other transistor lead. If your luck is as poor as mine, and still nothing happens, don't give up. Now reverse the ohmmeter prods on the collector and emitter and repeat the wet-digit test. One of the four tests will show a lower resistance between the collector and emitter if the transistor is amplifying. In effect, the wet finger serves as a high resistance from collector to base, biasing the transistor partially on (see Fig. 2).

You now know the collector lead. It is the one that gives the lowered resistance when "digitally" connected to the base. If you know the polarity of your ohmmeter prods, you also can determine if it is an NPN or PNP transistor: If the positive prod is on the collector, it's an NPN. ■

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CB to 10

—part XXV: using those surplus 40-channel boards

The Poly Paks flyer aroused my curiosity with the ad for "A 40-channel CB board complete with channel selector for only $14.88,"[1] and in a reasonable time UPS delivered what proved to be a rather sophisticated 40-channel PLL CB set minus the case, speaker, microphone, and volume and squelch controls.

A little examination and research revealed that this is a very versatile printed board, used in several Hy-Gain units and several Kraco models. What appear to be missing parts are deliberate omissions. These parts are ones that function in some other unit than that for which this board was intended.

With a little work and ingenuity, this board can be turned into a fully-functioning and illegal CB transceiver, and, with a little more work, it can become a neat 10-meter rig. All part numbers are silk-screened on the board, and all wiring is attached to numbered wire-wrap posts or to numbered holes in the board. My wiring instructions will denote wire-wrap posts with a "P" and a number and board holes with an "H" and a number.

Only the board mounting screws, the heat sinks, the antenna connector shield, and the two disc capacitors on the bottom of the board go to chassis ground. All other grounding points are attached to one of the board grounds, G1, G2, G3, or G4. Board grounds will be "BG" and chassis grounds "CG." Got it? Heat up the iron and go!

Wiring

Solder a red lead for +12 V to H1. Solder a black lead for −12 V to H2. Wire the center pin of an antenna connector to P58 and the shield to CG. Attach the leads of the two disc caps on the bottom of the board to CG. Install a jumper from P9 to P20. Wire a power on-off switch between P20 and P25. Wire an outer lug of a 15k squelch pot to P7 and the other two lugs to BG. Wire an outer lug of a 50k volume control to P19. Wire the center lug to P21 and the remaining lug to BG.

Wire the + terminal of a 0-1-mA S/rf meter to H34 and the − terminal to BG. Wire one speaker lead to P23 and attach the other speaker lead to BG temporarily. In actual operation, the speaker lead is routed to BG through the PTT switch on the microphone. A 500-Ohm dynamic mike is used. This mike has a DPDT PTT switch that opens the speaker lead as it grounds the PTT line. This is necessary since the modulation transformer is also used as the audio output transformer, and an unearthly howl results if the speaker is not disabled. This mike audio line goes to P22, the PTT line to P13, and the neutral to BG.

Tune-Up

Tuning up the receive requires a signal generator, a VTVM, and a little patience. The first step is to set the voltage on the PLL. Check your wiring a last time, apply power, and check for smoke. If everything is OK, turning the volume and squelch controls should produce noise in the speaker. Squelch range can be set with the on-board pot, RV101. Attach a VTVM probe to the end of R113 nearest T101 and the ground to BG.

What we're looking for here is 1.5 V on channel 1. Since the switch is not marked, we have no idea where channel 1 is, so tune T101 for 1.5 V on the VTVM and then rotate the channel selector clockwise. The voltage should rise and abruptly drop. The voltage drop indicates that you have just gone from channel 40 to channel 1. Reset T101 for 1.5 V and remove the VTVM.

Feed a 455-kHz signal through a .01 capacitor to the emitter of Q116, and tune T109, T108, and T107 for highest reading on the S/rf meter. The S-meter range may be adjusted with the on-board pot, TV103. Feed a 10.7-MHz signal through a .01 cap to the base of Q115 and tune T106 and L112 for the highest S-meter reading. Set the channel selector to channel 13 and feed a 27.115-MHz signal into the antenna connector. Tune T105 and T104 for highest S-meter reading. You now can attach an antenna and check for "Big 10-4s" and other esoterica amongst the local Good Buddies.

Set the channel selector to channel 13, attach a 10-Watt dummy load, key the mike or ground the PTT line, and adjust L103, L104, T102, T103, L106, L109, and L110 for the highest S/rf meter reading. Rf-meter range may be adjusted with the on-board pot, RV104.

10-Meter Conversion

Getting the rig on 10 involves replacing crystal X101 and retuning the PLL, the transmitter, and the

receiver front end. The crystal formula for the new X101 is: N/3 + 11.806 MHz, when N equals the new channel 1 frequency minus 26.965 MHz.

For example: If we wished the new channel 1 to be 28.965 MHz, then: N = 28.965 − 26.965 = 2.000; 2.000/3 = .667; .667 + 11.806 = 12.473 MHz for the new X101. The crystal may be ordered from any of several suppliers. Specify a parallel resonant mode, with a 30-pF load capacitance, an HC-18 holder, and .005% or better tolerance.

When the new X101 is installed, return to the section on tune-up and reset T101 for 1.5 V on channel 1. Retune the transmitter. It may be necessary to use the S-meter on a 10-meter receiver during initial transmitter tune-up until enough signal is obtained to register on the S/rf meter. Using a signal generator or on-the-air signal, retune T105 and T104 for the highest S-meter readings. The center frequency may be adjusted by tuning CT101. The automatic modulation-limiting level is set with the on-board pot, RV102.

Additional information on rigs using this board and their conversion to 10 may be found in previous issues of *73*[2,3] and in *Sams Photofact® CB-116*.[4] ■

References

1. Part #92CU5554. Poly Paks, PO Box 942-A3, South Lynnfield MA 01940.
2. Cliff Wiginton, Sr. WB5BSG, "CB to 10—Hy-Gain's PLL Rigs," *73*, September, 1978, p. 172.
3. Clay Webb W1PI, "CB to 10—Convert a Kraco PLL Rig," *73*, October, 1978, p. 254.
4. "Kraco Model KCB-2330B," *Sams Photofact CB Radio Series (CB-116)*, Howard W. Sams and Co. Indianapolis IN, 1977, p. 5.

✓Reader Service—see page 210

Harlan C. Curtis WB6KBM
3528 Castle Rock Rd.
Diamond Bar CA 91765

The Stolen Rig Retriever

—built-in gadget automatically sends your call with every transmission

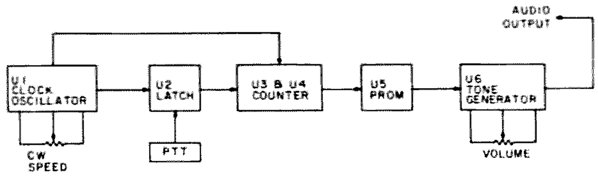

Fig. 1. Block diagram.

When VHF-FM activity got into full swing, equipment manufacturers started producing the "do-everything" transceiver. For the average amateur, these radios are expensive, and rather than purchase single-mode or limited-coverage crystal-controlled units, a single transceiver ends up as his only purchase.

These expensive rigs, when mounted in cars, have become tempting targets for the hamburglar. To counter the threat of rip-off, the amateur's resourcefulness is being severely challenged. He has responded with a number of strategies to outwit thieves and protect his equipment.

The best strategy, of course, is to remove the rig when the vehicle is unattended. Next best is to hide it by stowing it under a seat or, better yet, by mounting it in the trunk or glove box. Locking mounts and alarm systems are also recommended. Antennas may be disguised to resemble standard broadcast antennas, which helps to reduce vulnerability. However, all of these steps may fail to prevent the loss of an expensive investment.

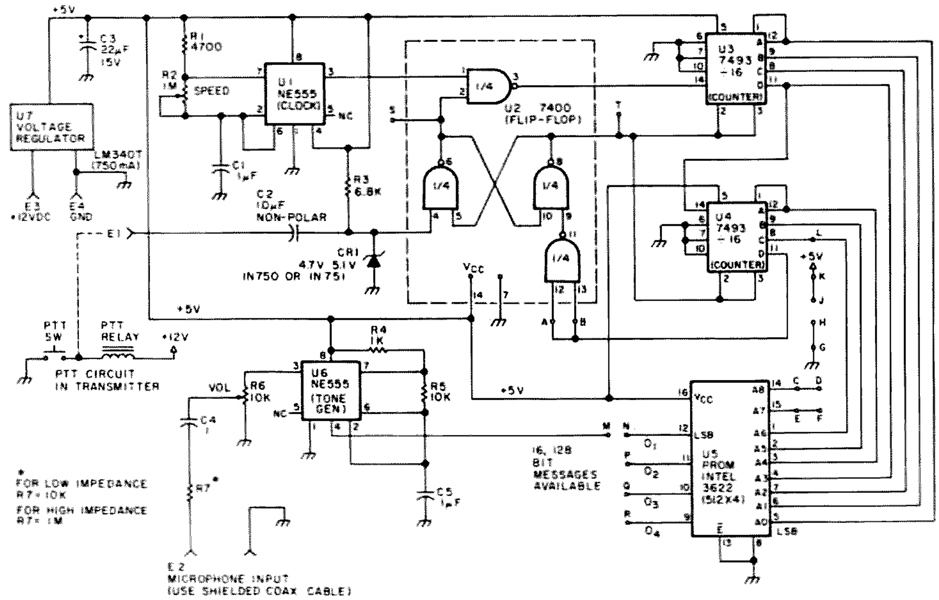

Fig. 2. Schematic diagram. Note: If the IDer is desired to be used as a CW beacon (continuous identification), connect pin 4 of U2 to ground.

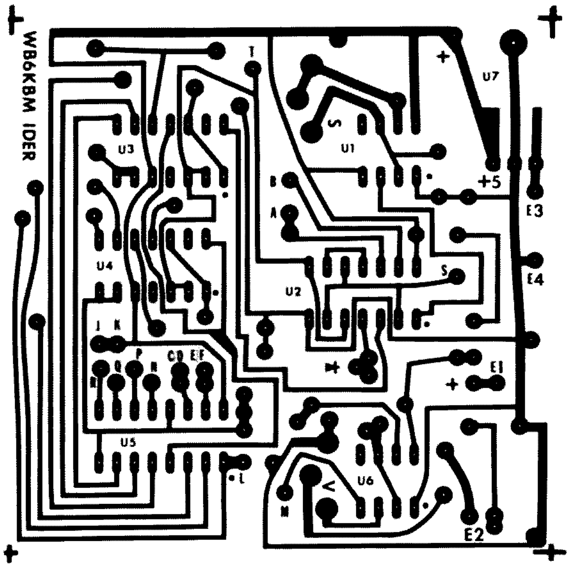

Fig. 3. Printed circuit board (foil side).

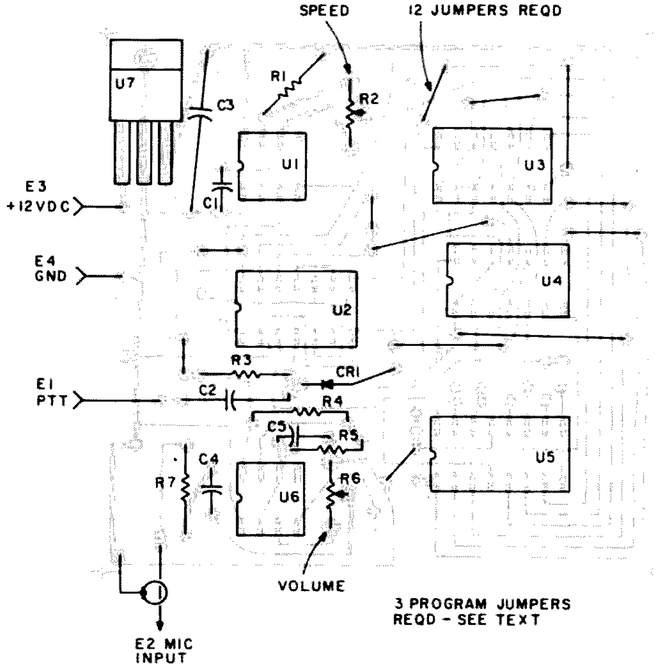

Fig. 4. Component layout.

For that reason, it makes sense to have some means of recovering your rig if it *is* stolen. The automatic CW identifier described here does just that. It identifies your call letters every time you "squeeze the pickle." Because the IDer is hidden inside the transmitter and is silent to its operator, a thief may be unaware that the IDer is proclaiming your ownership after you have lost possession!

Several of these devices are now available commercially. But if you want to save money and like to build or tinker with small projects, then this article is written especially for you. Because of the large capacity of the PROM used in the identifier, it turns out to be an excellent club project, the beauty being that the PROM can be programmed to contain sixteen different calls of 128 bits each. Therefore, once the PROM has been preprogrammed and the three unique address jumpers have been properly connected, the circuit will automatically transmit your selected call or any other short CW message.

A block diagram, Fig. 1, is provided as an aid in understanding the functions of the circuit, while Fig. 2 is a complete schematic diagram showing the pin numbers discussed.

How It Works

The clock oscillator determines the speed at which counters U3 and U4 will scan the PROM, U5. The output of U1 pin 3 goes low (ground) and arms the latch, U2. Pin 3 of latch U2 now goes high, which turns on counters U3 and U4. The clock oscillator puts out pulses which are divided by the counters. The counters scan the PROM, U5, column by column, until the last bit has been reached. The last bit in our case is number 128. Having counted 128 bits, pin 11 of counter U4 goes low, which causes pin 5 of U2 to go high and then the IDer is shut off (latched). When pin 4 is reset, the IDer will recycle itself, causing the message to be sent again.

Although a perfboard can be used, when you get the members of your club interested in a project like this, fabrication of printed circuit boards, programming of the PROM, and assembly of the IDer become simple problems to solve. Fig. 3 is a foil side printed circuit positive, and

Message Number	Address Jumper		
1	M TO N	D TO H	F TO G
2	P	H	G
3	Q	H	G
4	R	H	G
5	N	H	J
6	P	H	J
7	Q	H	J
8	R	H	J
9	N	K	G
10	P	K	G
11	Q	K	G
12	R	K	G
13	N	K	J
14	P	K	J
15	Q	K	J
16	M TO R	D TO K	F TO J

Fig. 5.

Fig. 4 shows the component layout.

Once you have the PC board in hand, careful examination of the component layout is a must. You should have a colored pencil to mark the symbols and jumpers as they are installed. All of the components are mounted on the clear (non-foil) side of the PC board. It is recommended that the resistors be installed first, as their cut-off leads are used for the twelve jumpers that are required. Sockets for the ICs are not necessary, but they simplify troubleshooting and component replacement.

Programming the PROM

The PROM selected for the IDer is the Intel 3622. Its selection was determined by availability, large capacity, and price. Most electronic suppliers have this PROM in stock, and for about $8.50 and a coding sheet, they will program the PROM for you.

PROM burning circuit requirements are given in the Intel data sheet, but construction and maintaining

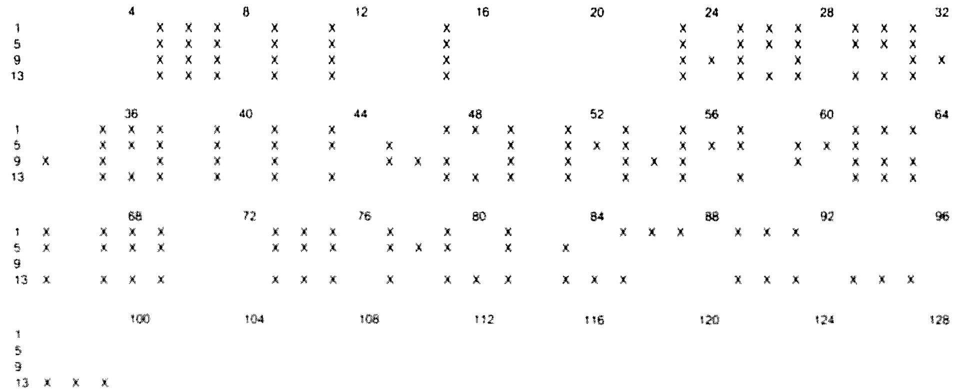

Fig. 6. Programming chart. Examples shown: line 1—DE WB6KBM; line 2—DE W6JAZ; line 3—DE N6XA; line 4—DE WB6KYO. Repeat this chart 4 times.

of critical supply voltages is very difficult. Several PROMs were burned using the manufacturer's recommendations, but the results were unsuccessful.

Sixteen different messages should be determined prior to programming the PROM in order to utilize its full capacity. Each line on the coding sheet is 512 bits long, so each line holds four 128-bit messages. Therefore, line 1 holds messages 1 through 4, line 2 holds messages 5 through 8, line 3 holds messages 9 through 12, and line 4 holds messages 13 through 16. Fig. 6 shows a portion of a coding sheet with the coding for 4 sample messages.

Before you start to fill in the coding sheet, you must know the following parameters. The 3622 device outputs are initially high, and, if it is directly inserted into the IDer without first being programmed, a continuous tone would be produced. It is necessary to burn out the selected bits for the desired message. Before you determine the selected message, you must keep in mind the 128-bit limit of each message. A single bit is a unit of time from which the Morse code is comprised. That is, a dot is one bit in length while a dash is three bits in length. Space between dots and dashes of a letter is one bit, between letters it is 3, and between words it is 7. The first 4 bits of each message are left blank, thereby ensuring proper key-down of the transmitter and no loss of the message.

Upon completion of the coding sheet, have a friend double-check your work. Errors must be corrected, as the PROM cannot be reprogrammed.

When ordering your PROMs, you must state, "positive logic, high output, ones indicate high and blanks indicate zero." This information will tell the company which programs your PROM which way to throw the logic switch.

Testing and Connections to Transceiver

Prior to installation of the programmed PROM, it is necessary to select the proper address codes. This is accomplished by connecting three jumper wires determined from the chart in Fig. 5. This chart shows each message by number and which jumpers to use.

Having installed the three appropriate jumpers as determined from Fig. 5 and the PROM, a final test and checkout is recommended, as it lets you set the speed and volume of the IDer off the air. You will need a 12-volt dc source of 300 mA and an 8-Ohm speaker. Connect the dc source to E3 and E4. Connect the speaker to E2 and ground. Ground the PTT circuit, E1, and adjust the CW speed control, R2, and the volume control, R6, to the desired settings.

Connection to the transceiver is quite simple. First find a suitable location. If none exists, then remove the speaker and install the IDer in its place. Most transceivers have an auxiliary speaker jack, so just add an external speaker and away you go. Refer to the schematic diagram, Fig. 2, for wiring connections. RG-122/U coaxial cable should be used for audio input to the mic if the distance is more than 6 inches.

Since the CW speed has already been set, an on-the-air test of the volume should be made. The CW audio should be just below the level of your voice to provide for proper audibility of your voice and the Morse code identification.

That's all there is to it! No more concern if you forget to identify yourself every time you go on the air, and you also can be proud of a job well done. This should get your club active again in the homebrew department.

I wish to give credit and many thanks to W6JAZ and N6XA for their testing, programming, and technical support on this project.■

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Constructing QRP Dummy Loads

—useful and inexpensive

Small rf dummy loads are one of the more useful things to have around your workbench. A high-power rf load for off-the-air transmitter tune-up and high-power testing is almost a necessity, but that is not the present subject.

Commercially-available loads tend to be precision devices that are relatively expensive. The ordinary workbench needs loads that are close to the standard impedances and that have very little capacitive or inductive reactance. This is another way of saying that they should have essentially one-to-one vswr (voltage standing wave ratio) at their operating frequency. Loads of this type that will handle ten Watts for short periods and five Watts for two or three minutes can be constructed easily and inexpensively as explained in this article.

Construction

The loads are built using several two-Watt *carbon* resistors clustered around a coax connector or the end of a coax cable. Five two-Watt resistors will allow ten Watts dissipation until they heat to a couple hundred degrees. If they are arranged with an eighth of an inch of clearance between them to allow cooling air to flow between them, they will handle their full ten-Watt rating long enough to adjust a two-meter FM transmitter rated at 10 to 20 Watts for maximum output. Additional dissipation can, of course, be achieved by blowing cool air over the resistors.

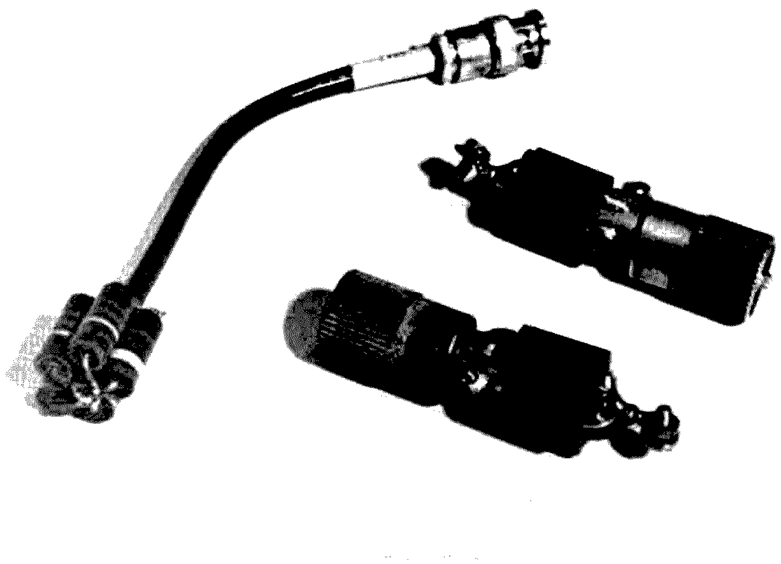

Photo A. Typical dummy loads as described in the text. Note the screw terminals shown on the UHF connector loads. These are for the connection of power-measuring circuitry.

The photograph shows two forms of the load. One is connected directly to a UHF connector and the other is at the end of a short length of coax cable terminated at the opposite end with a BNC connector.

The resistors may be chosen from Table 1 or, if you have a special load value requirement, the parallel resistor formula—$R = 1/(1/R_1 + 1/R_2 + 1/R_3 + 1/R_4 + 1/R_5)$—may be used to arrive at suitable values for your special case.

The first version of the load is constructed by

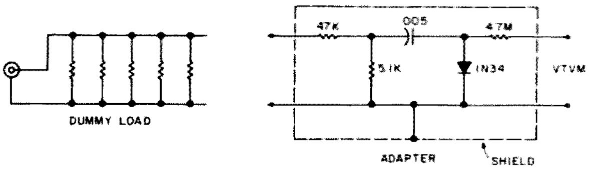

Fig. 1. Adapter circuit for VTVM with 11 megohms input resistance. Use carbon resistors only. The capacitor is in μF and should be a ceramic type rated at 100 V or more. Resistors may be ½ Watt for power levels less than 100 Watts.

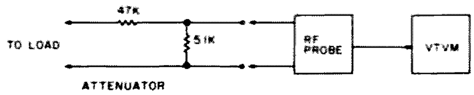

Fig. 2. A 10:1 attenuator for use with an rf probe and VTVM. The 47k resistor should be 2 Watts for 1000 Watts and the measurements limited to short periods.

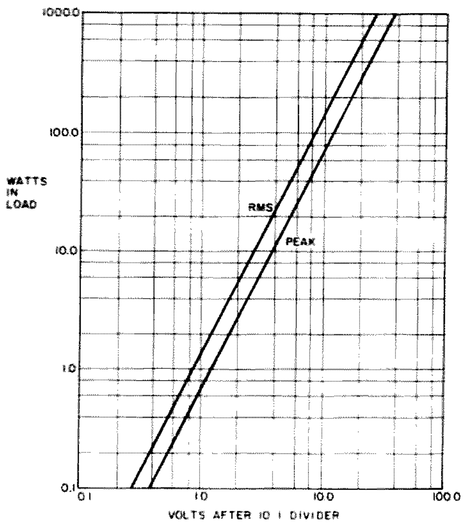

Fig. 3. Power calibration for a 75-Ohm load.

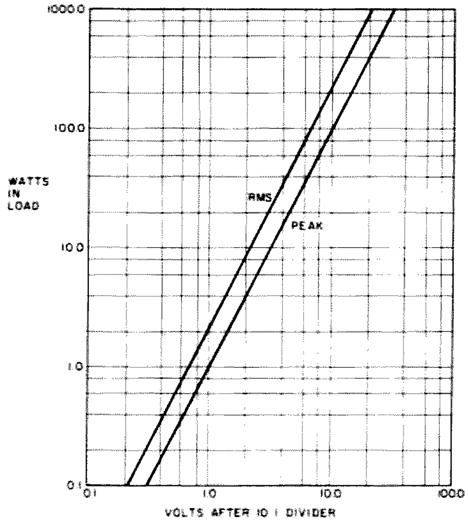

Fig. 4. Power calibration for a 50-Ohm load.

soldering a piece of #12 or #14 solid copper wire into the center pin of a UHF connector. Allow this wire to protrude about 1½" from the end that would normally accept the coax cable. Solder the resistors around the center conductor just installed. One end of each resistor goes to the center conductor and the other end goes to the edge of the connector where the outer diameter of the coax cable would normally enter the connector. Space the resistors 1/8 inch apart (more rather than less) to allow for air circulation. Trim the center conductor, leaving about 1/4 inch extending beyond the solder joint. The extension can be used to connect a measuring circuit if you so desire.

The second load is constructed at the end of a coax cable using a similar technique to that just described. The outer insulation and braid are stripped back about 1½ inches. Divide the braid into five approximately equal groups of strands and twist each group together. Trim their length to about 1/4 inch and tin each group with solder. Minimize the heat applied to these points while tinning and, later, while soldering, to avoid melting the coaxial insulating material and causing a short circuit. The resistors are now soldered from the center conductor to the five tinned points. The arrangement of resistors should be as previously described for the load mounted directly on the coax connector.

Results

The original loads were constructed using 5% resistors and their resistance values were as calculated using a calibrated Simpson 260 multimeter. The vswr was essentially one to one as indicated on a Heathkit® swr meter at 147 MHz. Chances of an equally good match at lower frequencies is excellent. These loads are probably useful at 220 MHz, but they were not tested at this frequency.

Power Measurements

Most amateur bench measurements do not have to be super-accurate. The most frequent need is to maximize or minimize the power being measured and to be assured that the power being measured is roughly what it should be. Remember that doubling or halving the transmitter's output will affect the signal received at another station by one-half an S-unit. Fighting for an additional five Watts out of a 100-Watt transmitter is just not worth it! And, similarly, knowing what your output power is (as long as it is within the law), to better the 20% is an unnecessary labor.

Using the circuits and graphs shown in the figures, good approximations of the rf power delivered to a dummy load can be made. Problems such as capacitive coupling to the measuring circuit and poor rf waveform can be ignored if the rf being measured is relatively free of harmonics and the adapter circuit or probe is shielded.

The attenuator resistors (47k and 5.1k) are included

Qty.	Resistance	Qty.	Resistance	Combined Resistance
5	240	—	—	48
5	270	—	—	54
3	240	2	300	52.2
5	360	—	—	72
3	330	2	470	74.9

Table 1. Resistor choices for common load resistances (Ohms).

to protect the diode in the adapter or probe. Normally, the diode-voltage limitation is about 30 volts. This value is exceeded before a power of 10 Watts is reached with 50- or 70-Ohm loads.

The formula for calculating the power in a load is $W = (E_{rms})^2/R = (E_p \times .707)^2/R$, where W is the power in the load, R is the load resistance, E_{rms} is the rms rf voltage across the load, and E_p is the peak rf voltage across the load. The graphs plot the value of rms voltage (as read on the VTVM's dc scale when using an rf probe or the adapter shown in the figure) versus power in the load. Peak voltage is also plotted in case the voltage is measured with a VTVM directly across the diode. The formula or graph can be used to change the scale on a meter if you are ambitious enough to build a permanent measuring setup. Note that the use of a low-impedance voltmeter in place of the VTVM will reduce the accuracy of power measurements but can be used to maximize the power in the load. Use the highest voltmeter scale possible to minimize the error in power measurement. A VTVM, on the other hand, normally has constant input impedance and, therefore, may be used on any scale.

Conclusion

Loads such as those described here will increase the potential of your workbench, making it possible to perform some of the measurements normally performed by the well-instrumented service shop.

The assistance of L.G.S. Wood W1WK in preparing the article is gratefully acknowledged. ■

The IC-211 Cookbook

—mods and tweaks to improve performance

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"Tired of listening to white noise during SSB monitoring? Try this squelch modification."

The above title was chosen for my original draft of an article which never made it into print. I had lent the article to a friend for review to detect any errors in spelling or punctuation and by the time I received the article back, I had investigated a number of different areas and compiled a lot of new information. This article includes all of the new information, plus the original SSB squelch modification.

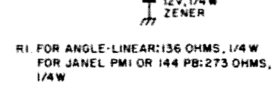

Fig. 1. +12-V dc power supply.

Since I don't have any convenient way of submitting nice pictures without many more weeks and/or months of delay, I'm afraid everyone will have to use the pictures in the Icom manual and my sketches. I would also like to say that some of the information to be presented was obtained directly from Icom East and Icom West and is so noted in the article. The following areas will be covered:

- Service manual
- Preamp installation and adjustments
- SSB squelch modification
- CW mode frequency offset problems and corrections
- Frequency adjustments
- Miscellaneous internal adjustments

SERVICE MANUAL

While talking with the sales people at Icom East, I was told that a service manual "is being developed" and will be available, although no projected availability date was given. Great! Unfortunately, this meant that all of my other questions had to be answered from a 13" x 20" schematic loaded with lines and parts, and by hunting around on the circuit boards.

PREAMP INSTALLATION AND ADJUSTMENTS

The stated Icom specifications of 0.6 uV or better for 20 dB of quieting on FM and 0.5 uV or better for 10 dB (S+N)/N for SSB looked good, but not great. Since I've had "Proglines" down to about 0.2 uV on FM, a preamp looked like a good bet if I could improve the noise figure and sensitivity on the solid-state front end of the 211.

Mounting and In-Circuit Placement

The preamp can be mounted on the power supply supporting bar since there is free space available. This will also place the preamp close to the area where the input and output leads are to be connected. To place the preamp into the circuit, it initially looked like the foil on the circuit board would have to be cut. However (courtesy Icom East), removing C202, which is located near the rf amplifier, Q47, and replacing it with the preamp solved the problem. Be sure that the input/output sides of the preamp match the input/output sides of C202. The input side of C202 is on the antenna jack-L38 side, while the output side is toward L52.

Power

The preamp that I used (Angle-Linear) has a +12-V dc requirement to maintain the noise figure. Also, I only wanted power applied to the preamp during the receive mode. These requirements were met by running the power lead from the preamp to the collector of Q34, which supplies +13.5 V dc, and by using a zener diode and limiting resistor to obtain the +12 V dc at the preamp. (See Fig. 1.)

Adjustment

Once the preamp is installed and operational, R106 (which is the agc control) should be turned fully counterclockwise to stop the agc voltage from being applied on low-level signals. Without this adjustment, the preamp would add nothing!

For those interested in recalibrating their S-meters, the following information

(courtesy Icom West) may be beneficial: In the FM mode, 10 uV produces S9; adjusted by R167. In the USB/CW mode, 32 uV produces S9; adjusted by R132. Then, 320 uV should produce a +20 dB indication; adjusted by R26. A 0.32 uV signal should just move the needle.

Results

Without the preamp, the IC-211 sensitivity measured 0.5 to .6 uV in the SSB mode. With the preamp installed and the agc adjusted, I had 0.1-uV sensitivity in the SSB mode. The tests were conducted using a Singer FM10.

SSB SQUELCH MODIFICATION

Most of my 2-meter work is done on SSB and many hours are spent monitoring. The ability to have squelch operation during these times (instead of listening to noise) seemed imperative.

Normal Operation

The circuit in question is comprised of Q11, Q49, Q50, Q51, Q53, and Q54. Their functions are as follows:

Q11—SSB audio preamp
Q49—FM audio preamp
Q50—audio low-pass filter
Q51—receive LED switch
Q53, Q54—noise amplifiers

During normal operation in the FM mode, audio from the discriminator is supplied to two points: the base of Q49 (FM audio) and the input of noise amplifiers Q53 and Q54 via the squelch control. Basically, noise present at Q53 and Q54 keeps Q52 (squelch switch) turned on. Q52, when turned on, keeps Q49 and Q51 off; thus, there is no audio output or receive signal LED lamp lighted. With a signal present, the noise at Q53 and Q54 is reduced, allowing Q52 to turn off. With Q52 off, Q49 and Q51 turn on, allowing audio to pass and lighting the receive lamp.

Modifications

In the SSB mode, two things prevent the squelch from operating: +9 V dc is removed by the mode switch from Q53 and Q54, which keeps Q52 off; the SSB audio from Q11 is placed on the collector side of Q49, thus bypassing Q52's switch action upon Q49. To complete these modifications, proceed as follows:

1. Remove the top and bottom covers from the set, power supply module, and PLL box. (Note: Both units are connectorized for easy removal.)
2. Unsolder the top side of R214. This side normally faces toward L53.
3. Solder a wire to the free end of R214, route it underneath the circuit board, and attach it to the emitter of the Q34 and D28 anode junction pad. This point supplies +9 V dc during receive.
4. Unsolder the top side of C210 (+ side).
5. Solder a wire to the C210 lead (+ side), route it underneath the circuit board, and attach it to the junction pad of the squelch cable (center conductor) and C164.

That's it—just two wiring changes! This modification seems to work quite well and even SSB signals that just move the S-meter will open the squelch if it is set loose. I have not noticed any degradation in either FM or SSB audio or any "different" operation of the squelch on FM. (Note: The agc circuit is operational when in the SSB mode and the agc fast/slow switch will control the length of the "squelch tail.")

CW MODE FREQUENCY OFFSET PROBLEMS AND CORRECTIONS

When you operate, let's say, on 145.100.0 on FM and then switch to the CW mode, your CW carrier should be on 145.100.0 and your receiver on 145.100.0. This is not the case with the IC-211. There is a +300-to-400-Hz receive shift and about a +800-to-1-kHz transmit shift. The transmit offset was manufactured into the IC-211 but, evidently, the receive change was not intended. These frequency shifts pose quite a problem when trying to work EME or aurora and, during general contacts, may cause leapfrogging around the band.

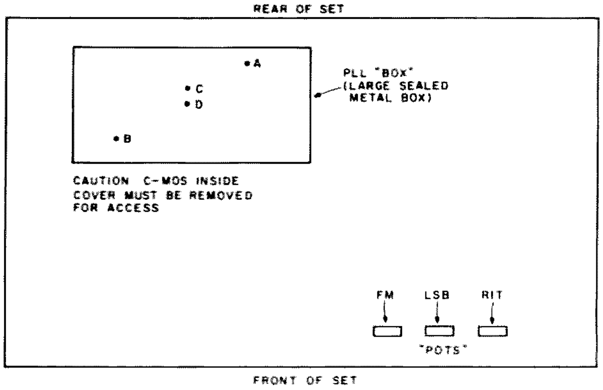

Fig. 2.

Receive Shift

I eliminated the receive shift by shorting out R17 (68 Ohms), which is located on the small circuit board near the mode switch (bottom side of rig).

Transmit Shift

On CW transmit, +9 V dc or less is put to D50 (anode), which cuts off D51. This removes C316 and C251 from the oscillator circuit and raises the transmit frequency about 800 to 1000 Hz. A cure appeared to be easy: Lift the anode of D50 from the circuit board. This did correct the frequency shift, but the power output went to zero! The FL1 filter will not pass the corrected frequency.

Since the transmit offset cannot be corrected easily, a change in operating procedures will have to suffice. Once you determine the amount of frequency shift, you can compensate by using split-frequency operation. For example, using a +800-Hz shift with a desired operating frequency of 144.100.0:

1. Use vfo A as transmit: Set dial to 144.099.2; your carrier will be on 144.100.0.
2. Use vfo B as receive: Set dial to 144.100.0.

The receiver and transmitter will then track correctly, the receive readout would be correct, and you can ignore the transmit readout. Any minor adjustments to the receive frequency could be done with the RIT control.

FREQUENCY ADJUSTMENTS

Since the IC-211 has a nice 7-digit readout, I would like to feel sure that it is correct. The IC-211 does not "compute" the operating frequency like the Kenwood TS-820. However, neither does the TS-700SP, which only reads the vfo injection. (And, I might add, the vfos are generally not linear over the entire 4-MHz band!) The IC-211 breaks down the LO injection voltage into 100 discrete dc voltage steps and uses phase comparison of the vco and the LO, which is referenced to a very stable crystal standard. This makes for an extremely accurate readout once the rig is aligned properly.

Now, on with ad-

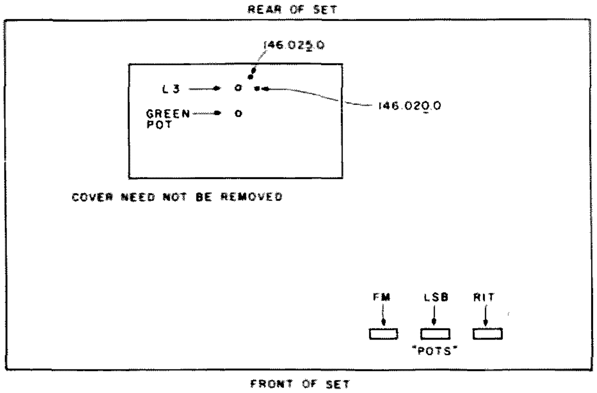

Fig. 3.

justments. There are two versions of the IC-211 out and the type which you have is easily determined by looking at the large sealed box underneath the rig. The older units, like the picture in the Icom manual, do not have openings in the case to get to all the adjustments; the newer units do.

Note: The rig should be turned on for about 30 minutes to an hour before starting; *all steps must be done in the order indicated*, and, for the older units, the cover must be removed from the PLL box. (Caution—CMOS inside!) The older unit is aligned as follows (see Fig. 2):

144-146 MHz

1. Using either a signal generator or second 2-meter rig, set the signal source to 145,100,000 Hz as verified by a frequency counter.
2. Set the IC-211 to 145.100.0, USB, receive, and adjust the coil at "A" for zero beat.
3. Set signal source to 145,099,900 Hz.
4. Set IC-211 to 145.099.9, USB, receive, and adjust pot at "B" for zero beat.
5. Set IC-211 to 145.100.0, FM, transmit, and adjust R18 for exact frequency on the frequency counter. (Note: R16 and R18 are reversed in the Icom manual picture.)
6. Set signal source to 145,100,000 Hz.
7. Set IC-211 to 145.100.0, LSB, receive, and adjust R16 for zero beat. (Note: R16 and R18 are reversed in the Icom manual picture.)

146-148 MHz

1. Set IC-211 to 146.025.0, FM, transmit, and adjust capacitor at point "C" for exact frequency on the frequency counter.
2. Set IC-211 to 146.020.0, FM, transmit, and adjust capacitor at point "D" for exact frequency on the frequency counter.
3. Repeat steps 1 and 2 as necessary to obtain correct readings, since these steps interact. The newer unit is aligned as follows (see Fig. 3): The rig should be turned on for about 30 minutes to an hour before starting; *all steps must be done in the order indicated.*

144-146 MHz

1. Using either a signal generator or second 2-meter rig, set the signal to 145,100,000 Hz as verified by a frequency counter.
2. Set the IC-211 to 145.100.0, USB, receive, and adjust L3 for zero beat.
3. Set signal source to 145,099,900 Hz.
4. Set IC-211 to 145.099.9, USB, receive, and adjust the green pot/trimmer for zero beat.
5. Set IC-211 to 145.100.0, FM, transmit, and adjust R18 for exact frequency on the frequency counter. (Note: R16 and R18 are reversed in the Icom manual picture.)
6. Set signal source to 145,100,000 Hz.
7. Set IC-211 to 145.100.0, LSB, receive, and adjust R16 for zero beat. (Note: R16 and R18 are reversed in the Icom manual picture.)

146-148 MHz

1. Set IC-211 to 146.025.0, FM, transmit, and adjust *rear* trimmer for exact frequency on the frequency counter.
2. Set IC-211 to 146.020.0, FM, transmit, and adjust *front* trimmer for exact frequency on the frequency counter.
3. Repeat steps 1 and 2 as necessary to obtain correct readings, since these steps interact.

MISCELLANEOUS INTERNAL ADJUSTMENTS

RF Power Output

The transmit stages and adjustments are as follows:
Q28—2 mW (alc-controlled stage)
Q30—100 mW; adjust C119, C123
Q31—1.6 W; adjust C132, C134
Q32—10 W; adjust C142, C144

FM

On the front panel, you have the rf power adjust which only functions in the FM mode. In addition to this control, there are two pots inside the top cover directly behind the front-panel power control. The pot on the left sets the lower power limit (typically 0.5 W) and is adjusted with the front-panel rf control set fully *counterclockwise*. The pot on the right sets the upper power level (typically 10 W) and is adjusted with the front-panel control set fully *clockwise*.

SSB/CW

Power output can be set for SSB/CW operation by adjusting R129, the alc control pot. R129 is adjusted for maximum power output, then backed off until the power just begins to decrease.

If your IC-211 has much more than 10 Watts of output, you should check the idling current on the driver and final (Q31 and Q32) to make sure they are set correctly. The proper current for Q31 should be 30 mA and is obtained by adjusting R127. The current for Q32 should be between 60 and 70 mA and is adjusted by pot R130. The adjustment procedure is as follows:

1. Remove the top cover.
2. Locate the plastic 4-pin plug near the back, left-hand side of the set.
3. Remove the male plug.
4. Insert an ammeter in series with pins 2 and 3.
5. Clip-lead pin 1 to pin 4.
6. Turn rig on and place in USB mode, microphone gain off.
7. Key microphone and adjust R127 for 30 mA.
8. Turn rig off.
9. Insert an ammeter in series with pins 1 and 4.
10. Clip-lead pin 2 to pin 3.
11. Turn rig on and place in USB mode, microphone gain off.
12. Key microphone and adjust R130 for between 60 and 70 mA.
13. Turn rig off, remove meter and clip leads, and replace jumper plug.

SSB Audio Gain

In the SSB mode, using either an audio tone or voice input (a long "five"), adjust R273 for maximum power output on a wattmeter.

Carrier Balance Adjust

Using a second receiver tuned to the operating frequency of the IC-211, put the IC-211 in the USB mode, microphone gain off, and key the transmitter. Adjust R270 for the *least* amount of signal/carrier received by the second monitor. (Note: A police/fire scanner that

covers the 2-meter band works nicely as the second set.)

Swr Control Set

1. Connect rig to a non-reactive 50-Ohm dummy load.

2. With the transmitter keyed, put the slide switch (located beneath the top access panel) to the Set position (right). Using the Swr Set pot, adjust for full-scale reading on the meter.

3. With the transmitter still keyed, put the slide switch to the Swr position (left) and adjust R135 for a null on the meter. R135 is located near the antenna jack on the top side of the set.

4. Remove the dummy load (set will not be connected to any antenna), put the slide switch back to the Swr Set position (right), key the transmitter, and adjust R136 to read +20 dB on the meter. R136 is located next to R135.

5. Reconnect the dummy load and key the transmitter. The meter should still read full scale.

Bfo Adjustments

1. For USB/CW operation, the 10.6985-MHz crystal is adjusted by C255. Measure with a frequency counter connected to CP9 (free end of R218, 470 Ohms).
2. For LSB operation, the 10.7015-MHz crystal is adjusted by C259. Measure with a frequency counter at CP9.

FM Transmit Modulator

The 10.7-MHz crystal is adjusted by L12 and measured with a frequency counter connected to CP2 (free end of R317, 470 Ohms).

In conclusion, I hope that the information and various modifications provided here may be of interest and help to all IC-211 owners in enjoying this truly unique set. ■

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Take a Hike

—backpacking with an HW-8

It isn't often that you can enjoy three hobbies at the same time, but the junior op, Scott WD4LYN, and I did just that for a couple of days two summers ago. Scott assembled an HW-8 QRP rig a few months before he received his Novice ticket and I quickly saw the possibilities of using it on camping trips. We each took along a camera, completing the hobby picture.

This summer, rather than just piling all (XYL, campstove, cots, pots, pans, cats, and rig) into the car and heading for "civilized camping" complete with showers, we decided to trek, or backpack as it's sometimes called, into a wilderness area nearby. We collected all the special gear needed: mountain tent, packs and frames, hiking boots, portable stove and cookgear, sleeping bags, light and heavyweight socks, and the not-to-be-forgotten first aid kit with "moleskin" for those inevitable blisters. On-the-air testing of the QRP station, using all accessories and the antenna we'd be taking, was the next step in getting ready.

Photo A. The QRP station assembled and ready for packing. Note the antenna and counterpoise (plastic-covered hookup wire) wound on empty vitamin bottles, just behind the key and antenna tuner.

The HW-8 had been on the air from the home QTH a few times and was used another time on an automobile camping trip, so we knew it would work well the way it was—no mods required yet. The greatest concern was the antenna. We wanted something both light and practical. I wanted the simplest type so that we could work several bands without too much fuss. The solution was an endfed 65-foot wire with a counterpoise about the same length to substitute for a ground. To facilitate loading, I built a compact wire tuner and chose a lightweight plastic-cased Radio Shack CB swr bridge to see what was happening.

The portable power source was almost a greater challenge until I recalled that the junk box contained two 6-volt motorcycle wet cells that I had on hand for a doorbell and burglar alarm project. They were spillproof and rated at 3 Ah. Taped together and wrapped in plastic to contain any accidental leakage, they made a neat 5-pound package. Other

types of rechargeable cells could have been used (nicads and gel-cells), but the added cost and weight to achieve the same capacity were not considered worthwhile. Our HW-8 drew less than 500 milliamperes key down, so there would be plenty of juice for all the operating we'd get in on a 3-day trek.

A final weighing-in of the gear rang up another 5 pounds for the transceiver, plus 2 pounds for the tuner, swr bridge, straight key, featherweight earphones, cables, and the antenna and counterpoise wire, for a total of 12 pounds. To save weight, I mounted RCA-type phono jacks on the swr bridge and tuner and used phono plugs on RG-174/U miniature coax for rf interconnections.

Photo B. A close-up of the QRP station as set up the first morning.

Our first trek was planned for mid-July, but Murphy's law governed and Scott ended up with a broken wrist from a skateboard fall, which meant a full-length cast on the right arm—and a postponement. After 3 weeks the cast was shortened, and with his fall school-opening only a week away, Scott announced that he was ready to go. We made a quick trip to the local outdoor outfitters for freeze-dried food and maps, jammed everything into our packs, and informed the XYL that we were off. We weighed our packs before loading up the car and found we'd each be carrying 10 to 12 pounds more than recommended by the guide books: Scott would be carrying 32 pounds, and I'd have 47 to tote. We couldn't throw out any of the food, and the QRP station required everything we had assembled. We finally decided we could sacrifice a couple of changes of underwear, but this drastic action resulted in a decrease in the weight of our packs of only a few ounces.

The area where we planned to backpack was in the upper part of the George Washington National Forest near Front Royal, Virginia, only 70 miles from home. We arrived at a US Forest Service recreation area early in the afternoon of August 28th, parked our car in the day picnic area, pulled on socks and boots, adjusted our packs, and were on our way by 3 o'clock. Our plan was to hike about six miles that afternoon, to reach by nightfall the Little Crease trail shelter, built and maintained by the Forest Service. The rugged terrain, uphill much of the way, plus 80 degree weather with high humidity, delayed us considerably so that stumbling along with flashlights at 9:00 pm, canteens dry, we finally decided to put up our tent by the side of the trail, close to a stream. Exhausted, we both decided to forego a hot meal and any attempt at operation that night. So it was water from the stream, trail snacks for the meal, and to bed—to listen to creeping and chirping things play leapfrog on the tent the rest of the night!

I managed to get up early the next morning, assemble the stove, and fix a passable meal of freeze-dried scrambled egg with imitation ham, powdered-juice drinks, and hot chocolate. Next the rig came out of the plastic wrappings, and I strung out the antenna. It loaded up easily and I was ready for a 9:00 am sked with Jim WD4LWE on 40 meters. I listened for him and called a few times with no response, so in 10 minutes we decided to try a few CQs. The signals were pouring in on 80, 40, and 20 and there was absolutely no QRN, but no one came back. A bit disappointed, we packed up and headed for the destination of the previous day, the trail shelter. It turned out that the shelter was only another 45 minutes down the trail we'd been on the night before!

The shelter was in great shape, had four plywood bunks, and offered good protection from the elements. It featured a clean stream nearby and a nice campfire area. This looked like just the place to spend the rest of the day and night and try some more hamming. We had reached the shelter at lunchtime, but were still somewhat tired from our previous day's trek and decided to make use of those bunks for awhile.

Late afternoon, I fixed a dinner of freeze-dried stew; after cleanup, it was time to pull the rig out again and warm up the fist. The antenna was supported at the far end by a sapling only 10 feet above the ground and the counterpoise was placed on the ground directly beneath it. The map showed that we were in a depression between two ridges which were 2,200 feet high. Our altitude was 1,600 feet above sea level. Everything was "go" and the bands sounded just as noise-free and hot as they had that morning.

This time, instead of wasting time calling CQ, I decided to try something different: answer only the strongest CQs. The strong-

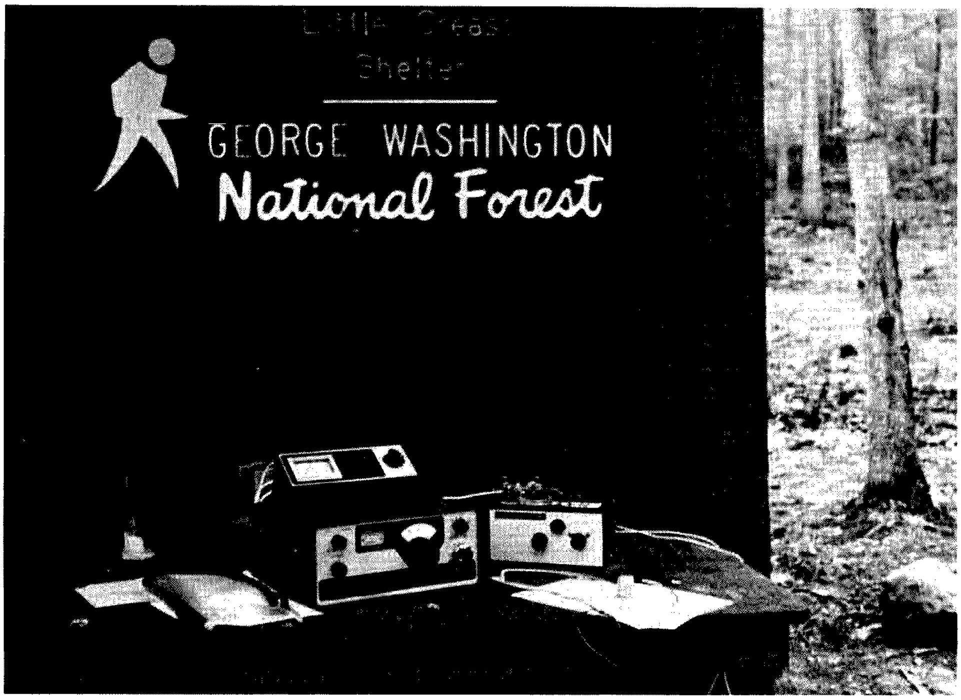

Photo C. The setup at Little Crease Shelter, George Washington National Forest, Virginia.

est on 40 at that time, 1930 hours Eastern Daylight, was Clarence VE3EZL on Georges Bay, Ontario. Clarence came right back and gave us a 559. When I told him about our operation, he expressed surprise in being able to copy our flea-power at that distance. After I signed with him, Scott decided to try out the rig in the Novice bands for awhile, but soon found that operating a straight key with the wrong wrist didn't work well at all. Operation was now by flashlight and a candle "lantern" left by a previous hiker. Scott got no replies, so we decided it was time to QRT.

The next morning, the 30th, it was scrambled, freeze-dried omelets, hot and cold drinks, and time to turn on the rig once more. Forty meters was again lively, and at 7:00 am the strongest CQ heard was Jack W8JZH in Toledo. A quick call, and Jack responded with 559, solid copy. There was no QRM, so I was able to get across details of the rig, where we were, and that we were planning to pack up the rig shortly after our QSO and retrace our steps to the car. We had a 20-minute QSO—a record for my QRP work on 40!

It took us only about half the time to walk out as it took us to walk in, even with generous rest stops for picture-taking and eating wild blueberries which the bear and deer had overlooked. Our packs were only slightly lighter since one can only eat so much food (we still had enough for two more days) and there is little one leaves in the wilderness unless it can be turned into ashes in a campfire.

A few days after returning home, I dropped W8JZH a note to describe the QRP operation in greater detail. Jack very kindly replied and emphasized what is perhaps the real key to working QRP, an effective antenna. The antenna we used was a compromise, of course, but it was tunable to several bands easily and worked as well as expected. Perhaps we could have gotten out better if the antenna had been higher, but that would have meant carrying more equipment—at least a slingshot and a ball of string.

One lesson learned was that calling CQ with low power produces little in the way of QSOs. Always pick the strongest CQs to answer, but answer only if it appears the frequency is reasonably clear of QRM. If you get a response and it remains clear, you've got a good chance of completing the QSO for your QRP logbook.

Next time out we plan to take less in the way of clothes and food. Plans are underway already for these modifications to the rig: more audio to drive a built-in speaker, an internal swr bridge, and a 25-kHz crystal calibrator. Now, does anyone have any ideas for an inexpensive, lightweight, biodegradable battery that can be activated by dipping it in a cool mountain stream? ■

Tuning Antenna-Mounted Preamps

—do it without additional wiring

73 Magazine *Staff*

It is often desirable to place a receiving preamplifier as close as possible to an antenna. This is particularly true on VHF/UHF frequencies, since placing the preamplifier at the receiver does not improve the overall receiving system sensitivity as much as having the preamplifier at the antenna. The reason for this is that the attenuation of the transmission line used adds directly to the overall noise figure of the receiving system, and, at VHF/UHF, most commonly-used coaxial transmission lines do have significant attenuation.

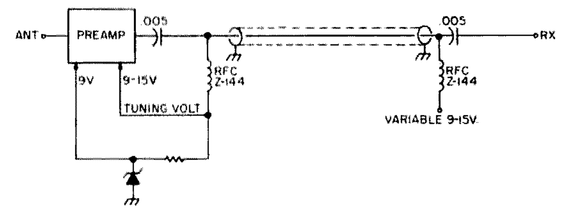

Fig. 1. The basic idea of how to both power and tune a preamplifier over the same coaxial line that carries the rf signal.

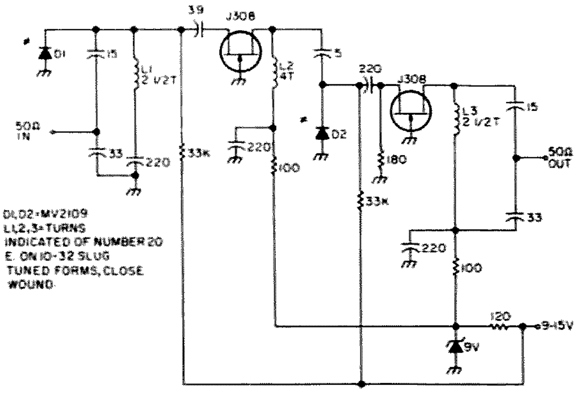

Fig. 2. An example of a 2-meter preamplifier to which remote tuning was applied.

The disadvantage of having the preamplifier at the antenna is that it has to be of the broadband type. One cannot have the advantage of being able to have the "front-end" selectivity possible with a tunable preamplifier. Of course, there are ways around this, but most amateurs do not want to run extra control lines up to a preamplifier. Usually, in fact, it is desired to keep the installation as simple as possible by running the dc voltage for the preamplifier over the transmission line using rf chokes and dc blocking capacitors.

Quite by accident, a way was found to have the best of both worlds. That is, one can still run the dc voltage needed for a preamplifier over the transmission line, and, at the same time and over the same transmission line, have a means to remotely tune the preamplifier. An application for this idea for a particular 2-meter preamplifier is described in this article, but it can be modified to be usable with almost any remotely-located preamplifier.

The accidental discovery of how to remotely tune the preamplifier came about when a 2-meter preamplifier was installed at the antenna with the dc power supplied over the transmission line. A vari-

able-voltage bench-type power supply was being used inside to temporarily test the preamplifier. It was noticed that when the power supply voltage was varied, the preamplifier could actually be tuned or peaked as indicated by the S-meter on the receiver. There were some protective diodes in the preamplifier and, as it turned out, these diodes were acting as varactor diodes when the dc supply voltage was varied and were actually tuning the circuits they were placed across.

A simple extension of what was observed led to the idea illustrated in Fig. 1. In this case, the dc supply voltage is fed over the transmission line in the usual fashion, using rf chokes and dc blocking capacitors. The operating voltage for the preamplifier stages is zener-regulated so that the stages have a constant operating point. However, by using a variable supply voltage, and having the variable voltage control varactor diodes, one can remotely tune the preamplifier while remotely powering it at the same time.

A specific application for the idea is shown in Fig. 2. This is a dual-FET amplifier designed for the 2 meter band using two of the newer Siliconix "super" FETs. The preamplifier will provide a gain of about 20 dB and 1.5- to 2.0-dB noise figure. The FETs are available directly from Circuit Specialists, P.O. Box 3047, Scottsdale AZ 85257, at only 75 cents each plus 40 cents for shipping.

Although the purpose of this article was not to describe a preamplifier as such, those who do duplicate the preamplifier will find that it performs extremely well. As in any such VHF preamplifier, lead lengths must be kept short. There are so few components involved in the preamplifier that using the "isolated pad" type of construction on a single-sided PC board is probably easier for the individual builder than trying to etch a PC board. The circuit is inherently stable, and one has only to sufficiently isolate the various coils. This can be done by individual can-type shields, or by simple barriers of PC board between the coils with the copper side of the barriers grounded to the main board containing the circuit.

The coils are first peaked in the middle of the desired operating range with a supply voltage of about 12 volts. Then as one changes frequency and varies the supply voltage, it should be readily noted how the preamplifier can be peaked using the variable supply voltage. One will probably have to do a bit of adjustment of the slugs in L1 and L2 to get reasonable tracking between the two tuned circuits over the band. It should be possible, however, to have the preamplifier tune over the entire band.

All of this work can be done on the bench before the preamplifier is remotely installed. Assuming that bench adjustment is done using the same enclosure, connectors, etc., as will be used in the final installation, the preamplifier should work without difficulty when remotely installed.

The remote tuning idea described can be applied to a host of preamplifiers. The only thing required is to modify the tuned circuit(s) with suitable varactor tuning diodes. Table 1 gives some of the capacitance variations possible between 9 and 20 volts for the readily-available and inexpensive Motorola MV series of voltage-variable capacitance diodes. Usually, by some form of parallel or series combination of the varactor diode with a fixed value capacitor, any tuned circuit can be modified for remote tuning.

The basic scheme worked so well in the case of the preamplifier application that the idea came up to have the remote tuning of the preamplifier coupled to the main tuning on a receiver. That undoubtedly can be done using sufficient circuit sophistication, but one should be aware of the fact that the varactor diode capacitance value is temperature-dependent. The variation is not significant enough to be noticed during the course of a whole afternoon of operating, but it will be significant enough after periods of extreme temperature change to persuade one to leave the remote tuning control for the preamplifier as a separate one. ■

Tuning Diode Type	Capacitance (pF at 9 V)	Capacitance (pF at 20 V)
MV 2101	5	3.9
MV 2105	10	6
MV 2109	25	15
MV 2112	40	25
MV 2115	70	50

Fig. 3. The inexpensive Motorola MV series of tuning diodes will satisfy most needs for remotely tuning a VHF or even an HF preamplifier.

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PC Artwork Made Easy

—lift layouts from the page with transparent contact paper

A commercial product was introduced recently to lift PC artwork from magazine articles. The material was quite expensive for my 14-year old son, Chris, a prolific builder, who hit upon an inexpensive alternative.

Essentially all you need is some clear contact-type paper from your local K-Mart store (Kwik Kover), or any pressure-sensitive transparent plastic. Currently, we pay about $.59 for a square yard.

Make a Xerox® copy of the magazine pattern you wish to produce. The reason for this will be clear as you read on. Now carefully peel off the contact paper backing and apply the plastic to your Xerox copy of the artwork, forcing out all the air bubbles with a blunt instrument. The next step is to soak it in a dish of warm soapy water for about twenty minutes. After soaking, rub the Xerox paper with your finger until it is completely dissolved. At this point you will have the plastic with an image lifted off the artwork.

Now prepare your circuit board by washing it with scouring powder to remove contaminates, and allow to dry overnight. The board, as prepared now, is ready for sensitizing in a safelight area. We use a yellow bug light in a dark room for this operation. Since most magazine articles show positive artwork, we use a positive photoresist and carefully spray it on the copper side. This is then allowed to air-dry overnight in a dark room.

Now place your contact paper mask over the copper side of the board and use your exposure frame (we use two pieces of plate glass held together with clothespins). This should be done under safelight conditions only.

Exposure can be done with sunlight, photoflood lamp, or even a fluorescent lamp. About four minutes in sunlight works for us; you may have to experiment at this point.

After exposure, remove the mask and place the circuit board in a developer solution per the instructions on the solution bottle and slowly agitate. When all of the resist is gone, wash the board in fresh water to stop the resist action. Now clean the board with an SOS pad and soapy water.

Use the previously-made mask as a drill guide when drilling out your board.

As you can see, this is a very inexpensive way to reproduce professional circuit boards. The contact paper also can be used to make decals for panels or meter scales, even in color. Naturally, the edges should be sealed with a little clear urethane to keep them from lifting. ■

Electronic Dice—a Family Pleaser

—Las Vegas, look out!

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Looking for an inexpensive, easy construction project which can be used by the whole family? Try "electronic dice" for a fun project with no hassle, no hard-to-get parts, and quick assembly in an evening or two. With its small size and complete portability, this goof-proof project was an instant hit and has been in nearly continuous use since it was eagerly snatched off the bench by my avid 14-year-old "war-gamer."

The schematic diagram, Fig. 1, shows the simplicity of the completed project. U1b is configured as a simple gated oscillator, its frequency being determined by R4 and C1. The output of the oscillator is fed directly to a programmable counter, U2, whose BCD output goes to U3, a single-chip latch, decoder, and 7-segment LED driver for a common-cathode display. U2 and U3 are repeated at U4 and U5 for the second digit. Additional digits can be added as indicated, with each digit representing one die.

Operation is very simple: U1b oscillates at a very high frequency (about 50 kHz) for as long as the dice are being "rolled" by depressing S1. U2 is programmed by DP1-DP4 (pins 2, 5, 11, and 14) to count downward from 6 to 1 with each input clock-pulse. When U2 reaches digit 1, the next clock pulse resets the counter to 6 instead of continuing to 0, and the count continues to recirculate downward through only the digits 6 to 1. At some random time when you release S1, the clock stops and the count is displayed. Randomness is ensured by keeping the clock frequency very high in comparison with the number of times per second you could manually depress and release S1.

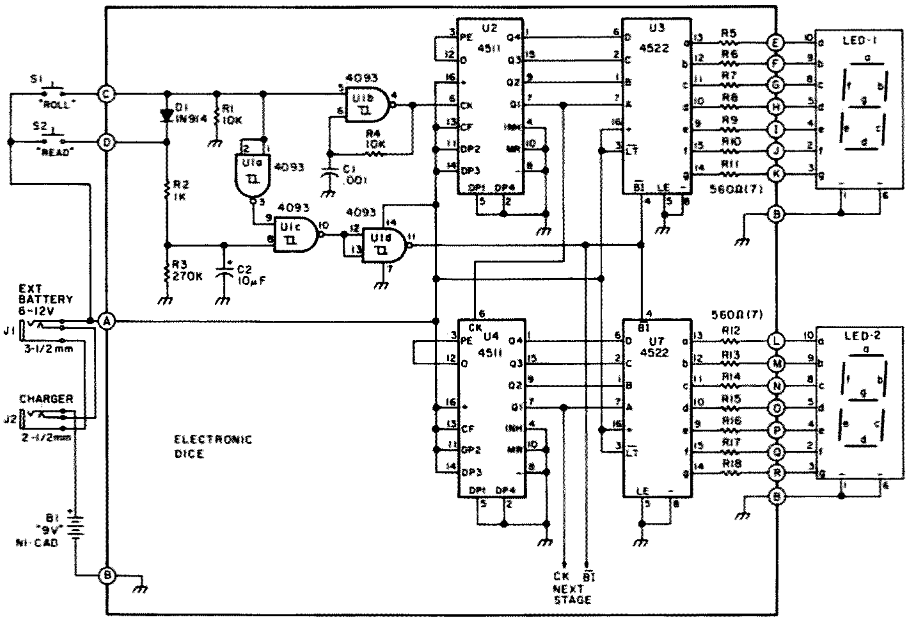

Fig. 1. Schematic diagram.

After S1 is released, the display will stay lighted for about four seconds and then go out to conserve battery power. This time delay is generated by the time the charge on C2 takes to decay through R3 to the lower trip voltage of Schmitt trigger U1c. Depressing S2 recalls the last digit rolled by restoring the charge on C2, and the display will remain lighted for another four seconds after S2 is released.

When adding more display digits to the two shown in Fig. 1, any of the four BCD output lines of the pro-

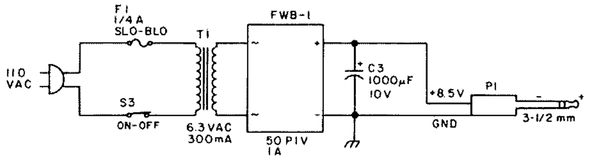

Fig. 2. Nine-volt battery eliminator (0-100 mA).

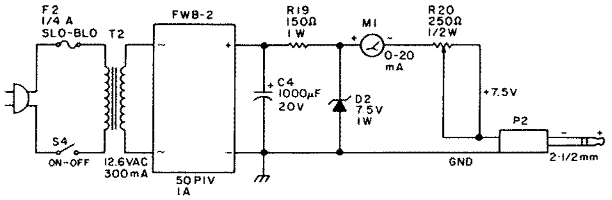

Fig. 3. "Nine-volt" nicad charger.

grammable counter can be used for the clock input of the next digit's counter. Although this divides the input clock frequency, the basic oscillator, U1b, is operating at a frequency high enough to ensure randomness in many succeeding counter stages. However, it is important that a counter-input clock signal be derived from one of the outputs of the preceding counter stage (pins 1, 7, 9, or 15), not its input (pin 6), since otherwise the counters would be clocking at the same frequency and there would be no randomness whatsoever in the displayed digits.

Note the absence of an on-off switch. Since all ICs are CMOS, idle current drain is negligible (about 0.005 microamps!) unless the displays are lighted. The drain is then just under 100 mA, maximum, which obviously is the reason why the four-second display feature was incorporated. Although a 9-V nicad (actually 7.2 V) transistor radio battery was used to permit recharging after a particularly furious day of wargaming, a standard inexpensive 9-V battery could be used equally as well and could be connected directly to point A (if no external power source is desired) or to the center pin of J1 (if an external power source is desired).

J1 is a 3½-mm jack to allow the electronic dice to be powered from an external battery or power supply. The simple power supply shown in Fig. 2 was constructed in a minibox 1½" high by 2" wide and 4" deep. It powers not only the electronic dice, but also a few thousand other gadgets around the house which use 9-V transistor batteries, such as the Little Professor Mathbox™, Mattell's electronic football game, calculators, radios, etc. It's really a battery-saver (money-saver)!

J2 is a 2½-mm earphone jack to allow charging the nicad inside the electronic dice cabinet. The 9-V nicad used is actually rated at 7.2-7.8 volts and requires 7-10 mA charging current for 16 hours. An inexpensive nicad charger could have been built, as shown schematically in Fig. 3, but the simplest, easiest, and cheapest way to recharge the nicad is to connect it to a current-regulated power supply as shown in Fig. 4 and adjust the current and voltage controls for the minimum required to supply 10 mA to the nicad. The earphone jack for the charger (J2) was purposely made smaller than the external Vcc jack, J1, on all our "toys" to make external hookups as "kid-proof" as possible.

The entire circuit shown in Fig. 1 was constructed on a scrap of perfboard about 1½" × 2" using IC sockets and point-to-point wiring. The perfboard is mounted on two 3/4" #2 bolts, with three nuts under the perfboard to provide some spacing between it and the chassis. Component leads themselves can provide good attachment points for the ribbon cable to the displays and for the wires to the jacks on the rear panel, S1 and S2 (see Fig. 5). An inexpensive clip-holder for the battery is bolted to the chassis bottom with #2 hardware. The cabinet used gives a nice finished appearance, as do the use of a panel-mounted display assembly and bezel, although these certainly are not necessary.

After being in near-constant use for the last few months on both the external power supply and the internal nicad, I'm glad I included the option. The electronic dice themselves have instant kid appeal, and the nicad permits complete portability. The only gripe I've had with this project is that initially I made up only one unit! Try it; you'll like it, too! ■

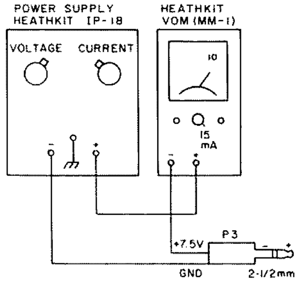

Fig. 4. Alternative 9-V nicad charger.

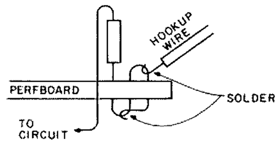

Fig. 5.

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Fun with Foozle

Here's a fun little construction project that will challenge your logic abilities for many hours at a time. It's inexpensive to build, easy to operate, and totally engrossing. I call it "Foozle."

The game is built around a 7-segment LED readout and seven push-buttons. The object of the game is to start with all segments off, and then, by pressing one push-button at a time, to turn all the segments on, find a different sequence which will turn all segments off, and then find a third sequence which will turn them all on again. There are two catches, however. The first is that each push-button controls more than one segment at a time; whether the segments turn on or off depends on whether they were on or off before the button was pushed. The second catch is that the first and third sequences which turn on all the segments cannot be the same (the logic won't permit it)!

Your assignment, should you choose to accept it, is first to figure out the logic of which segments are controlled by each push-button and then to figure out the minimum number of push-button depressions in each of the three sequences which will take you from all segments off to all on, back to all off, and finally back to all segments on. The START pushbutton initializes the display by turning all segments off and resetting all the logic gates.

Although the logic principles of Foozle can be figured out easily from Fig. 1 (if you want to cheat before the unit is built), the

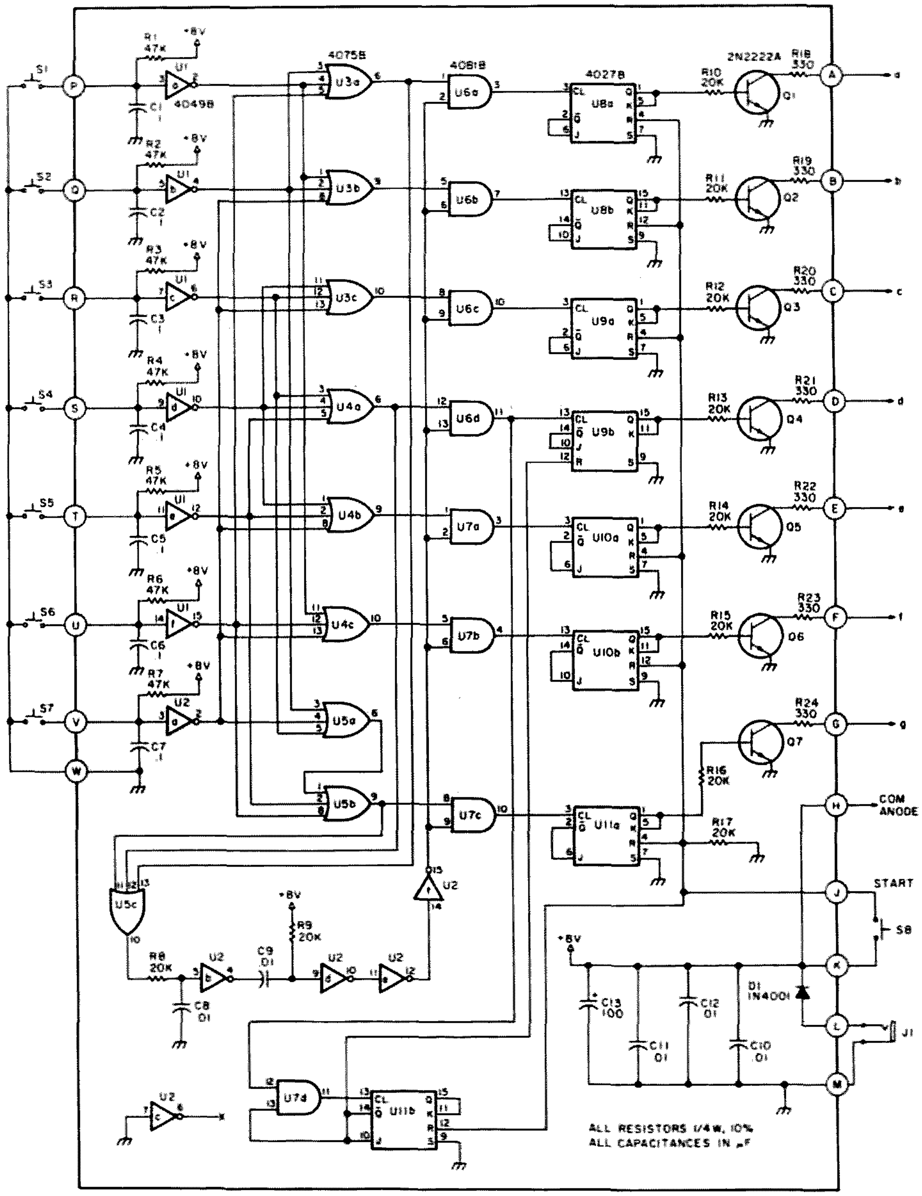


Fig. 1. Schematic diagram.

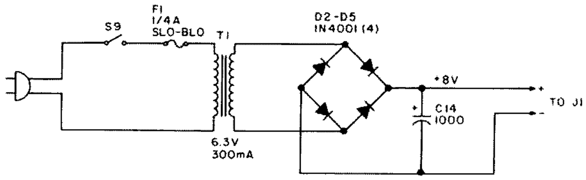
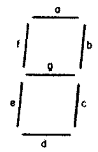


Fig. 2. Power supply.



SEGMENT	PIN
+	14
a	1
b	13
c	10
d	8
e	7
f	2
g	11

Fig. 3. 7-segment display (common-anode).

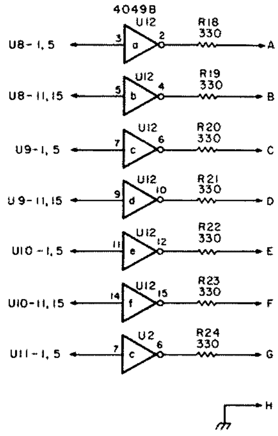


Fig. 4. Alternate common-cathode display drivers.

minimum number of steps in each sequence is not so obvious, and I'm not going to give you any help there. What good is a game if there is no challenge to it?

The logic is, of course, hard-wired and does not have any variation from game to game unless you want to interchange two or more push-button leads or 7-segment display leads later on. However, should you happen to stumble across a sequence of steps which does "win," the chances are that you won't remember them all, since there are an infinite number of sequences. The chances are even greater that the sequence you stumbled across was not the one having the minimum number of steps!

What the circuit does is change the logic state of selected segments when certain push-buttons are pressed. The seven input inverters serve to debounce the push-buttons; the U3, U4, U5a, and U5b gates serve as logic encoders that determine which segments are controlled by which push-buttons. With each push-button depression, a single positive-going pulse is generated by U2b and U2d. This pulse is fed to all AND gates, U6, U7a, U7b, and U7c; however, only those AND gates selected by the encoding logic of U3, U4, U5a, and U5b are enabled to allow the pulse to go to flip-flops U8, U9, U10, and U11a. These are J-K flip-flops configured for alternate action: Each pulse on the clock input causes that flip-flop to change state. When the Q output of each flip-flop goes to logic 1, its corresponding driver transistor is saturated, allowing current to flow through that segment of the readout display. Depressing S8 resets all flip-flops so that all Q outputs are logic zero; this cuts off all transistors and turns all the display segments off.

The unit shown was mounted in a standard LMB enclosure about 2″ × 3½″ × 6″. The common-anode 7-segment readout was cemented onto a small piece of perfboard, which then was cemented to the cabinet. The eight push-buttons then were installed and hookup wires connected to them and to the display leads (see Fig. 3). All the basic logic circuitry of Foozle was built up on a separate perfboard about 2½″ × 5½″ and mounted on four #4 bolts 1½″ long. The wires from the push-buttons and display were then connected to the logic board. Finally, a 3½-mm earphone jack was added for supply of power to the entire unit.

Since the game is completely CMOS, current drain with all segments off is on the order of microamps. Any power source from 6-12 volts capable of delivering up to about 80 mA (at 6 volts) to 130 mA (at 12 volts) will be adequate. The standard Radio Shack battery eliminators work very well for this game. D1 was added just to make sure that no damage is done if the supply polarity gets reversed unintentionally.

One final circuit note: If you wish, the 7 driver transistors can be eliminated and replaced with the circuit shown in Fig. 4. This saves seven transistors and seven resistors; however, a common-cathode display must then be used. I built the circuit up as shown in Fig. 1 since I had the required parts on hand.

Well, if you've read this far, the chances are that you've accepted the challenge and are willing to spend an evening or two building it up. One word of caution, though: It probably will take much longer than that to get the minimum number of steps in each sequence down pat! (Hint: The minimum number of push-button depressions for each of the three sequences is less than 12. Would you believe less than 10? Than 8?) Don't get too frustrated; if you feel you're about ready to self-destruct, take another hard look at the schematic and think about it for a minute! ■

The Demise of Component Stores

—parts places are past their prime

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Each time I drive past Peter's Wholesale Electronics, I slow down, almost reverently, and permit myself aged but fond memories.

Those were the days—decades ago, it seems—when we would rummage through the barrels of tubes and transformers and capacitors, searching for the bargains, and then laboriously spend hours transforming them into some useful contribution to amateur radio. In those days, Peter himself would wait on us, offering advice on parts substitutions, searching for some requested, exotic item, and answering our questions about the new gear on the shelves. We would elbow up to the counter amidst the TV repairmen, and Peter would patiently wait as we spent our pittance, never once complaining about how our two-dollar orders might be interfering with his regular trade.

Times have changed of course. Peter graduated himself to an office upstairs, hired a flock of yearlings to tend the store, had a tendency to ignore his ham radio customers, and devoted his attention to the industrial trade. Can't really blame him, though—a guy's got to make a living—but it surely would be nice if it were easier to obtain parts nowadays.

And I've changed. I'm an appliance operator now, and I know it. I have lists of cliche-type arguments justifying my demise: lack of time, the difficulty in trying to keep up with technology, family responsibilities, career pressures . . . Still, I have those memories to recall: the late hours spent hunched over the workbench, the ecstatic joy of discovery when a project actually worked.

My amateur radio interest has been waning and my involvement has become stifled and stereotyped: regular rag chewing on 75, occasional DX-chasing on 20, semiconscious activity on 2-meter FM.

Why not, I asked myself, get back to building? Why not, I said, face the obstacles, overcome them, and return to the joy of home-brewing?

It didn't take long for a project to come to mind. I needed a keyer, and just a short time ago *73* ran an excellent construction article on one, complete with dot memory, automatic spacing . . .

A few days later, I presented myself at the store armed with a list of the parts my junk box lacked, bursting with novice-like enthusiasm.

As I approached the counter the clerk took a look at me and said, "Be with you in a minute," and sidestepped me in favor of a TV repairman. Be humble, I told myself.

That clerk never did return; finally, one of his colleagues approached me with raised and questioning eyebrows.

"Peter around?" I asked, knowing what the answer would be, yet hoping that the fact that I knew the boss might influence the service and pricing I would get.

"Nah," was the reply. "He's playing golf."

I should have known. Ever since Peter got rich, that's all he does—play golf. (Except in the winter; then he takes extended vacations.)

"Need some parts," I said, extracting the list from my pocket. The clerk's eyebrows shot up in despair. Quickly I added, "Just a few."

I gave him the size for a small cabinet to house my

keyer. He shook his head. "We don't stock cabinets anymore," he said. "Too many sizes. We just order them on request. Takes about six weeks to get 'em."

I shrugged. "How about a miniature 1000-Ohm pot?" I requested.

He glanced on a shelf behind him. "Sorry," he said, "We're out. They're back-ordered."

"Really?"

"Yup. Happens all the time."

"I need a couple of ½-Watt, 22-Ohm resistors," I said.

He nodded and disappeared, returning with a bin and a confused look. "These things are all mixed up," he groaned. "Let's see," he mused, "if I can figure this out without looking at the chart. Would it be red, red . . black or brown?" "Brown," I said frowning, and then I realized my mistake. But it was too late; he already had plucked my choice from the bin and I couldn't admit my error. Perhaps I might be able to find them in the junk box after all.

"A 6.3-volt transformer, about 200 mA," was my next request.

He returned with what would appear as a monster in a keyer circuit. "It's the closest I have," he offered. "One Amp."

"Well, maybe I can get the power from the exciter," I said.

"I don't think we stock them," he said.

"What?"

"Exciters," he replied, solemnly.

I wanted to cry. "Never mind," I replied. "I'll skip the transformer. How about a half-dozen zero-one bypasses, low voltage?"

He returned the transformer to stock, lifted a blister-pack from a shelf, and tossed it to me.

"I don't need all those," I pleaded.

"There's only twenty-five," he said.

"But I need only six."

"Well, the package will cost you two bucks. If I break it, I have to charge you twenty cents each, so that's a buck-twenty."

I sighed and nodded my agreement, then gave him my list of semis. He disappeared behind a wall, reappearing with a package of universal replacements.

"Don't you have the originals, the jedec numbers?" I asked.

He frowned at me. "Do you know how many transistors there are? The numbers you want are back-ordered. But these will work OK." Then he added, "Of course you know we don't guarantee transistors?"

I cringed. "Could I order the original numbers?"

It was his turn to cringe. "I guess . . ." he replied, not very convincingly. "But we have a twenty-five dollar minimum invoice charge."

"Twenty-five dollars!" He smiled, and grudgingly I agreed. "Order them."

He reached under the counter, but his hand came up empty. Again he disappeared, this time returning with a sheepish grin. "You won't believe this, but we're out of order forms. *They're* back-ordered. Let me get a pad of blank paper and I'll take your order."

As I waited, my eyes wandered about the store, comparing its image with the vision of yesteryear. In the corner, with the few remaining pieces of ham gear Peter stocked, I spotted an old Hallicrafters TO keyer. I could remember reading the ads for them years ago and wishing I had one.

"How much?" I asked the clerk when he returned, pointing to the keyer.

He thought for a moment, then shrugged. "Fifteen bucks?"

Without hesitation I replied, "Sold!" ■

✓ Reader Service—see page 210

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Atkinson NH 03811

Priority Frequency Power-Up for the FT-227R

—the right place, first time, every time

Tired of finding your FT-227R on 147.000 MHz each time you bump the cigarette lighter plug? Would you like the Memorizer to come on at your favorite frequency? Read on to discover two methods to the same end.

Caution: Your Memorizer contains CMOS logic elements (ICs) which are susceptible to permanent damage due to static discharge. Check your pencil soldering iron with an ohmmeter to ensure that the tip is grounded (connected to the third wire of the plug). If not, this is the time to update this very important tool.

With both methods, the PLL counter is preset to your favorite frequency each time the Memorizer is turned on. (Consult Fig. 8 on page 19 of your manual.) As +5 volts rises from 0 to +5, C702 (with R702) produces a positive pulse to pin 1 of Q707, Q708, and Q709. This is the preset strobe input of the up/down counter. Presetting establishes the initial frequency, depending on the voltage level applied to pins 3, 4, 12, and 13. If the input level is low (0 volts), the counter stage will be set to a "zero." Conversely, if the input level is high (+5 volts), the counter stage will be set to a "one." Note that these inputs on Q707 and Q708 are connected to ground so that both the 100-kHz digit and 10-kHz digit are reset, i.e., set to zero. By inspection, you will note that pins 3, 4, and 12 of Q709 are also ground, but pin 13 of Q709 is connected to +5 volts. If you check the Q308 Code Chart on page 36, you will find that this corresponds to bit P11 and results in 7 MHz. To alter this start-up frequency, it is simply a case of removing the appropriate grounded inputs and connecting them through a "pull-up" resistor to +5 V.

Should you be fortunate enough to have only one favorite frequency, or want to minimize your cost, follow method 1. On the other hand, if you want switching capability to allow changes in frequency quickly and easily, follow method 2.

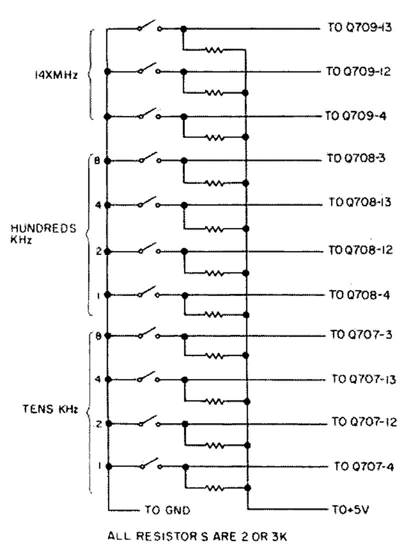

Fig. 1.

Method 1

In this method, locate the "ones" in Table 1. Using a sharp pair of small cutters, cut these pins on the component side of the PLL board between the chip and the board. Cut the pins as close to the board as possible. Then carefully bend each of these pins up from the board so that they are pointing up from the chips. Carefully connect each of these cut pins together with jumper wire, and then connect a resistor (2k or higher) from the jumper wire to +5 volts. If you have selected any MHz value other than 7 (144, 145 or 146 MHz), it

will be necessary to remove the +5 volts which Yaesu connected to Q709 pin 13. Clip this pin in the same manner, and connect a jumper wire from it to ground.

Method 2

Cut and bend up Q707 and Q708 pins 3, 4, 12, 13, and Q709 pins 4, 12, and 13.

Cement 11 SPST switches (mini dip-switches) to a piece of Vectorboard® cut to fit in the tone squelch area. Note that the pins presently located in this area will line up with holes in the vectorboard. Solder a wire to one side of each of these switches. The other end of this wire will be attached to ground. Connect one end of a "pull-up" resistor (2k or higher) to the opposite end of each switch. Bus the opposite end of each of these resistors together and connect to +5 volts. Connect a wire from the junction of the resistor and each switch to the pin indicated in Fig. 1.

Slip the vectorboard assembly over the pins in the tone squelch area. It can be secured easily by twisting one turn of wire on two of these pins above the vectorboard and soldering the wires to the pins.

Consult Table 1 for switch settings. A logic 1 is an open switch.

Observation of the frequency versus bit-pattern of the 100-kHz and 10-kHz switch banks will reveal that the coding is binary-coded decimal (BCD). Obviously, the same pattern exists in part for the MHz bank. If you attempt to set the MHz bank to an invalid frequency such as 143 or 149 MHz, the PLL will not lock up and the display will indicate one of two images. If the attempted frequency is lower than 144 MHz, the MHz digit will be blank. If the attempted frequency is higher than 145 MHz, the display will read 9.XXX, where X is a valid digit. However, the entire display will blink.

A convenient method for simulating power-on cycles consists of momentarily shorting out capacitor C702. By setting each switch on, one by one, starting with the right-hand switch in each decade (bank), followed by shorting out C702 while power is applied, you will rapidly check your success. With all switches closed, the display will show .000. Opening the right hand switch of each decade will change that decade display to 1. The next switches have the value of 4 and 8 respectively.

Follow the chart to your favorite frequency.■

Digit	Q709-Pin 13	Q709-Pin 12	Q709-Pin 4	Q708-Pin 3	Q708-Pin 13	Q708-Pin 12	Q708-Pin 4	Q707-Pin 3	Q707-Pin 13	Q707-Pin 12	Q707-Pin 4
0	Not Used			0	0	0	0	0	0	0	0
1	Not Used			0	0	0	1	0	0	0	1
2	Not Used			0	0	1	0	0	0	1	0
3	Not Used			0	0	1	1	0	0	1	1
4	0	0	1	0	1	0	0	0	1	0	0
5	0	1	0	0	1	0	1	0	1	0	1
6	0	1	1	0	1	1	0	0	1	1	0
7	1	0	0	0	1	1	1	0	1	1	1
8	Not Used			1	0	0	0	1	0	0	0
9	Not Used			1	0	0	1	1	0	0	1
	MHz			100 kHz				10 kHz			

Table 1. 1 = +5 volts; 0 = 0 volts.

Computerize Your Contest Paperwork

—two BASIC programs do it all

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Are you a contest operator? Have you been assigned as a Field Day Chairman? If the answer to either question is yes, this article is for you! The two BASIC programs presented here will check for duplicate contacts, alphabetize, and print results in a form acceptable to most contest managers. You don't own a microcomputer? I don't either. I bet you can find someone who does.

```
0005 REM AMATEUR CALL DUP CHECK AND SAVE PROGRAM
0006 REM WRITTEN BY BERNARD HOHMAN WA8WIA
0007 REM REVISED JULY 20, 1978
0008 REM SWTP 8K BASIC VER. 2.0
0010 POKE( 62,6)
0015 LINE= 100
0020 DIM D$(60),E$(80),F$(130),G$(120),H$(30)
0025 DIM I$(10),J$(20),K$(130),L$(120),M$(75)
0028  D$(1)="0":E$(1)="0":F$(1)="0":G$(1)="0":H$(1)="0"
0029  I$(1)="0":J$(1)="0":K$(1)="0":L$(1)="0":M$(1)="0"
0060 PRINT "ENTER DATA";CHR$(17);
0065 INPUT B$
0066 PRINT CHR$(19)
0080 IF B$="RECORD" THEN GOTO 2100
0090  V$=MID$(B$,2,1)
0100 IF V$>"9" THEN 155
0112 LET R=VAL(V$)
0113 IF R=0 THEN R=10
0120 ON R GOTO 200,300,400,500,600,700,800,900,1000,1100
0155  V$=MID$(B$,3,1):IF V$<="9" THEN 100
0160 PRINT B$;" IS AN INVALID CALL":GOTO 60
0200 FOR D1=1 TO 500
0210 IF D$(D1)="0"THEN 240
0220 IF D$(D1)=B$THEN PRINT"DUP":GOTO 60
0230 NEXT D1
0240  D$(D1)=B$:D$(D1+1)="0":PRINT D$(D1),D1:GOTO 60
0300 FOR E1=1 TO 500
0310 IF E$(E1)="0"THEN 340
0320 IF E$(E1)=B$ THEN PRINT"DUP":GOTO 60
0330 NEXT E1
0340  E$(E1)=B$:E$(E1+1)="0":PRINT E$(E1),E1:GOTO 60
0400 FOR F1=1 TO 500
0410 IF F$(F1)="0"THEN 440
0420 IF F$(F1)=B$ THEN PRINT"DUP":GOTO 60
0430 NEXT F1
0440  F$(F1)=B$:F$(F1+1)="0":PRINT F$(F1),F1:GOTO 60
0500 FOR G1=1 TO 500
0510 IF G$(G1)="0"THEN 540
0520 IF G$(G1)=B$ THEN PRINT"DUP":GOTO 60
0530 NEXT G1
0540  G$(G1)=B$:G$(G1+1)="0":PRINT G$(G1),G1:GOTO 60
0600 FOR H1=1 TO 500
0610 IF H$(H1)="0" THEN 640
0620 IF H$(H1)=B$ THEN PRINT"DUP":GOTO 60
0630 NEXT H1
0640  H$(H1)=B$:H$(H1+1)="0":PRINT H$(H1),H1:GOTO 60
0700 FOR I1=1 TO 500
0710 IF I$(I1)="0" THEN 740
0720 IF I$(I1)=B$ THEN PRINT"DUP":GOTO 60
0730 NEXT I1
0740  I$(I1)=B$:I$(I1+1)="0":PRINT I$(I1),I1:GOTO 60
0800 FOR J1=1 TO 500
0810 IF J$(J1)="0" THEN 840
0820 IF J$(J1)=B$ THEN PRINT"DUP":GOTO 60
0830 NEXT J1
0840  J$(J1)=B$:J$(J1+1)="0":PRINT J$(J1),J1:GOTO 60
0900 FOR K1=1 TO 500
0910 IF K$(K1)="0" THEN 940
0920 IF K$(K1)=B$ THEN PRINT"DUP":GOTO 60
0930 NEXT K1
0940  K$(K1)=B$:K$(K1+1)="0":PRINT K$(K1),K1:GOTO 60
1000 FOR L1=1 TO 500
1010 IF L$(L1)="0" THEN 1040
1020 IF L$(L1)=B$ THEN PRINT"DUP":GOTO 60
1030 NEXT L1
1040  L$(L1)=B$:L$(L1+1)="0":PRINT L$(L1),L1:GOTO 60
1100 FOR M1=1 TO 500
1110 IF M$(M1)="0" THEN 1140
1120 IF M$(M1)=B$ THEN PRINT"DUP":GOTO 60
1130 NEXT M1
1140  M$(M1)=B$:M$(M1+1)="0":PRINT M$(M1),M1:GOTO 60
2100 PRINT CHR$(18):Q=10
2110 FOR V1=1 TO 50:NEXT V1
2120  Q=Q-1
2125 IF Q=0 THEN Q=10
2130 FOR V=1 TO 100
2140 FOR V2=1 TO 50:NEXT V2
2150 ON Q GOTO 2200,2300,2400,2500,2600,2700,2800,2900,3000,3100
2160 NEXT V
2200 IF D$(V)="0"THEN 2120
2210 PRINT D$(V):GOTO 2160
2300 IF E$(V)="0"THEN 2120
2310 PRINT E$(V):GOTO 2160
2400 IF F$(V)="0"THEN 2120
2410 PRINT F$(V):GOTO 2160
2500 IF G$(V)="0"THEN 2120
2510 PRINT G$(V):GOTO 2160
2600 IF H$(V)="0"THEN 2120
2610 PRINT H$(V):GOTO 2160
2700 IF I$(V)="0"THEN 2120
2710 PRINT I$(V):GOTO 2160
2800 IF J$(V)="0"THEN 2120
2810 PRINT J$(V):GOTO 2160
2900 IF K$(V)="0"THEN 2120
2910 PRINT K$(V):GOTO 2160
3000 IF L$(V)="0"THEN 2120
3010 PRINT L$(V):GOTO 2160
3100 IF M$(V)="0"THEN 3200
3110 PRINT M$(V):GOTO 2160
3200 PRINT CHR$(20):GOTO 60
3300 END
```

Fig. 1. Program 1 listing.

For a number of years I have had the job of preparing Field Day forms (dupe check sheets) for submission. Even before the June, 1978, event, I started thinking that there ought to be a better way to process the logs. Why not a microcomputer? I was aware that Dick Wright owned an SWTP system, so I called him and introduced myself.

Dick did not have much experience in handling strings (alphanumeric characters), and I had never written a computer program in my life. I explained that I was willing to learn the language, so he lent me his BASIC manual and I began one of the more challenging and satisfying experiences in my life (I am now a confirmed computer freak). Dick and I spent at least ten long July nights developing the programs to do the manipulations I wanted, and these two BASIC programs are the result.

Dick's system included: SWTPC 6800, AC-30, CT-1024, KSR 33, 16K RAM, and 8K BASIC Version 2.0. We had only 8K of available memory, so neither program is documented with instructions or REM statements. We found 500 string variables (calls) impossible to process in 8K of RAM without two programs and the POKE(62,6) trick published in *Kilobaud* (#19, July, 1978, "Little Bits"). Thanks, Dale, you saved our lives!

Although the data was already on log sheets, the first program was written so that it could be used during a contest. It checks for duplicate contacts, places calls in ten different lists, and then records the valid data on cassette for processing by Program 2 later. Program 2 takes the data from cassette, alphabetizes the calls, and prints the lists for submission.

Program 1

Subscript string processing is rather slow when checking a single list of 500 plus contacts for duplicates, so I assigned a different subscript string for each of the ten call areas: D$(D1) for the 1s, E$(E1) for the 2s, and so on. By using this routine, only the calls in the area of interest will be searched for duplicates. You will have to redimension the arrays in lines 20 and 25 according to an estimate of the contacts you will be making with each of the call areas from your location. As listed, lines 20 and 25 allow sufficient memory for contacts on 40 meters from northwest Ohio.

Since the number in a call always appears in position two or three of the call, the MID$ function was put to good use. Lines 60 through 160 decide which list to search for duplicates, and then the computer jumps to that routine. If a duplicate is found, DUP is printed, and the computer again prompts with INPUT DATA? It's easy to make a mistake at 3 am. If that happens, use CTRL C to get out of the program. In the direct mode (no line numbers), make the subscript string variable in error equal to "@".

For example, an error in call area three, position 22, can be corrected by entering LET F$(22)="@": GOTO 60; and then you are ready to enter the next call. In order to know which string to change, I suggest you write D$=1, E$=2, F$=3 . . . M$=0 on a piece of paper for reference. Lines 200 through 1150 are the dupe find routines.

When all the calls have been entered, it's time to record the calls on cassette for processing by the sec-

```
ENTER DATA? K3DZV

K3DZV              100
ENTER DATA? K3YEW

DUP
ENTER DATA? K9AOM

DUP
ENTER DATA? W8MVE

W8MVE              62
ENTER DATA? K8DFX

K8DFX              63
ENTER DATA? K4WJJ

K4WJJ              79
ENTER DATA?
READY
#LETG$(78)="@"

READY
#GOTO60
ENTER DATA? K4WJ

K4WJ               78
ENTER DATA? K4KA

K4KA               79
ENTER DATA? WB4NTA

WB4NTA             80
ENTER DATA? RECORD


K9U@N
N9IF
WA9AEK
W9LRG
WB9TXO
K9EYA
W9CEQ
W9GL
W9DQA
N9RD
W9IC



ENTER DATA? WBOY

WBOY IS AN INVALID CALL
ENTER DATA?
```

```
ENTER DATA? K3DZA

K3DZA              101
ENTER DATA? W8MVB

W8MVB              64
ENTER DATA? K3YEW

DUP
ENTER DATA? K9AOM

DUP
ENTER DATA? KBOY

KBOY IS AN INVALID CALL
ENTER DATA? K8@Y

K8@Y               65
ENTER DATA? W8MVB

DUP
ENTER DATA? K4WJJ

K4WJJ              81
ENTER DATA?
READY
#LETG$(81)="@"

READY
#GOTO60
ENTER DATA? K4WJG

K4WJG              81
ENTER DATA? REVORD

REVORD IS AN INVALID CALL
ENTER DATA? RECORD


K9U@N
N9IF
WA9AEK
W9LRG
WB9TXO
K9EYA
W9CEQ
W9GL
```

Fig. 2. Program 1 sample run.

```
0005 REM AMATEUR CALL SORT AND PRINT PROGRAM
0006 REM WRITTEN BY BERNARD HOHMAN VA8VIA
0007 REM REVISED JULY 24, 1978
0008 REM SWTP 8K BASIC VER. 2.0
0010 POKE( 62,6)
0015 LINE= 100
0020 DIM D$(60),E$(80),F$(130),G$(120),H$(30)
0025 DIM I$(10),J$(20),K$(130),L$(120),M$(75)
0060 PRINT "ENTER DATA";CHR$(17);
0065 INPUT B$
0066 PRINT CHR$(19)
0080 IF B$="PRINT" THEN 1220
0085 IF B$="SORT" THEN 250
0090  V$=MID$(B$,2,1)
0100 IF V$>"9" THEN 155
0112 LET R=VAL(V$)
0113 IF R=0 THEN R=10
0121 IF R=1 THEN DI=DI+1:D$(DI)=B$
0122 IF R=2 THEN EI=EI+1:E$(EI)=B$
0123 IF R=3 THEN FI=FI+1:F$(FI)=B$
0124 IF R=4 THEN GI=GI+1:G$(GI)=B$
0125 IF R=5 THEN HI=HI+1:H$(HI)=B$
0126 IF R=6 THEN II=II+1:I$(II)=B$
0127 IF R=7 THEN JI=JI+1:J$(JI)=B$
0128 IF R=8 THEN KI=KI+1:K$(KI)=B$
0129 IF R=9 THEN LI=LI+1:L$(LI)=B$
0130 IF R=10 THEN MI=MI+1:M$(MI)=B$
0132 GOTO 60
0155  V$=MID$(B$,3,1):IF V$<="9" THEN 100
0160 PRINT B$;" IS AN INVALID CALL":GOTO 60
0250 IF DI<2 THEN 295
0255 FOR N=1 TO DI-1
0260 FOR K=N+1 TO DI
0265 IF D$(N)<D$(K) THEN 285
0270  X$=D$(N)
0275  D$(N)=D$(K)
0280  D$(K)=X$
0285 NEXT K
0290 NEXT N
0295 PRINT "1'S SORTED"
0350 IF EI<2 THEN 395
0355 FOR N=1 TO EI-1
0360 FOR K=N+1 TO EI
0365 IF E$(N)<E$(K) THEN 385
0370  X$=E$(N)
0375  E$(N)=E$(K)
0380  E$(K)=X$
0385 NEXT K
0390 NEXT N
0395 PRINT "2'S SORTED"
0450 IF FI<2 THEN 495
0455 FOR N=1 TO FI-1
0460 FOR K=N+1 TO FI
0465 IF F$(N)<F$(K) THEN 485
0470  X$=F$(N)
0475  F$(N)=F$(K)
0480  F$(K)=X$
0485 NEXT K
0490 NEXT N
0495 PRINT "3'S SORTED"
0550 IF GI<2 THEN 595
0555 FOR N=1 TO GI-1
0560 FOR K=N+1 TO GI
0565 IF G$(N)<G$(K) THEN 585
0570  X$=G$(N)
0575  G$(N)=G$(K)
0580  G$(K)=X$
0585 NEXT K
0590 NEXT N
0595 PRINT "4'S SORTED"
0650 IF HI<2 THEN 695
0655 FOR N=1 TO HI-1
0660 FOR K=N+1 TO HI
0665 IF H$(N)<H$(K) THEN 685
0670  X$=H$(N)
0675  H$(N)=H$(K)
0680  H$(K)=X$
0685 NEXT K
0690 NEXT N
0695 PRINT "5'S SORTED"
0750 IF II<2 THEN 795
0755 FOR N=1 TO II-1
0760 FOR K=N+1 TO II
0765 IF I$(N)<I$(K) THEN 785
0770  X$=I$(N)
0775  I$(N)=I$(K)
0780  I$(K)=X$
0785 NEXT K
0790 NEXT N
0795 PRINT "6'S SORTED"
0850 IF JI<2 THEN 895
0855 FOR N=1 TO JI-1
0860 FOR K=N+1 TO JI
0865 IF J$(N)<J$(K) THEN 885
0870  X$=J$(N)
0875  J$(N)=J$(K)
0880  J$(K)=X$
0885 NEXT K
0890 NEXT N
0895 PRINT "7'S SORTED"
0950 IF KI<2 THEN 995
0955 FOR N=1 TO KI-1
0960 FOR K=N+1 TO KI
0965 IF X$(N)<K$(K) THEN 985
0970  X$=K$(N)
0975  K$(N)=K$(K)
0980  X$(K)=X$
0985 NEXT K
0990 NEXT N
0995 PRINT "8'S SORTED"
1050 IF LI<2 THEN 1095
1055 FOR N=1 TO LI-1
1060 FOR K=N+1 TO LI
1065 IF L$(N)<L$(K) THEN 1085
1070  X$=L$(N)
1075  L$(N)=L$(K)
1080  L$(K)=X$
1085 NEXT K
1090 NEXT N
1095 PRINT "9'S SORTED"
1150 IF NI<2 THEN 1195
1155 FOR N=1 TO MI-1
1160 FOR K=N+1 TO MI
1165 IF M$(N)<M$(K) THEN 1185
1170  X$=N$(N)
1175  M$(N)=M$(K)
1180  M$(K)=X$
1185 NEXT K
1190 NEXT N
1195 PRINT "0'S SORTED"
1210 GOTO 60
1220 INPUT "ENTER DATE OF FIELD DAY IE: 6,23,78",Z5,Z6,Z7
1230 INPUT "ENTER FIELD DAY CALL USED",A$(2)
1240 INPUT "ENTER BAND WORKED FOR THIS REPORT",A$(3)
1250 INPUT "ENTER MODE OF OPERATION",A$(4)
1255 FOR X=1TO10:PRINT:NEXTX
1260 PRINT "PAGE #1":PRINT:PRINT:PRINT
1270 GOSUB 1700
1300  S=HI
1310 IF DI>S THEN S=DI
1320 IF EI>S THEN S=EI
1330 IF FI>S THEN S=FI
1340 IF GI>S THEN S=GI
1350 FOR T=1 TO S
1360 IF T<=DI THEN PRINT D$(T);
1370 PRINT TAB(16);
1380 IF T<=EI THEN PRINT E$(T);
1390 PRINT TAB(32);
1400 IF T<=FI THEN PRINT F$(T);
1410 PRINT TAB(48);
1420 IF T<=GI THEN PRINT G$(T);
1430 PRINT TAB(64);
1440 IF T<=HI THEN PRINT H$(T);
1445 PRINT
1450 NEXT T
1460 FOR X=1TO10:PRINT:NEXTX
1470 PRINT "PAGE #2":PRINT:PRINT:PRINT
1480 GOSUB 1700
1500  S=II
1510 IF JI>S THEN S=JI
1520 IF KI>S THEN S=KI
1530 IF LI>S THEN S=LI
1540 IF MI>S THEN S=MI
1550 FOR T=1 TO S
1560 IF T<II THEN PRINT I$(T);
1570 PRINT TAB(16);
1580 IF T<JI THEN PRINT J$(T);
1590 PRINT TAB(32);
1600 IF T<KI THEN PRINT K$(T);
1610 PRINT TAB(48);
1620 IF T<LI THEN PRINT L$(T);
1630 PRINT TAB(64);
1640 IF T<MI THEN PRINT M$(T);
1650 PRINT
1655 NEXT T
1656 PRINT :PRINT:PRINT
1657  A=DI+EI+FI+GI+HI+II+JI+KI+LI+MI
1659 PRINT "TOTAL NUMBER OF CONTACTS = ";A
1660 FOR X=1TO10:PRINT:NEXTX
1670 GOTO 60
1700 PRINT TAB(17);
1710 PRINT "AMATEUR RADIO FIELD DAY CONTACT REPORT"
1720 PRINT :PRINT:PRINT
1730 PRINT "DATE ";Z5;"/";Z6;"/";Z7;TAB(20);
1740 PRINT "CALL ";A$(2);TAB(40);
1750 PRINT "BAND ";A$(3);TAB(60);
1760 PRINT "MODE ";A$(4)
1770 FOR X=1TO72:PRINT"-";:NEXTX
1775 PRINT
1780 RETURN
```

Fig. 3. Program 2 listing.

ond program. Set up the cassette interface and the cassette machine for record and enter RECORD. The computer will jump to line 2100 and the valid calls will be saved on tape.

Program 2

The contacts saved on tape by Program 1 are now ready to be used by lines 60 to 160 of Program 2. As in Program 1, the calls are put into ten separate arrays. After all data is loaded, type SORT and the ordering begins. SWTP BASIC is rather slow. To avoid the feeling that something is surely wrong, I had the computer print "1's SORTED", "2's SORTED", etc., after each array has been alphabetized.

After all sorting is completed, type PRINT. The program then jumps to line 1300 and asks for the date, call used, band, and mode. It then prints the calls on two pages with five call areas per page. At the end of page two, the total number of contacts is printed. In Dick's system, his CT-1024, TVT, and KSR 33 are all interfaced with port 1. If you have a different arrangement, you must change the print routine accordingly.

Conclusion

With some changes, the two programs were tried on a TRS-80 Level II 16K and an OSI 1P 8K. If you send

```
ENTER DATA? W8RFZ
ENTER DATA? SORT
1'S SORTED
2'S SORTED
3'S SORTED
4'S SORTED
5'S SORTED
6'S SORTED
7'S SORTED
8'S SORTED
9'S SORTED
Ø'S SORTED
ENTER DATA? PRINT
ENTER DATE OF FIELD DAY IE: 6,23,78? 7,2,79
ENTER FIELD DAY CALL USED? W8XXX
ENTER BAND WORKED FOR THIS REPORT? 4ØM
ENTER MODE OF OPERATION? A3
```

me an SASE, I would be glad to forward the pertinent information to adapt both programs for use with either of the above-named microcomputers.

Don't forget that there are a lot of computer owners out there who are eager to show off their systems and do something worthwhile at the same time. Thanks, Dick, for the use of your system, for the help in programming, and for helping with the development of this article. ■

AMATEUR RADIO FIELD DAY CONTACT REPORT

DATE 7 /2 /79 CALL W8XXX BAND 4ØM MODE A3

K1AM	K2AA	K3BQZ	AA4AA	AA5I
K1AR	K2AZ	K3CSG	AA4AQ	K5DX
K1CE	K2DR	K3CZ	AA4HF	K5FC
K1WEW	K2GE	K3EF	AA4RX	K5JB
K1XR	K2HVR	K3IVO	K4BFG	K5NE
N1OM	K2IH	K3LF	K4BFT	K5OJI
W1BW	K2IJL	K3NJH	K4DQ	K5SLD
W1ECV	K2IZ	K3PI	K4FOY	N5AA
W1HEB	K2KO	K3SSC	K4HEX	N5AU
W1JP	K2PLF	K3SZG	K4HYB	N5CW
W1MV	K2RQA	K3TJM	K4IOT	N5KK
W1QGN	K2VI	K3YBW	K4JK	N5RQ
W1RK	K2YNT	N3AY	K4JUO	N5TT
W1RT	K2ZFV	N3EA	K4NC	W5GD
W1SW	N2HR	N3EI	K4NE	W5HT
W1SY	N2MD	N3FM	K4PJ	W5XX
W1TM	N2NW	N3IC	K4QMH	WA5QGT
W1TR	N2OO	N3KK	K4SE	WB5IFK
W1VW	VE2CRO	N3SB	K4STR	WD5JOT
W1WEO	VE2CWI	VE3AAC	K4UAS	
W1YR	VE2DUB	VE3AC	K4UWH	
WA1KUL	VE2WX	VE3AEA	K4UW	
WA1UBC	VE2XL	VE3AEO	K4VHF	
WA1YGA	W2AA	VE3AWJ	K4VLY	
WA1ZMM	W2AE	VE3BA	K4VX	
WB1ABY	W2CWI	VE3BGA	N4AI	
WB1DXE	W2CXV	VE3BPC	N4DJ	
	W2EEL	VE3CRC	N4EN	
	W2FSL	VE3DEC	N4GA	
	W2GLQ	VE3DIF	N4HR	
	W2GOQ	VE3DNG	N4KG	
	W2GSN	VE3DRT	N4RA	
	W2IJO	VE3EA	N4TM	
	W2KLW	VE3EC	N4UR	
	W2KPV	VE3ECP	VE4BL	
	W2OT	VE3EWN	W4AM	
	W2PGS	VE3FIU	W4BEJ	
	W2PHF	VE3GCB	W4BFB	
	W2RCX	VE3HIB	W4BKM	
	W2RR	VE3IBH	W4ETI	
	W2SB	VE3IBM	W4CC	
	W2SV	VE3IHZ	W4DV	
	W2VA	VE3MRC	W4FEG	
	W2YNT	VE3NAR	W4FM	
	W2YV	VE3NSR	W4IKR	
	W2ZJ	VE3ORC	W4KOW	
	W2ZQ	VE3OW	W4LEN	
	W2ZV	VE3PRC	W4NYK	
	WA2DEB	VE3RAL	W4POX	
	WA2IUC	VE3RAM	W4POP	
	WA2JAS	VE3RC	W4TP	
	WA2NSM	VE3RPT	W4TEC	
	WA2QME	VE3SOO	W4UR	
	WA2TGW	VE3TC	W4XD	
	WA2ZYX	VE3UE	W4XQ	
	WB2BHX	VE3UOT	W4YJ	
	WB2EOK	VE3VFK	W4YKH	
	WB2GPN	VE3VM	W4ZCV	
	WB2RLO	VE3YNA	WA4AAC	
	WB2TLK	VE3ZM	WA4BNL	
	WB2VUK	W3ACH	WA4BTG	

AMATEUR RADIO FIELD DAY CONTACT REPORT

DATE 7 /2 /79 CALL W8XXX BAND 4ØM MODE A3

VE7NOR	K8AA	AA9A	AAØN
	K8ALB	K9AOM	KØAW
	K8CC	K9CDB	KØCWW
	K8CW	K9DIM	KØER
	K8LAC	K9DXD	KØGFV
	K8DDV	K9EC	KØKT
	K8DXF	K9EYA	KØLIR
	K8EA	K9FC	KØNB
	K8EMY	K9IJ	KØSG
	K8FA	K9IU	KØSVW
	K8KRG	K9IW	KØVM
	K8PJ	K9LCR	KØVKS
	K8QDP	K9QAT	KØYH
	K8SF	K9SA	NØAN
	K8TK	K9UQN	NØII
	K8TV	K9VQC	NØNT
	K8ZPL	N9AX	WØAJA
	K8ZUU	N9DF	WØBA
	N8CG	N9EV	WØBMJ
	N8ED	N9GT	WØCS
	N8JV	N9IF	WØDCW
	N8KK	N9JR	WØEEE
	N8LT	N9RD	WØGN
	N8RR	N9RJ	WØHJA
	N8VT	W9AIU	WØHWJ
	VE8AEO	W9AO	WØJV
	W8AL	W9CAF	WØNL
	W8AWE	W9CEQ	WØPU
	W8BEP	W9CUS	WØSJ
	W8CC	W9DF	WØSN
	W8CDZ	W9DK	WØTQA
	W8DF	W9DQA	WØWRD
	W8EBG	W9DUA	VAØCGV
	W8FH	W9DUP	WAØQIT
	W8FY	W9DY	WBØMVE
	W8GI	W9EOC	WBØSSV
	W8KEA	W9EPU	WBØWEB
	W8KGG	W9GFD	
	W8KVV	W9GL	
	W8LC	W9HD	
	W8MRM	W9HE	
	W8MVE	W9HQH	
	W8OGV	W9IC	
	W8RFZ	W9IKN	
	W8RSN	W9JB	
	W8UM	W9JUQ	
	W8VA	W9JZE	
	W8VVL	W9KQ	
	W8WE	W9LMN	
	WA8CHT	W9LM	
	WA8SUE	W9LO	
	WA8YJE	W9LRG	
	WA8ZID	W9LTU	
	WB8FAA	W9MEP	
	WB8IEN	W9MM	
	WB8PPG	W9NEN	
	WB8UCW	W9NQ	
	WB8VCU	W9OBF	
	WB8VVY	W9PC	
	WD8EGW	W9PCS	
	WD8GOM	W9PJT	

Fig. 4. Program 2 sample run.

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Emulate an Elephant

—but let your micro bear the burden

Has the following ever happened to you? You're tuning around 80 meters one night, call a CQ, and listen to the reply and a familiar voice:

"VE6BB, this is VE6XYZ. Hi, Basil, old buddy. How are the wife and kids? Did you ever get that 101 of yours fixed? Say, are you going to the picnic again this year? . . ." etc.

Now, you *know* the guy. You've met him lots of times. The only thing is that you can't for the life of you remember his name right now, and he's waiting. Is it Joe? Bill? Arthur? (You haven't actually worked him for over a year now—that's 1500 contacts ago.) Finally, you try "Jim" and the cool reply from the other end tells you two things: First, his name is Ken (oh, of course, *now* I remember!). And second, you just lost another friend (relations are never the same again).

Does that sound familiar? I'm sure that it's happened to many others besides myself, and after the first time or two, it virtually forces one to implement some form of card index system.

Well, if you have a microcomputer and a North Star floppy disk system, then the following program can prove very useful. It stores, for instant recall, the callsigns, names, and QTHs of all hams that you work, with some additional side benefits that I'll explain later. If you have a floppy disk system that is not North Star, then you will have to modify both the data-accessing procedures and the North Star BASIC instruction set.

The program is written in Release 4.0 of North Star BASIC. Once the program is typed up, then merely order NSAVE AMATEUR and the interpreter will create the file (type 2) and save the program for you.

Disk Creation

Type in Program 1, check it thoroughly, and save it (NSAVE AMATEUR). Now create some data files using radio prefixes for the file name, as in Fig. 1, for example. With the example

```
20 !CHR$(12):!"         H A M   D I R E C T O R Y":!:!
30 INPUT"WHICH PREFIX ARE YOU INTERESTED IN?  ",P$
40 !:!"YOU MAY ADD (A),DELETE (D),LIST (L), OR SEARCH (S) FOR HAMS"
50 !"WHICH DO YOU WANT? ",:A$=INCHAR$(0):!A$
60 IF A$(1,1)="A" THEN 110
70 IF A$(1,1)="L" THEN 410
80 IF A$(1,1)="D" THEN 220
90 IF A$(1,1)="S" THEN 280
100!"BAD INPUT ... REMEMBER":GOTO40
110 OPEN#0,P$:!"TYPE 'DONE' FOR THE CALL WHEN YOU COMPLETE."
120 GOSUB 540
130 READ#0%43*Z,A$,B$,C$:IFA$(1,3)="END"THEN150
140 Z=Z+1:GOTO130
150 Z=Z-1
160 GOSUB540:Z=Z+1
170 INPUT"CALL?  ",A$(1,7):IFA$(1,4)="DONE"THEN200
180 INPUT"NAME?  ",B$(1,10):INPUT"QTH? ",C$(1,10)
190 WRITE#0%43*Z,A$,B$,C$:GOTO160
200 A$(1,3)="END":B$(1,2)="OF":C$(1,4)="FILE"
210 WRITE#0%43*Z,A$,B$,C$:GOTO520
220 INPUT"WHICH CALL DO YOU WISH TO DELETE? ",Z8$:Z8$=Z8$+" "
230 OPEN#0,P$:Z=0
240 READ#0%43*Z,A$,B$,C$:IFZ8$=A$1,LEN(Z8$))THEN260
250 IFA$(1,3)="END"THEN510:Z=Z+1:GOTO240
260 Z=Z+1:READ#0%43*Z,A$,B$,C$:Z=Z-1:WRITE#0%43*Z,A$,B$,C$
270 IFA$(1,3)="END"THEN500ELSEZ=Z+1:GOTO260
280 !"BY CALL, NAME, OR QTH? ",:Z9$=INCHAR$(0):!Z9$
290 INPUT"WHAT ARE YOU LOOKING FOR? ",Z8$:!
300 OPEN#0,P$:Z=0
310 GOSUB540
320 READ#0%43*Z,A$,B$,C$:IFA$(1,3)="END"THEN500
330 IF Z9$(1,1)<>"C"THEN 360
340 IFZ8$=A$(1,LEN(Z8$))THEN!A$,TAB(15),B$,TAB(25),C$
350 Z=Z+1:GOTO310
360 IFZ9$(1,1)<>"N" THEN 390
370 IFZ8$=B$(1,LEN(Z8$))THEN!A$,TAB(15),B$,TAB(25),C$
380 Z=Z+1:GOTO310
390 IFZ8$=C$(1,LEN(Z8$))THEN!A$,TAB(15),B$,TAB(25),C$
400 Z=Z+1:GOTO320
410 !:OPEN#0,P$:Z=0
420 Y=0
430 READ#0%43*Z,A$,B$,C$
440 IFA$(1,3)="END"THEN500
450 !A$,TAB(15),B$,TAB(25),C$:Y=Y+1
460 IF Y>13 THEN 470 ELSE Z=Z+1:GOTO 430
470 !"PRESS RETURN TO CONTINUE ":Z9$=INCHAR$(0)
480 IF ASC(Z9$)<>13 THEN 500
490 Z=Z+1:GOTO 420
500 !:!TAB(12),"FINISHED":GOTO520
510 !:!"NOT FOUND"
520 CLOSE#0:!:!"AGAIN? ",:E$=INCHAR$(0):!E$
530 IF E$(1,1)="Y" THEN 40 ELSE 550
540 A$="              ":B$=A$:C$=A$:RETURN
550 END
```

Program listing.

```
CREATE "VE",30
CREATE "DX",30
CREATE "W6",30
```

An example of using the "CREATE" command to create data files (type 3) on North Star disc.

Fig. 1.

```
115 Z=-1:GOTO 160
```

Enter this line into the program when accessing a data file for the first time only. Make one entry (at least) into the file and then delete this line. Use line 115 for each new prefix data file.

Fig. 2.

shown, you will have three files, for VE, DX, and W6 contacts. You can open files for any prefix you wish. You are limited only by the size of your disk storage, so I would suggest that you keep at least one disk just for your card index (byte index?) files. In opening a new file that has just been created, however, you must make a slight modification to the program—but only the first time. This is because our random access data file is set up as follows:

[CALL, NAME, QTH] [CALL, NAME, QTH] [. . .] ["END", "OF", "FILE"]

The program expects "END OF FILE" to be in the data storage as the last entry and looks for this to finish whatever it's doing. Consequently, when you have a brand new data file, you don't have an "END OF FILE" written in for the program to find, and it will return a TYPE ERROR. This is how we get around it:

(a) Enter the line from Fig. 2 in your program.

(b) Now RUN the program and enter your new data file name as the prefix when requested by the program. Enter one call/name/QTH at least, and then type "DONE" for the call when it is requested. An example of this is shown in Fig. 3.

(c) Finally, delete line 115 and your data file is ready.

Remember, you have to do this only once for every new data file you create. Once it is done and you have entered the calls, names, and QTHs of hams you've worked, then you can recall any detail instantly.

The side benefits of this program include the fact that you also can search for all the hams you have worked who live in a particular location. Thus, you can display all hams who live in Hobart, for example, or those whose names begin with B, or BOR, or JI, or even all VK7s. The program searches for whatever you have asked for, and examples of this are given in Fig. 4.

The Program Itself

The program is written in North Star BASIC, Release 4.0, using a DOS personalized for VDM and 3 P+S I/O. North Star BASIC permits multiple statements per line, separated by a colon (:) or backslash (\). "PRINT" may be abbreviated by "!". Any portion of a string may be accessed by string delimiters. For example, if A$ = "DEVONPORT", then A$(1,1) = "D", A$(1,3) = "DEV", and A$(6,9) = "PORT".

In line 20, the CHR$(12) is a clear screen command. You may have to change that to suit your own system.

The "INCHAR$" command in lines 50, 280, 470, and 520 waits for a single character to be input and operates on that character immediately without waiting for a carriage return. To modify these lines for Release 3 of North Star BASIC, refer to Fig. 5.

No dimensioning of character strings is necessary with North Star BASIC, but other forms of BASIC may require this during modifications.

Random Access Files

All files are accessed randomly, and for this to work satisfactorily, all blocks of data should be the same length. Therefore, line 540 sets A$, B$, and C$ to a certain length with a number of blanks, and entries made by you take up the first portion of that length. Should you enter any name or QTH longer than is allowed, the excess is truncated.

Data [CALL, NAME, QTH] are read (and written) in blocks of 43 bytes, so that to successively read (and write) the blocks of data requires multiplying 43 by 1, then by 2, then by 3, and so on. This is handled by incrementing a counter, "Z". Thus, you can access any block merely by setting Z to the correct value (the number of the block minus one), multiplying it by 43, and reading (or writing) from that point in the file. For example, the statement in line 130—

130 READ#0%43*Z,A$, B$,C$ . . .

—means that from file No. 0 (previously opened in line 110), move the file pointer to the (43 x Z) position and read A$, B$, and C$.

The counter, "Y", which appears in lines 420-460 of Program 1 is designed to allow the VDM driver to display 14 lines and then wait for a carriage return to be input before displaying another 14 lines, ad infinitum. Otherwise, the whole file can zip right past your eyes in a flash in a "LIST" command. In effect, this is a form of in-program paging. When the program pauses at that point, if it receives any character other than a CR, it stops at that point.

Conclusion

Don't let the small size of this program put you off. It's powerful enough to get the job done, and you'll appreciate having your index at your fingertips. The program can stand further optimizing, but I'll leave that to you. ■

```
(Operator entries are underlined)

H A M   D I R E C T O R Y

WHICH PREFIX ARE YOU INTERESTED IN?  VE

YOU MAY ADD (A), DELETE (D), LIST (L) OR SEARCH(S) FOR HAMS
WHICH DO YOU WANT?  A
TYPE 'DONE' FOR THE CALL WHEN YOU COMPLETE.
CALL?  VE6BB
NAME?  BASIL
QTH?   BONNYVILLE
CALL?  DONE
```

An example of a typical ADD entry into the data file. Following this entry delete line 115 (if entered) from the program, and the prefix file 'VE' is ready for further entries.

Fig. 3.

```
YOU MAY ADD (A), DELETE (D), LIST (L) OR SEARCH (S) FOR HAMS
WHICH DO YOU WANT?  S
BY CALL, NAME OR QTH?  C
WHAT ARE YOU LOOKING FOR? VK7

VK7DK    DEN      PERTH
VK7TR    RAY      HOBART
VK7MG    MAURICE  SWANSEA

      FINISHED

AGAIN?  Y

YOU MAY ADD (A), DELETE (D), LIST (L) OR SEARCH (S) FOR HAMS
WHICH DO YOU WANT?  S
BY CALL, NAME OR QTH?  N
WHAT ARE YOU LOOKING FOR?  JO

VK6AM    JOHN     PERTH
VK7JV    JOHN     LAUNCESTON

      FINISHED

AGAIN?  N
```

Some examples of using the search routine in the program to isolate particular calls or names, or parts of calls or names.

Fig. 4.

```
 50  INPUT "WHICH DO YOU WANT? ",A$
280  INPUT "BY CALL, NAME, OR QTH? ",Z9$
470  INPUT "PRESS RETURN TO CONTINUE ",Z9$
520 CLOSE#0:!:INPUT"AGAIN?  ",E$
```

If using Release 3 North Star Basic, then changes will have to be made to the above lines as shown. (Release 3 does not incorporate the "INCHAR$" command).

Fig. 5.

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Prefix Challenge

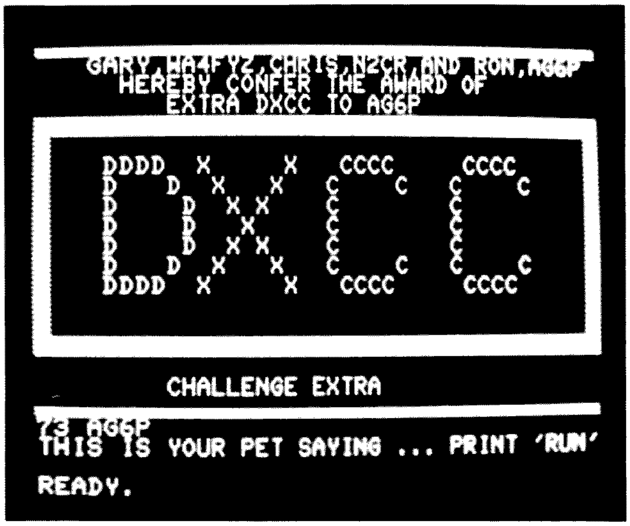
—try this while you're waiting for the band to open up

When fellow hams visit your computer, do you spend time *telling* them what it will do? Well, here's a way to *show* them what it will do, be they new Novices or seasoned DX Honor Roll veterans.

Lay "Ham Prefix" on them and let them select their own level of difficulty. This 7K BASIC program will give prefixes/countries like W, F, Canada, Mexico, and VK to the Novice and rate him at Extra, Advanced, General, or Novice (under 30% yields "TRY AGAIN").

The veteran, on the other hand, gets none of these goodies, but, instead, gets to cope with ST, Turkey, Uruguay, VP1, Clipperton, and the like.

All will receive one of 12 full-screen awards at the end, along with final score and appropriate comments. Many may want a second chance, and every game is different!



Most people even remotely associated with ham radio will earn the SHORT-NOVICE level award, while not every DXCC holder will achieve the top CHALLENGE-EXTRA endorsement on their certificate.

This program runs on the 8K Commodore PET™ as is, but will also adapt to any 8K RAM/BASIC operating system in a TRS-80, Apple II, Heath, etc., with a few simple mods that I will explain in detail at the end of this article.

If you've read this far, you'll appreciate a description of the program's features. The 3 levels of difficulty revolve around 15, 35, or 60 country/ham prefix identifications. Each series draws randomly from a pool of country/prefix pairs which are twice the size of the game, except that the CHALLENGE (60) series omits the easiest 26 from its pool of 120.

In any game, 90% yields an Extra rating, while Advanced, General, and Novice follow at 70%, 50%, and 30% respectively. Under 30% brings up "SRI OM, TRY AGAIN."

Since the computer can only spell perfectly and since this is not a spelling test, there is an arbitration feature that allows you to call up a PROTEST to allow someone else to judge if you're close enough. Who wants to let someone else beat him out just because it's hard to spell Rumania or Lithuania correctly?

My compliments to Gary Toncre WA4FYZ and Chris Wiener N2CR on the basic idea which appeared in the May, '79, *73 Magazine*. It has kept me busy for days. Further evolution could take place, for instance, by adding some competitive scoring features (before taking it to the local DX club meeting, of course!).

Most of the required

Program listing.

```
5 REM HAM PREFIX COPYRIGHT 1979 BY RON  GUNN
20 FORU=0TO29:PRINT:NEXT
30 PRINT"WELCOME TO HAM PREFIX2 AND QRZ?"
40 FORM=0TO10:PRINT:NEXT
50 PRINT"11111";
55 INPUT"NAME OR CALL ";H$
60 FORB=1TO30:PRINT:NEXT
80 PRINT"OK, ";H$";YOU WILL BE ASKED TO     "
90 PRINT"IDENTIFY RANDOM HAM PREFIXES AND THE"
100 PRINT"COUNTRIES THEY BELONG TO.":PRINT
102 PRINT"YOU WILL BE CREDITED WITH ONE QSO2 FOR"
104 PRINT"EACH QUESTION, AND ONE QSL2 FOR EACH"
106 PRINT"CORRECT ANSWER."
109 PRINT:POKE59468,14
110 PRINT"You will be rated by your percent"
120 PRINT"correct, given TWO tries on each."
125 PRINT
130 PRINT"IF YOU HAVE NO IDEA, ENTER '?'       "
135 PRINT"-THINK ";
140 PRINT"YOU'RE RIGHT? ENTER 'P' FOR "
145 PRINT"PROTEST2 ";
150 PRINT"INSTEAD OF SECOND GUESS"
152 PRINT:PRINT"GO SLOW - RETURN WITHOUT DATA IS FATAL2":PRINT
162 PRINT"YOU MAY CHOOSE A SHORT2, COMMON PREFIX, "
164 PRINT"GAME OF 15 COUNTRIES, AN EXPERT2 LEVEL"
166 PRINT"GAME OF 35; OR A CHALLENGE2 SERIES OF"
168 PRINT"60, INCLUDING THE MORE ARCANE. ":PRINT
170 PRINT"SELECT S(SHORT), E(EXPERT), OR "
175 INPUT"(C)CHALLENGE SERIES NOW";E$
180 POKE59468,12
190 IFE$="S"THEN260
192 IFE$="E"THEN270
194 IFE$="C"THEN280
200 PRINT"S=SHORT,E=EXPERT,C=CHALLENGE":GOTO162
260 N=15:B$="SHORT":GOTO445
270 N=35:B$="EXPERT":GOTO445
280 N=60:B$="CHALLENGE": GOTO445
445 PRINT:PRINT
450 PRINT"OMIT 'ISLAND' IN ANY NAME"
460 PRINT"'#' MEANS PREFIX INCLUDES THE NUMBER"
475 PRINT
490 L$(1)="GOT YOU ON THAT ONE, ANSWER IS       "
500 LETW=0:REM HEART OF PGM
510 LETX=0
515 C=2*N:REM NR OF COUNTRIES
520 DIMQ$(C),A$(C)
525 FORI=1TOC
530 READQ$(I),A$(I):REM SET UP ARRAY
535 PRINTA$(I);" ";:NEXTI:PRINT:PRINT
540 FORI=1TON
545 S=(C*RND(1))+1:REM RANDOM SELECTION 550
548 LETT=0:PRINT
552 S=INT(S)
554 IFQ$(S)="NO"THEN545
555 IFN<>60THEN558
556 IFS<26THEN545
558 PRINTQ$(S);:PRINTTAB(25)S
560 INPUTG$
562 IFG$="?"THENT=1
570 IFA$(S)=G$THEN650:REM A WINNER!
575 IFG$="P"THEN1800
580 IFT=0THENPRINT"SRI OM, TRY AGAIN."
585 IFT=0THENC1$=G$
590 IFT=1THENPRINTL$(1)
600 T=T+1
610 IFT=1THEN558
620 PRINTTAB(15)A$(S)
632 IFX<>8THEN635
633 IFW=8THENPRINT"VG! KEEP IT UP O M"
635 IF(W-X)=13THEN PRINT:PRINT"HOW ABOUT TRYING FOR W A S?":PRINT
637 W=W+1
640 PRINT:GOTO680
650 PRINT"CORRECT, WELL DONE"
660 LETX=X+1:W=W+1
680 PRINT"YOU NOW HAVE ";W;"/";X;"QSO/QSL"
685 Q$(S)="NO"
700 NEXTI
710 IFX>=.3*NTHEN744
720 PRINT
725 PRINT"YOU ENDED UP WITH ";X/N ;"PERCENT ":PRINT
727 PRINT"WE HAVE NO AWARDS TO COVER THAT"
730 PRINT"SRI, TRY AGN OM? EACH GAME IS DIFFERENT"
735 PRINT"            OR...."
740 PRINT"YOU CUD TRY UR HAND AT COMPUTER PROGRAMS"
742 GOTO850
744 IFX>0.9*NTHENC$="EXTRA":GOTO754
746 IFX>0.7*NTHENC$="ADVANCED":GOTO756
748 IFX>0.5*NTHENC$="GENERAL":GOTO758
750 C$="NOVICE"
752 D$="A START,":E$=" WITH SOME EFFORT,":GOTO760
754 D$="SIMPLY OUTSTANDING!":E$="WITH EASE.":GOTO760
756 D$="QUITE GOOD,":E$="RAPIDLY.":GOTO760
758 D$="OK,":E$="BY WORKING ON IT.":GOTO760
760 PRINT"YOUR KNOWLEDGE OF THIS SUBJECT"
770 PRINT"COMPELS US TO AWARD YOU ";C$" DXCC.":PRINT
790 LETY=X/W*100:Y=INT(Y)
800 PRINT"YOU HAVE ACHIEVED A ";Y;"% QSO/QSL "
810 PRINT"RECORD, THAT IS ";D$:PRINT
820 PRINT"YOU ARE GOOD ENOUGH TO GET THAT OTHER2"
825 PRINT"DXCC AWARD ";E$;"."
830 PRINT"WE ARE GENERATING YOUR AWARD - SRX 1"
831 FORB=1TO10000:NEXTB
840 GOSUB1020
850 PRINT"73 ";H$
860 PRINT"THIS IS YOUR PET SAYING ... PRINT 'RUN'"
865 GOTO3999
880 DATA DENMARK,OZ,CANADA,VE
885 DATA TI,COSTA RICA,FRANCE,F
890 DATA KP4,PUERTO RICO,W,USA,G,ENGLAND
895 DATA BELGIUM,ON,4X4,ISRAEL
900 DATA XE,MEXICO,DK,GERMANY,YV,VENEZUELA
905 DATA ITALY,I
```

```
910 DATA KZ5,CANAL ZONE,COLUMBIA,HK,PY,BRAZIL
915 DATA SPAIN,EA
920 DATA OE,AUSTRIA,AUSTRALIA,VK,HB,SWITZERLAND
925 DATA JA,JAPAN
930 DATA CE,CHILE,FINLAND,OH,KL7,ALASKA
935 DATA RUSSIA,UA,CO,CUBA,NEW ZEALAND,ZL
940 DATA HC,ECUADOR,BULGARIA,LZ,ZS,SOUTH AFRICA
945 DATA URUGUAY,CX
950 DATA FC,CORSICA,WAKE*,KW6:REM 30
952 DATA POLAND,SP,GUANTANAMO BAY*,KG4
955 DATA LIBERIA,EL,GW,WALES
957 DATA KG6,GUAM,PITCAIRN*,VR6,JAMAICA,6Y
960 DATA YO,RUMANIA,LIECHTENSTEIN*,HB0
962 DATA UR2,ESTONIA,CHRISTMAS IS.*,VK9,TF,ICELAND
965 DATA ZD8,ASCENSION,FORMOSA,BV
967 DATA GUATEMALA,TG,OH,FINLAND,LU,ARGENTINA
970 DATA JT,MONGOLIA
972 DATA NORWAY,LA,LUXEMBOURG,LX,SK,SWEDEN
975 DATA JY,JORDAN,NAVASSA*,KC4,MIDWAY*,KM6
977 DATA GM,SCOTLAND,HUNGARY,HA
980 DATA ST,SUDAN,GREECE,SV,VP1,BELIZE:REM 60
989 DATA ANDORRA*,C31
990 DATA VU,INDIA,IVORY COAST,TU
995 DATA KP6,PALMYRA,TURKEY,TA
1000 DATA AP,PAKISTAN,CLIPPERTON*,FO8
1020 PRINT"YOUR CERTIFICATE OF ACHIEVEMENT"
1030 FORB=1TO25:PRINT:NEXT
1033 PRINT
1040 FORI=0TO38
1050 PRINTTAB(I)"(";
1060 NEXTI
1070 PRINT
1080 PRINTTAB(3);"GARY,WA4FYZ,CHRIS,N2CR,AND RON,AG6P"
1090 PRINTTAB(5);"HEREBY CONFER THE AWARD OF"
1095 PRINTTAB(8);C$;" DXCC TO ";H$
1500 FORI=0TO38
1510 PRINTTAB(I)"&";
1520 NEXTI
1521 PRINT" ";
1525 PRINT"&                                    &"
1530 PRINT"&   DDDD  X     X  CCCC     CCCC     &"
1540 PRINT"&   D   D  X   X   C    C  C    C    &"
1550 PRINT"&   D    D  X X    C       C         &"
1560 PRINT"&   D    O   X     C       C         &"
1570 PRINT"&   D    D  X X    C       C         &"
1580 PRINT"&   D   D  X   X   C    C  C    C    &"
1590 PRINT"&   DDDD  X     X  CCCC     CCCC     &"
1600 PRINT"&                                    &"
1610 PRINT"&                                    &"
1630 FORI=0TO38
1640 PRINTTAB(I)"&";
1650 NEXTI
1660 PRINT:PRINT
1670 PRINTTAB(8)B$;:PRINTTAB(18)C$
1680 FORI=0TO38
1690 PRINTTAB(I)"(";
1700 NEXTI
1705 PRINT
1707 RETURN
1710 GOTO3999
1800 PRINT
1810 PRINT"THIS IS NOT A SPELLING TEST, HAVE AN "
1815 PRINT"IMPARTIAL OBSERVER PRESS ANY KEY AND "
1820 INPUT"COMPARE ANSWERS.";M$
1822 IFM$=""THEN1822
1823 PRINT:PRINTTAB(5)G1$;TAB(20)A$(8)
1824 PRINT:PRINT"ENTER 'A' IF PROTEST ALLOWED."
1826 INPUT"ANY OTHER LETTER TO CONTINUE";F$
1830 IFF$="A"THEN650
1840 FORY=0TO25:PRINT:NEXT:PRINT
1850 T=0:GOTO580
2000 DATA IS,SARDINIA,KURE IS.*,KH6,MIDWAY*,KM6
2010 DATA OA,PERU,SURINAM,PZ,BV,CRETE
2020 DATA VP9,BERMUDA,VB6,HONG KONG,HL,KOREA
2030 DATA PANAMA,HP,VATICAN,HV,HZ,SAUDI ARABIA
2040 DATA SVALBARD,JW,YUGOSLAVIA,YU,ZA,ALBANIA
2041 REM 82
2050 DATA GUADELOUPE,FG,NEW CALEDONIA,FK
2060 DATA FM,MARTINIQUE,ST, PIERRE,FP,YEMEN,4W
2070 DATA 4S7,SRI LANKA,5A,LIBYA,NIGERIA,5N
2080 DATA SIERRA LEONE,9L,9V,SINGAPORE,TRINIDAD,9Y
2090 DATA MELLISH REEF*,VK9,LATVIA*,UQ2,UP2,LITHUANIA
2100 DATA UG6,ARMENIA,MALI REP.,TZ,UB,UKRAINE
2110 DATA THAILAND,HS,HR,HONDOURAS,HAITI,HH
2120 DATA REUNION,FR,FB8X,KERGUELEN,IRAN,EP
2130 DATA COOK IS,*,ZK1,ZE,RHODESIA,GIBRALTAR,ZB
2140 DATA ZA,ALBANIA,YN,NICARAGUA,IRAQ,YI
2141 REM110
2150 DATA OX,GREENLAND,DENMARK,OZ,NETHERLANDS,PA
2160 DATA SU,EGYPT,XV,VIETNAM,LAOS,XW
2170 DATA AFGHANISTAN,YA,CAYMAN IS.,ZF
2180 DATA CEOA,EASTER,MOROCCO,CN,CT2,AZORES
3000 PRINT"OK (DIAGNOSTIC)"
3999 END
READY.
```

play instructions come up at the start of the program. Your teaching responsibility will be limited essentially to showing each member how to type in and (return) (enter) (line-feed) the responses.

You will have to put in the goodies that you have worked, and a little time spent on the CHALLENGE series will make you a tiger in the DX bands yourself.

Now let's look at the listing for function: The program starts with a request for your name or callsign, gives instructions, then asks for your choice of series, be it SHORT, EXPERT, or CHALLENGE.

Lines 110 and 120 list strangely because of PET's lower-case organization. Make them read "You will be rated by your percent" "correct, given TWO tries on each."

At line 500, the program begins by taking the series selected and loading up the appropriate data matrix from the data statements containing the prefix/country pairs. W and X are part of the scoring. T keeps track of how many guesses you've had, while I (line 540) watches the

Weird Symbol	You Type In
11111 (line 50)	"CRSR CRSR CRSR CRSR CRSR"
2 (after word)	RVS before word, SHIFT and RVS after word
"(" or "&"	SHIFT and a bar graphic (remember the quotes)

Fig. 1.

number of pairs you've been given, as determined by N.

545 randomly selects the next Q\$-A\$ pair to be presented.

554 rejects previously used pairs.

575 brings up the PROTEST subroutine.

685 sets the Q\$ just used to "no," so line 554 will recognize that it has been used already.

700 directs the program execution back to line 540, until there have been N questions.

710 starts the scoring, which goes on for a bit. Appropriate comments are picked by the percent correct to be used in the closing remarks.

This section contains the author's message: Nowhere is anyone, in any way, repeatedly put down. I feel that a put-down is funny, once. Then it gets old. I am human, however. I could not resist putting in the comment, at 13 misses, "How about trying for WAS?"

The program avoids "screen clear" and certain cursor-positioning commands that are not general BASIC functions except as noted below. If you have a screen clear, you can use it on lines 20, 60, and 1030.

Some of the award graphics starting on line 1050 should be made up using whatever you have on your machine. Experiment with this. It's fun and you can get many nice effects. How would the letters DX look as a border? Try it by making line 1040 read: For I=0 TO 19 STEP 2. Then put "DX" in line 1050.

If you need a non-PET program, mark the listing as follows:

Omit lines 50, 109, and 180.

Delete strange characters showing in lines 30, 102, 104, 145, 152, 162, 164, 166, and 820.

Look at the discussion of the listing for the text of lines 110 and 120.

860: Put in your machine's name (Emily???).

Option: The A\$ (answers) appear on the screen while the matrix is loading at the start. Go to line 535 and remove all up through the first colon(:) and it will not print. Keep it in until you have it running OK, as it is a great way to see if the matrix is loading properly. It can then be removed if you don't like it.

For those of you who are typing this program into your PET, you must interpret the listing as shown in Fig. 1.

This program was a pleasure to work on and is a challenge to run. It loads in a couple of minutes from a cassette and is guaranteed to be a pleasurable adjunct to your computer system.

I'll try to help you with your Ham Prefix bugs. Please describe them as completely as possible and enclose an SASE. In the meantime, type carefully (especially those fly speck (.), (,), (;), and (:) characters). They bear an importance that is all out of proportion to their size.

My compliments to Wayne, who in less than two decades has led me to SSB, FM, and now computers! Oh God, what next? ■

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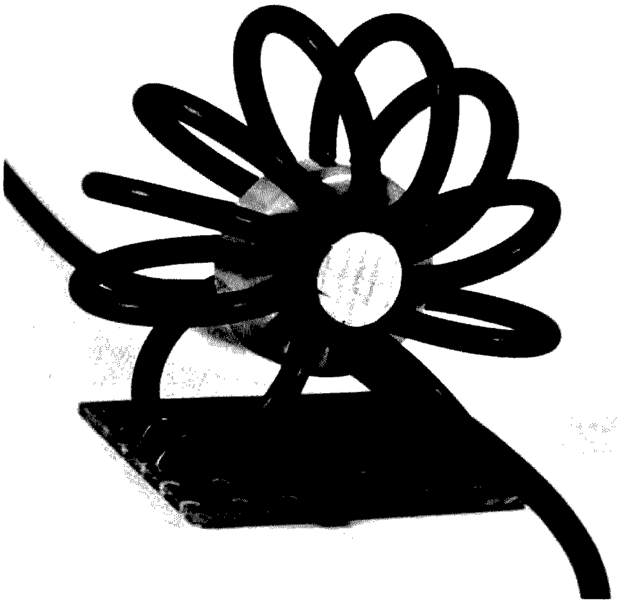
Check Chirp with a Choke

—get 599 every time with this quick fix

The choke described here solved the chirp problem I had which resulted from having antenna current on the outside of the coaxial transmission line get into my home-brew vfo. Although the power leads entering the vfo were carefully filtered, chirp was reported when the 3.5-MHz vfo was used on eighty meters, but not when multiplying to higher bands. The fact that the vfo was chirp-free on the higher bands indicated that it was stable and suggested that the cause was rf feedback from the transmitter when it was operated straight through.

The first experiment tried was to wind about 30 turns of miniature coax on a large-size oatmeal box and use this coax in the feedline between the transmitter and antenna tuner. The tuner feeds a short wire antenna in the attic over an apartment and is worked against a ground connection to a pipe which is part of the heating system. In a system of this configuration, current in the antenna wire is balanced by an equal and opposite current which spreads out in the ground system. Since the feedline coax is in a strong rf field, some of this current will flow along the outside of the coax. Winding sufficient coax into a choke will provide a barrier to current on this path. The oatmeal-box choke did the trick: no more chirp on eighty.



Transmission-line choke wound with RG-58 foam coax on a 1.58-inch ferrite core. Turns are held in place by a cork pressed into the center.

An improved choke was conceived when the author espied a large toroidal core in a box of goodies at the local radio club. As shown in the photo, 10 turns of RG-58 foam-dielectric coax were wound through the core. The inductance of this choke is 21 microhenries (less than the oatmeal choke), but also is effective. A measurement of core permeability yielded a value of 120, indicating that it is probably intended for low-frequency use. This leads one to wonder whether much rf power is dissipated in the core. The output of my old Harvey-Wells transmitter is 25 Watts; if only 2 Watts were dissipated in the core, it would get very warm, but, in fact, there is no perceptible temperature rise.

Similar results would probably be obtained if one used a salvaged core from a TV flyback transformer. Several cores could be stacked to increase the inductance, if necessary. If solid dielectric coax is used rather than foam-type dielectric, the turns should be larger to avoid distorting the coax, which could adversely affect swr or result in breakdown.

The use of low-frequency ferrite material in a high-frequency choke is quite effective and is the basis of the ferrite-bead chokes commonly used in the VHF region. The choke described here might be likened to a giant ferrite-bead choke. Although such a choke has substantial resistance in addition to its inductive reactance, it does not produce appreciable power loss in the present application since rf ground currents find alternate low-impedance paths in the remaining parts of the ground system. ■

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Reawaken that Sleeping Rx

—first steps in receiver alignment

Almost every ham goes through the traumatizing experience of realizing that his or her receiver needs an alignment. Typical signs of this common malady are loss of sensitivity (the receiver is not as "hot" as it used to be), loss of frequency-readout accuracy (for those of us who use a transceiver, the first indication of this problem very well may be a "what-were-you-doing-out-of-the-band?" admonition from an FCC observer), or what might be described as a general deterioration in the performance of the receiver.

Many amateurs simply let the receiver suffer a protracted and tortuous death. Others, in a fit of panic, thumb through their logs or notes for the phone number of that celebrated guy "who really knows his stuff." Still others heave a sigh of surrender and tearfully send their receivers out, either to the manufacturer or to a technical lab, musing about the possibility of equipment maintenance someday being covered by Blue Cross.

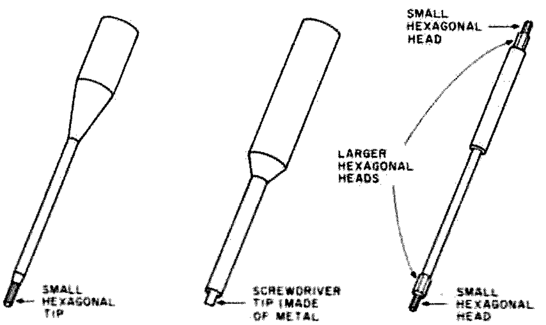

Fig. 1. Several tools used for aligning receivers. Note that except for the screwdriver tip at the end of the center figure, each tool is made of plastic. This prevents the circuit being aligned from being affected by a metal tool.

In any event, like so many aspects of our hobby which so often are considered untouchable, it is, in the last analysis, fear and ignorance which keep us at arm's length from amateur radio's most interesting exotica.

I would like to present a step-by-step procedure for receiver alignment that may make the process a bit more palatable for even the most timid of hams.

The equipment needed for a satisfactory alignment is simple. You will need the following:

1) A VTVM.
2) A *calibrated* rf signal generator whose frequency limits are from about 1.5 MHz to about 30 MHz. The generator must have a provision for modulating its rf signal. (These generators are common enough so that they can be borrowed and cheap enough so that they can be bought.)
3) A 50-Ohm resistor.
4) A 0.001-uF capacitor.
5) An appropriate alignment tool (see Fig. 1).

The alignment procedure is one which moves from the last i-f section of the receiver back toward the front end of the rf section. (Refer to Fig. 2 for orientation.) The starting point is the grid or base of the first stage of the last i-f. (Some receivers have more than one i-f stage.) You will, of course, need a circuit diagram of your receiver. Fig. 3 shows typical starting points for both tube and solid-state circuits.

You will have to prepare a 50-Ohm termination network for the signal generator's lead. Refer to Fig. 4 for this.

Before making any adjustments at all, let the receiver, the VTVM, and the signal generator warm up for at least one-half hour (one hour is preferable).

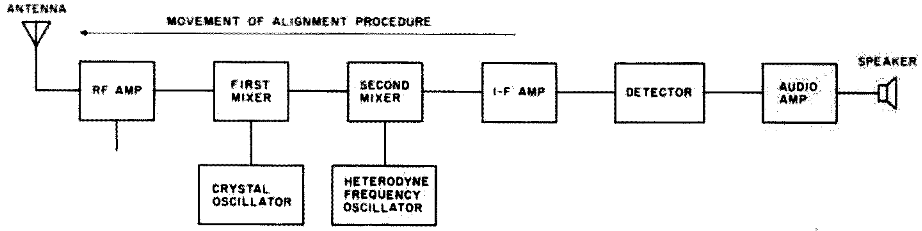

Fig. 2. Illustration of the movement of the alignment procedure. The alignment begins with the first stage of the last i-f amplifier and ends at the rf amplifier. The receiver in the figure is a double-conversion superheterodyne type.

While the gear is simmering, you can look at the schematic of the receiver and locate the following points:

1) The grid or base of the last i-f.

2) The grid or base of the preceding i-f(s).

3) The associated i-f transformers.

4) the output of the AM detector.

5) The oscillator trimmer capacitors for each band.

6) The slug-tuned oscillator coils for each band.

Each of the above-mentioned points or components must be located on the schematic and physically located in the receiver.

The first part of the alignment procedure will be for the last i-f stage.

Procedure—First Part

1) Set up the receiver controls for AM reception.

2) Clip the VTVM dc probe to the output of the AM detector.

3) Connect the signal generator (with the 50-Ohm termination) to the grid or base of the first stage of the last i-f. (Of course, the ground lead of the generator is clipped to the receiver's ground—usually the chassis.)

4) Set the frequency of the signal generator very precisely to the frequency of the last i-f of your receiver. This information is in the receiver's manual. It is important that the frequency setting of the signal generator be extremely precise. (A calibrated frequency counter will obviate the need for a precisely-calibrated signal generator. Often, the use of a frequency counter permits a much more accurate setting of frequency than is possible with a signal generator dial.)

5) Turn the modulation switch on the generator to internal modulation.

6) Feed only enough signal into the receiver to cause a small deflection on the VTVM. (Set the VTVM's scale appropriately—not at 1000 V dc!)

7) Find the last i-f transformer.

8) The adjustment will start with the transformer winding closest to the AM detector. Stick in a suitable alignment tool and turn it. Don't be afraid. You will see the meter pointer move. Tune the slug for maximum meter deflection.

9) Move your way back toward the input of the i-f section, turning the slugs in the transformers for greatest meter deflection.

10) When you have finished tuning all the slugs, start from the beginning and go through the procedure again. Then do it a third time.

11) If your receiver has an i-f stage (or stages) preceding the one just aligned (double-conversion), follow the same procedure to peak that stage. However, the intermediate frequency will change. Look it up in the manual.

Remember that the accuracy of alignment is a direct function of the accuracy of the signal generator's frequency and peak indication on the VTVM.

We now move to the alignment of the rf stage, or front end, of the receiver. The following preparation is necessary:

1) Feed the generated signal (with the 50-Ohm network at the end of the probe) into the antenna jack of the receiver.

2) Again, allow a long warm-up of the gear (the signal generator, the receiver, and the VTVM).

3) Connect the VTVM leads to the speaker terminals.

4) Turn the band selector to the highest band.

There are three adjustments that will have to be made:

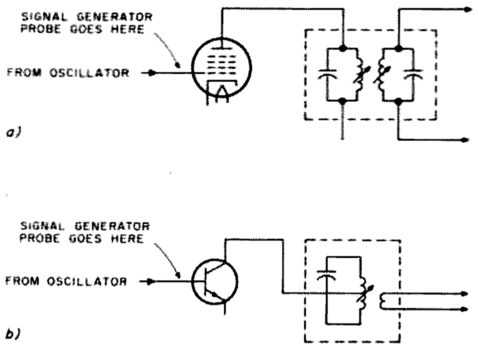

Fig. 3. Starting points for a receiver alignment in a tube (a) and a transistor (b) unit. The circuits diagrammed illustrate the last i-f stages of the receiver.

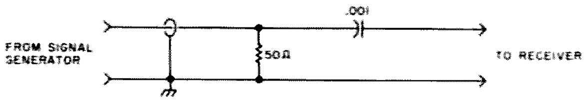

Fig. 4. 50-Ohm termination network. Use shielded cable.

1) Calibrate the high-end dial frequency with the oscillator trimmer capacitor.

2) Calibrate the low-end dial frequency, usually by adjusting a slug in the oscillator coil.

3) Align the tuned rf stages. Some receivers have more than one adjustment for each stage. Check the manual for that information.

Procedure—Second Part

1) Align the dial pointer at both extremes of its excursion.

2) For the high-end adjustment of the top band:

a) Set the (modulated) rf generator to 30 MHz. Turn the receiver tuning dial in the vicinity of 30 MHz. You should see two meter deflections. One of them represents an image frequency. The one you want is the fundamental frequency, indicated by the greater meter deflection of the two.

b) Adjust the oscillator trimmer for the highest band so that 30 MHz corresponds to the greatest meter deflection.

c) Follow the same procedure in adjusting the low end of the band. Set the signal generator to that frequency. Find the fundamental on the receiver and adjust the oscillator coil slug for maximum meter deflection.

d) Make the adjustment several times back and forth between the high end and the low end of the band. Make the last adjustment at the high end.

e) Before going on to the next band, make sure that this one is impeccably tuned.

f) Repeat the high-end and low-end procedure for each band on your receiver.

When you are finished aligning all the bands, go through the procedure again to guarantee optimum performance of your receiver.

And that's it. Obviously, a tune-up procedure on a complex receiver can be tedious (not difficult!). That's why most amateurs save it for a rainy day. Good luck! ■

Rubber Thumbs and Pilot Lamps

—if you're all thumbs, enlighten yourself!

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If you've ever been on the losing end of a tussle with a snug-fitting pilot lamp of the style that's so common to surplus radio equipment, you'll appreciate the fun I used to have with the home-brew device shown in Fig. 1. It's a two-level constant-current nicad battery charger that uses a 100-W lamp to control the 400-mA charging source and a 6-W lamp to control the 25-mA trickle source. It's the latter that used to test my religion.

During one of those dreaded sessions when I was trying to replace the little devil, I was literally clutching at straws to get a grip on the defective lamp without breaking the glass. It was then that I tried a clerk's rubber thumb over it, as pictured in Photo A. The rubber surface grips the glass all around evenly when you gently push down on it. For smaller diameter lamps, simply cut the open end so the whole thing is a little shorter.

Even when we hams overtly try to implement the KISS method (Keep It Simple, Stupid), it's very difficult unless it's by accident! ■

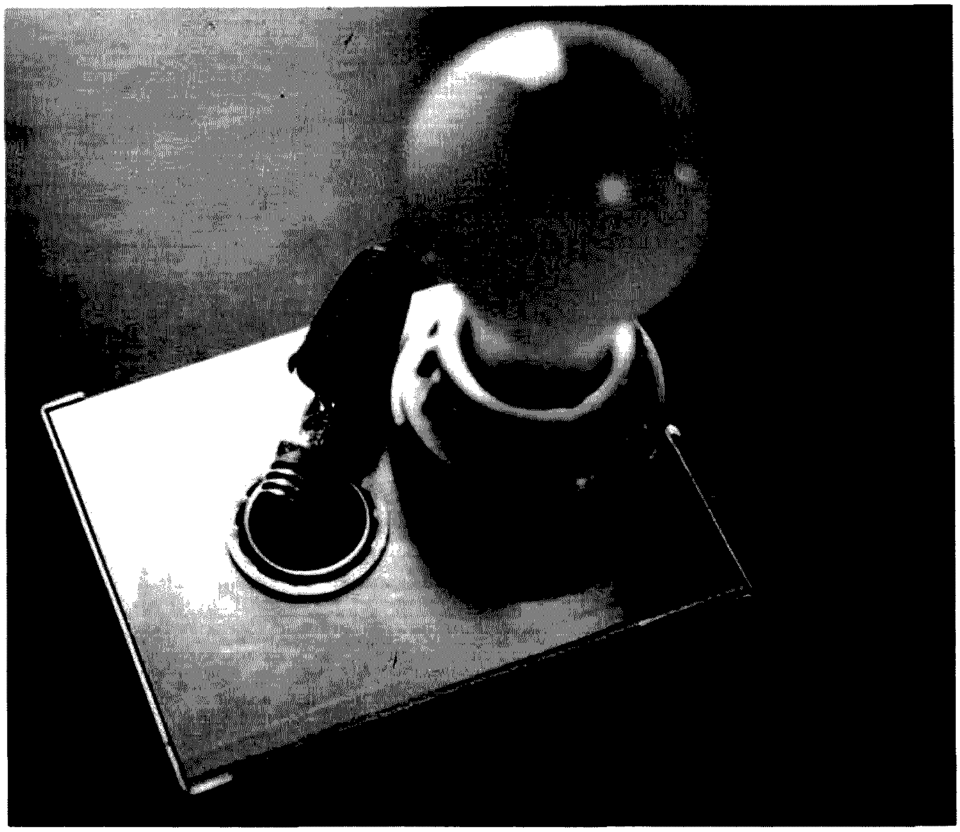

Photo A.

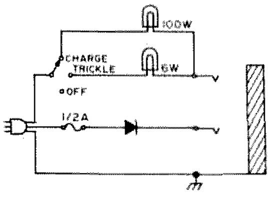

Fig. 1.

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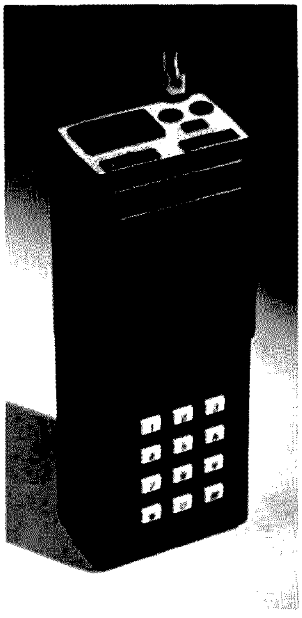
Tempo S1 2-Meter Portable

—800 channels, to go!

Two-meter FM is probably the most popular aspect of ham radio ever to come along. With repeaters in virtually all areas of the country, one can be in touch with police in case of emergency or just wile away the miles on the interstates chewing the rag a bit. However, once at your destination, you either sit in the car with your synthesized rig (a real pain on hot summer days) or drag out a 12-volt power supply to continue your hamming. That problem has now been solved by the boys at Tempo.



The Tempo S1 FM transceiver.

Synthesized HT

Tempo, through Henry Radio, has released their S1 synthesized HT-type portable rig. This nifty little rig, 1.6" x 2.5" x 6.5" (40 x 62 x 165 mm) in size, has all the features of all but the most expensive mobile and base rigs. Its small size and light weight (about one pound) make it very attractive to traveling hams who'd like to stay in touch on two meters but don't want to pack a 12-volt power supply in their baggage. With an upcoming trip to VK2-land, this was extremely important to me. Best of all, it's synthesized in 5-kHz steps from 144.000 MHz to 147.995 MHz for complete coverage of the two-meter band, including the new repeater subband.

The frequency of operation is selected by three thumbwheel switches (1 MHz, 100 kHz, and 10 kHz) and a +5-kHz slide switch located on the top of the unit. Repeater offsets (−600 kHz, simplex, and +600 kHz) are selected by a slide switch on the back of the unit.

Theory of Operation

The heart of the whole thing is a vco which operates in the range of 44.4333 MHz to 45.765 MHz followed by a tripler which results in a two-meter output minus 10.7 MHz. This frequency is mixed with the incoming two-meter signal for receive in a dual conversion mode, which results in a sensitivity of better than .3 uV for 20-dB SINAD.

For transmit, the tripled vco signal is mixed with either a 10.7-MHz signal for simplex or with 11.3-MHz or 10.1-MHz signals for +600-kHz or −600-kHz repeater offsets, respectively. Three buffer amps and a power amp then kick the signal up to a whopping 1.5 Watts out.

Frequency stability is maintained by a phase-locked loop circuit which really seems to do its job well. The worst frequency deviation I've measured was −80 Hz, and that was at 144.000 MHz. Granted, this is outside the amateur band, but since phone transmissions aren't authorized below 144.100 MHz, this really isn't anything to worry about unless you get your jollies banging away on the push-to-talk switch and trying to decipher squelch tails as code.

Versatile Operation

Since I live near Chicago, I'm practically within spitting distance of umpteen repeaters and have no trouble hitting most of them within a fifteen-mile radius. As such, my S1 has taken over many of the duties previously dealt out to my other two-meter rig.

For those of you who live out in the boonies, say, forty miles or so away from the nearest machine, don't despair, for Tempo also has 30-Watt and 80-Watt matching amplifiers available. Connection is made through an antenna jack on top of the rig right next to the earphone jack.

And for you autopatch users (I'm probably the only ham left who doesn't use autopatch), a touchtone™ pad is available factory-in-

stalled for an extra half of a C-note.

I've had quite a few QSOs with my rig and have been given nothing but the best reports for audio quality and readability. While listening on my other rig through what pass around here for hi-fi speakers, the transmitted audio sounds more like broadcast quality than any other rig I've ever heard. The received audio is crisp and clean with none of the hollow squawk-box sound so common to other portable rigs.

The S1 is powered by an internal 250 mAh nicad battery pack (supplied) which is charged at a rate of 50 mA by a little plug-in charger (also supplied). According to its label, the charger will work on both 60-Hz and 50-Hz current, needing only a step-down transformer to work on foreign current. This is another plus for the ham who wants to take his hobby overseas with him.

Unlike its nearest competitor in the synthesized portable field, the S1 can be operated while charging. Therefore, if this is to be your only two-meter rig, you won't be QRT while the batteries are being charged (about 10 hours for a completely dead battery pack). Fortunately, though, dead batteries shouldn't plague you, since the transmit indicator LED also lights up and stays on continuously while receiving when the battery charge is about used up.

A Few Disadvantages

Naturally, nothing is perfect, and this is true even with a neat little rig like this.

The first thing is that you're limited to simplex or standard repeater offsets. If a weird offset is needed, you either modify the thing or do some fancy thumbwheel flipping. I've opted for the latter, since I hate drilling holes or doing anything else to void the warranty of a new unit. Besides, I'm all thumbs, and the innards are packed in pretty tight. So here's one for the Mod Squad to tackle. All that is necessary is to add another crystal and a four- (or more) position switch to accommodate the oddball repeater offset position(s).

Next, it would be nice to have an external mike for use in the mobile, as picking up the whole thing with both its power and antenna cables dangling could hamper your ability to drive and talk at the same time. Again, the problem is space—where to mount the mike connector. If this were done, though, it would add much more convenience to an already great rig.

Finally, the Lexan case could stand being made a bit heavier. This really isn't too much of a drawback as long as you don't plan to drop-kick the rig across the room or pitch it off the edge of the Grand Canyon. Still, an ounce of prevention . . .

Summary

While it might be a bit presumptuous to say that Tempo's S1 transceiver is the greatest thing since the audion tube, just consider the 800 channels, a hot receiver, and the clean 1.5 Watts out of a one-pound rig that fits neatly into your hand. Considering all the options available and a price only slightly higher than that of most six-channel rigs, I'm sure you'll at least rank it right up there among the top ten goodies to come along in recent years. ■

73 Magazine *Staff*

A Proper Pedestal for PCBs

—handy holder eases circuit board construction and repair

When working with PC boards, either to repair them or to put together kits which use them, it often is handy to have a holder for them so that hands are free for soldering, placing test leads, and other tasks. Many such holders are available commercially but they tend to be a bit expensive. One can, however, with a bit of ingenuity, usually use available parts to homebrew a very satisfactory holder.

This article presents a description of one homebrew holder made out of available odds and ends. It has some features which even commercial holders do not have—such as pinpoint illumination on the underside of the board so that one can hunt down bad connections, cracks, and so on. You may not wish to duplicate this particular holder exactly, but you can use the ideas presented to develop a holder using available materials.

Photo A shows the completed holder. The circular base is the lead weight from a discarded table lamp, and is about 5 inches in diameter. Any sort of heavy base is suitable. Another version of the holder was constructed later using a piece of ¼" steel plate about 4 x 8 inches in size as the base. This base proved to be even steadier than the circular one shown. The rest of the holder consists of an arrangement of BNC connector hardware and a gooseneck section. The arrangement of the BNC connector hardware allows the PC board being held to be rotated into any conceivable position. It also can be rotated rapidly around so that one can get at either side of the board. This is a feature which many commercial holders do not have, and it is extremely convenient when one has to check back and forth frequently between the component and foil sides.

The arrangement of the BNC hardware is shown in Fig. 1. Since each of the connectors can rotate on its axis and the UG-306 right-angle adapter can rotate fully on both of its axes, one can readily appreciate how it is possible to achieve any PC board positioning.

Assembly is extremely simple. The BNC hardware

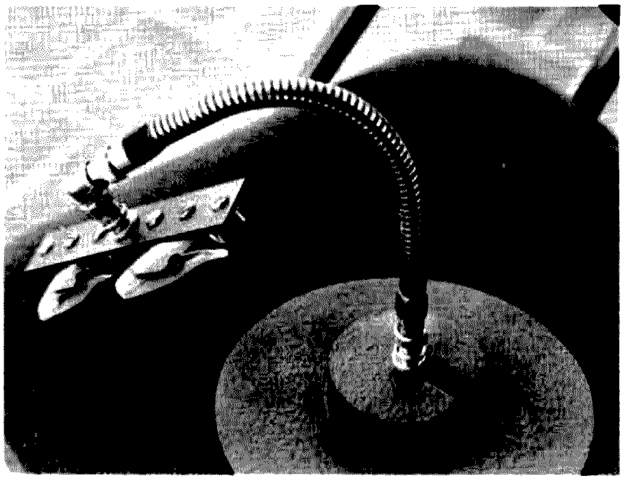


Photo A. This is the completed holder.

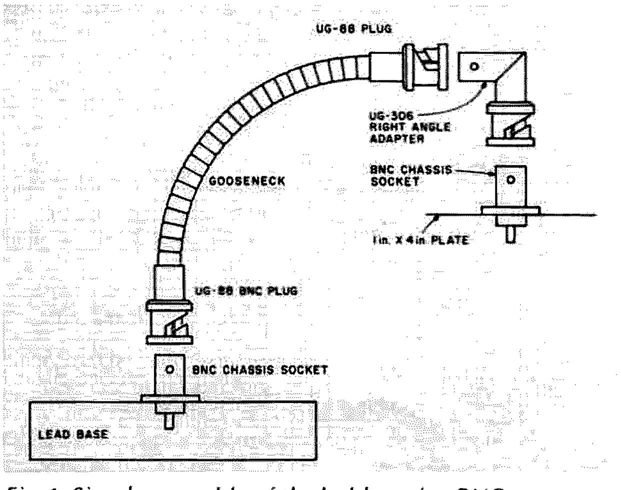


Fig. 1. Simple assembly of the holder using BNC connector hardware.

just connects together and the two female BNC connectors are of the single-hole mounting type. The gooseneck is a standard lamp type approximately 9" long which should be available at any large hardware store. It has a threaded stud on each end which loosely fits into the back of the UG-88 plugs. Epoxy cement can be used to make a firm bond between the studs and the plugs. In fact, the assembly of the gooseneck and the two UG-88 plugs should be prepared first and the epoxy allowed to set thoroughly.

Two *plastic* clothespins are attached to the plate shown in Fig. 1 using 6 x 32 hardware and wing nuts. The plate can be of aluminum or plastic. The 6 x 32 hardware is placed with equal spaces along the 4"-long plate so that the clothespins can be moved to accommodate any small- to medium-size PC board.

Photo B shows the holder in use, and also illustrates the hardware mounting on the 1- x 4-inch holder plate for the clothespins. As one looks at the photo, the PC board can be rotated fully 360° horizontally and also 360° in and out of the page.

Although the holder as shown was used for some time quite satisfactorily, the thought later came to develop also a lamp function since the BNC connectors provide an available electrical connection no matter how the holder is rotated. The unit was disassembled and a wire connection made between the two UG-88 plugs on the ends of the gooseneck. Electric power was run to the female BNC connector in the base of the holder. The lamp was installed on the 1- x 4-inch plate as shown in photo C. In this case, just a simple flashlight bulb was used, with leads soldered to it (covered by shrink tubing) and to the female BNC connector on the 1- x 4-inch plate. Later on, the unit was modified to use one of the 12 volt, high-intensity bulbs as a source of illumination. In any case, the illumination feature has proved to be extremely handy when examining PC boards—particularly complex boards with close-spaced foil patterns. The board is illuminated from the foil side, and then by carefully viewing the board from the component side one can often locate faults (breaks and solder bridges) which otherwise would not be readily apparent.

There is no need to follow exactly the construction of the holder as described. Possibly, one can devise an even better system using two goosenecks where there is a holder and illumination source at the end of each gooseneck.

Whatever form the holder may take, however, it can be an extremely useful tool around the shack for even some non-electrical application where a "third hand" would come in handy. ■

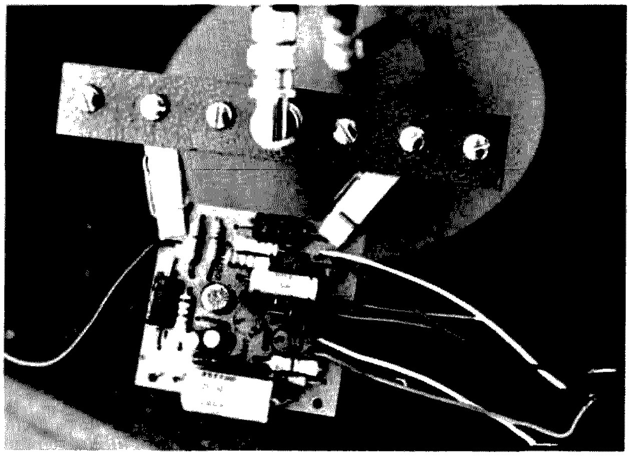


Photo B. This shows the holder in use. Note how the clothespins can be set to accommodate different sizes of PC boards.

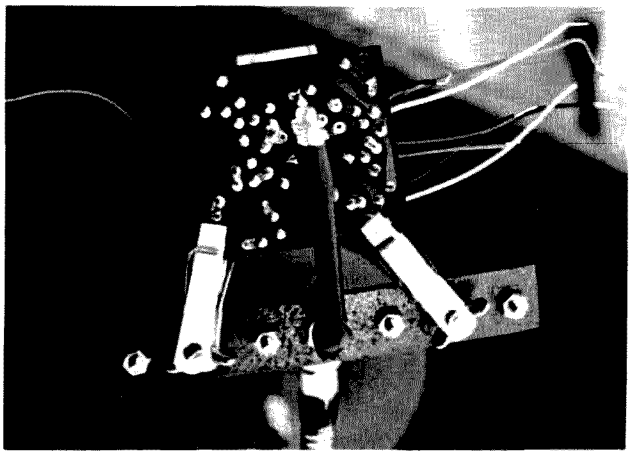
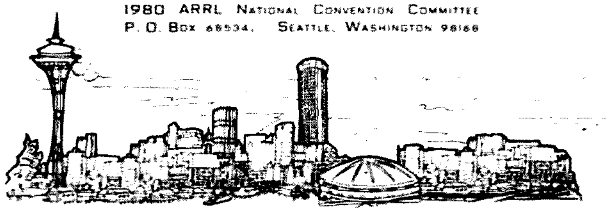


Photo C. A lamp can easily be added to the holder to provide illumination for tracing PC board faults.



Arthur Gillman K1VIC/2
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Princeton NJ 08540

Surplus Treasures

—assemble a quality ham station for less than $200

The price of new ham radio equipment has gotten so high these days that starting or expanding an amateur radio station can be tremendously expensive. State-of-the-art quality has a justifiable premium put on it, but what is state-of-the-art today is run-of-the-mill tomorrow, and the values that are available on the used-equipment market bear this out. The submillionaires among us would do well to consider used (previously owned) equipment for their next purchase. For a newcomer to the hobby, there is a gold mine of excellent gear to be had for a small percentage of what equivalent new gear would cost.

My own experience in this area comes from buying and selling at the local flea markets a few times each year. These outings not only have provided quite a lot of enjoyment, but they have given me the opportunity to examine a lot of different types of equipment—some ancient, and some not so ancient. The station that I am presently using is built around top quality bargains obtained by utilizing just a bit of patience and experience at these markets.

Although I own a transceiver, I wanted a little more versatility for operating CW and RTTY. My Swan 300B didn't really fill the bill. Usually a couple of quality rigs show up at each flea market, so I wandered around in search of something suitable that I could afford. What caught my eye was a mint National NC-303 with matching 6- and 2-meter converters and speaker. I was hooked, especially since the asking price was $125.

For those who don't remember, the NC-303 is a wonderful, large receiver which, in 1964, retailed for about $450 without accessories. The dial and bandswitch mechanism would cost nearly that to duplicate today. So, with nearly 100 pounds of receiver in my trunk, I headed home to try it out. It worked perfectly, and the silky-smooth controls are a pleasure. The NC-303 cannot be accused of being miniature, but it certainly does *feel* good, and signal for signal it equalled or surpassed the performance of my Swan (especially on CW).

Well, that receiver demanded a matching transmitter, so at the next few markets I concentrated on finding a suitable companion for it. The fruit of my labors was a Hallicrafters HT-37 SSB transmitter in

perfect condition for the remarkable price of $60. (The original price of the HT-37 was also about $450.) This transmitter was one of the most popular of its day. It uses a phasing-type sideband generator and is very stable and easy to operate. In about 10 minutes I added an FSK circuit to the HT-37 and was on the air. Reports on all modes have been excellent, and the total investment, including speaker and converters, was $185!

Why buy new super-expensive gear? Possible reasons may be as follows: (1) It is certainly smaller. (2) The new all-solid-state rigs take less time to warm up and, on the average, they drift less. (3) Transceivers, especially broadbanded ones, require less fuss.

My own personal comments on these are, in order: (1) I *like* big equipment. It somehow feels and looks more substantial. (2) My two units take about 10-15 minutes to come to temperature, after which stability is perfectly acceptable. Not all old gear drifts. (3) The operation of separate receiver and transmitter, while not as simple as a transceiver, allows all sorts of convenience, especially on CW and RTTY. True, in most cases zero-beating the transmitter is a bother, but it quickly becomes part of the routine.

To this I should add the most important point of all. For under $200 I have assembled a station that can equal the performance of most new gear at 3 to 5 times the price. A slightly less ambitious station could be put together for even less. Novices take note. Cost is certainly no excuse for inferior equipment. ■

Listen in Secrecy with a Giant Inductive Loop

—monitor your rig from anywhere in the house—without wires

Fred Johnson ZL2AMJ
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My late father (Joe ZL2GA) developed a hearing impairment in later life and was outfitted with a number of hearing aids of various types. Several had "telephone" coils fitted in them. These use a pick-up loop or coil which can be switched in place of the normal hearing-aid microphone. The loop is held alongside the telephone or its earpiece so that stray energy from the induction coil or telephone earpiece can induce a signal into the loop. It is then amplified and fed to the hearing-aid earpiece.

By this means, a deaf person can hear on the telephone far more effectively than with the normal telephone earpiece or with an amplifer-type telephone. The characteristics of the hearing aid can be tailored to fit the hearing deficiency of the individual.

On an occasion when my father visited me, he mentioned that he would like to feed the audio output of his amateur receiver to his hearing aid directly, to avoid the loudspeaker-to-hearing-aid audible link. This would give better acoustic quality for his particular hearing requirement and would eliminate other shack noises from being picked up by the hearing-aid microphone. A simple experiment quickly showed that these hearing aids are not only useful for the amateur with a hard-of-hearing problem, but are useful for the amateur with good hearing, too. Many useful amateur radio applications are possible, plus some other useful applications, too. This article outlines several uses to which hearing aids with induction or telephone coils can be put.

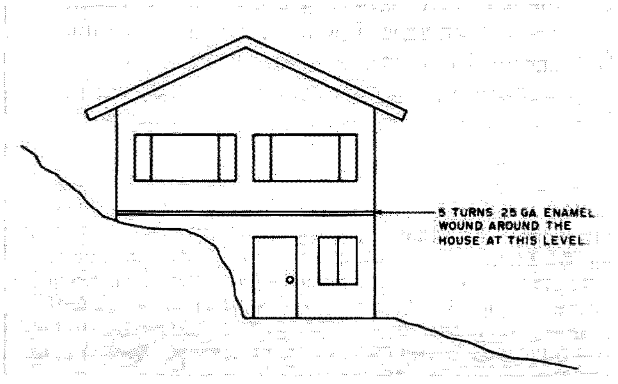

Fig. 1. How one house was wired for induction-wireless.

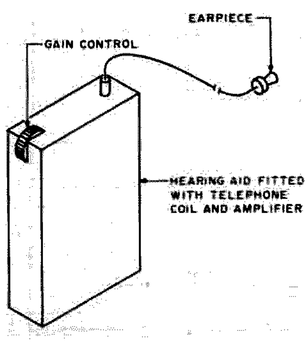

Fig. 2. A simple induction-loop receiver.

The Loop Around the House

Five turns of 25-gauge enameled wire were wound around the house. Fig. 1 shows the scheme. The house is two-story over most of its area. The loop was wound around at the upper-floor level by simply winding it around the outside! The number of turns on the loop does not appear to be critical; five to ten have been found to be adequate. The position of the loop is not critical; anywhere between floor and ceiling seems to be satisfactory. Several houses of different styles have been

fitted, and all installations seem to work effectively.

The loop could be made from one turn of a multi-conductor cable (if you have a suitable length available) by connecting the individual conductors in series to form a multi-turn loop. The gauge of wire used does not seem to be critical.

The two ends of the loop are connected in place of the loudspeaker in the receiver or tape recorder that you wish to monitor. An "external speaker" socket can be used. The audio gain setting should be about the same as that for normal room loudspeaker use. No damage appears to have been done to any audio amplifier by the removal of its usual loudspeaker and replacement with this unusual load. I have used the loop with my two-meter gear for monitoring the local repeater. It can also be used on my FT-101B on the HF bands so that if I have to leave the shack, I can continue to listen to the rig unhindered as I move about the house.

Coverage

Testing coverage from this induction-wireless unit is rather like checking the coverage of a two-meter repeater, but the distances are smaller! There are nulls and peaks and extensive areas of first-class coverage. The signal level falls quite quickly outside the loop, but is usable to about one loop-diameter or more away. My loop covers most of my property. In a two-story house, excellent coverage is obtained across both levels.

The Receiver Units

Hearing aids with telephone coils make excellent monitors. Two general types have been tried. The hearing aid with separate earpiece (Fig. 2) is a good unit to use for persons with normal hearing. It fits in a pocket and can be carried easily. Quite simply, if you wish to leave the shack, switch from speaker to loop and grab the hearing aid. Push earpiece into ear, switch on, set audio level, and put unit in pocket. You can then wander about the house monitoring the shack receiver as you go.

The spectacle-type aid (Fig. 3) also works very effectively as an induction receiver. It is ideal for persons who are hard-of-hearing and who have spectacles already fitted. Some spectacles have amplifiers fitted into each side-piece but usually only one is fitted with a telephone coil. Spectacle receivers are a bit elaborate for a person with normal hearing to use, but a very good application will be given later.

Power-line hum problems are not serious. The signal-to-hum ratio is generally such that the hum is not noticed. The response characteristics of the hearing aids reject signals at the low-frequency end of the audio spectrum hence minimizing the hum problem.

It is quite uncanny to walk about an absolutely quiet home and monitor amateur signals via a pair of spectacles with no one else listening. Secret listening applications suggest themselves!

Audio-Coupled Listening

Other applications for induction-wireless become possible. It is not always convenient to wind a loop around a house. For short-range and portable use, a ferrite rod (from an old broadcast radio) can be used. It is wound for its full length with 25-gauge enameled wire and connected in place of a speaker in a receiver. The

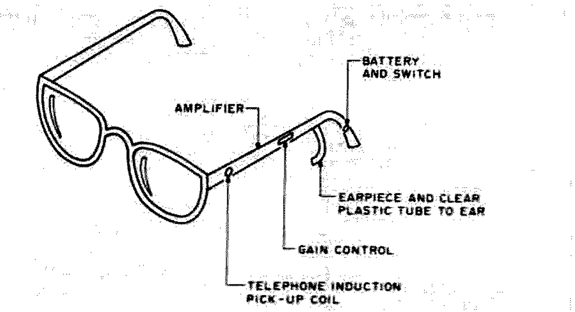

Fig. 3. Hearing-aid spectacles fitted with a telephone coil.

rod can be placed under a shelf above a rig and this gives close-area directional coverage. The number of turns or quality of ferrite used does not seem to be critical. By this means, a deaf person can operate his rig using his spectacles for listening.

Secret Listening

A small broadcast-band radio has been fitted with such an added ferrite rod wound with wire and connected in place of its speaker. It can radiate to spectacles over some six feet or more. This means that "no-wire" private listening to the radio is possible—secret listening with no one else hearing it (see Fig. 4).

I have attended meetings (which I knew were going to be boring) and have listened to a radio located in my briefcase alongside my chair without anyone else hearing it or knowing about it. Anyone spotting the frames of my spectacles would assume I was going deaf—and I probably got undeserved sympathy as a result!

Conclusion

Other applications for induction-wireless soon present themselves. For monitoring the local repeater or a net when you have to leave the shack, it is excellent. It is unfortunate that a multi-channel system is not as simple!

If you have to wear spectacles fitted with a hearing aid, and if your hearing aid

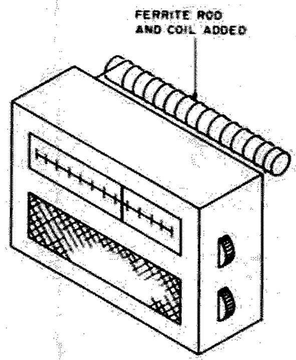

Fig. 4. A receiver fitted for "secret listening."

is fitted with a telephone coil, then I expect that you will be delighted to fit a loop around your shack or house and listen to your receiver through your spectacles. You will find it very convenient, and it does not disturb the other occupants in the house—they hear nothing!

My father, Joe ZL2GA, was intending to write an article on this topic to help others who were hard-of-hearing and whom he considered would gain enormous benefit from this induction-wireless system. He became a silent key before he completed the task, so I have done the job for him. My grandfather was deaf, my father was deaf, and my turn will come. It will not be a handicap if I can put a pair of hearing-aid spectacles to other use!

I am interested in corresponding with others who have experimented with audio-coupled wireless systems of this type. Good listening! ■

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Those Hamtronics Kits . . . How Can You Use Them?

—an in-depth look at some electronic bargains

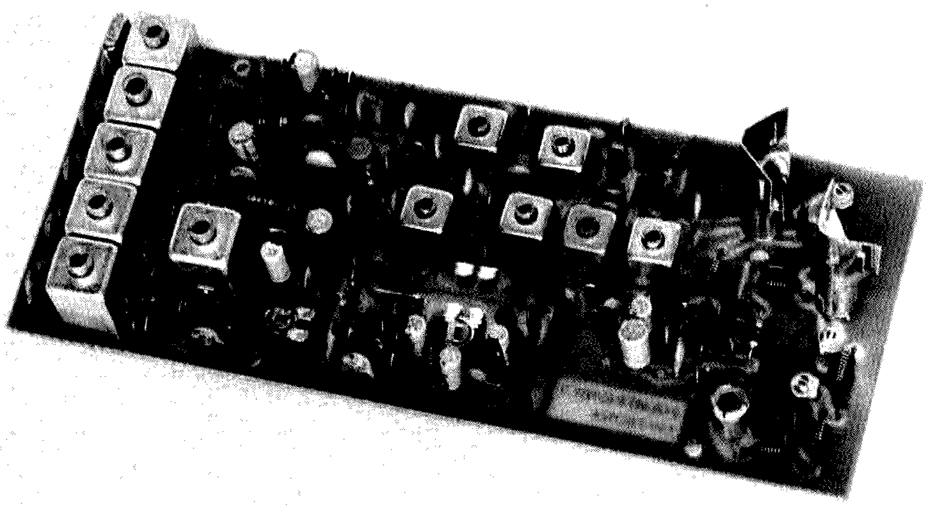

Photo A. T50 FM exciter: a high-quality VHF kit at a low price.

Through the years, many fine companies and products have come and gone in the capricious game of consumer electronics. Ham radio certainly has not escaped its share of casualties. But one company which has been around for a while is Hamtronics, well-known for its quality kits and reasonable prices.

Recently, I decided to have an up-to-date look at their growing catalog to see for myself some of their more recent products. I was so impressed that I decided to take a closer look at some of the kits.

T50 2-Watt VHF Exciter

Designed to put out 2 Watts on any one of three bands (6, 2, or 1¼ meters), this $44.95 rig will accommodate six crystal-con-

trolled channels. Either narrow-band FM or CW modes may be selected. Individual crystal trimmers allow precise netting for accuracy.

For voice transmission, a trimpot allows adjustment from 0- to 7-kHz deviation. A phase modulator includes audio shaping and filtering for maximum *audio punch*. Microphone gain is adjustable separately from deviation limitation.

With TVI such a constant problem, I paid particular attention to suppression of unwanted spurious signals. The T50 shielded oscillator and multiplier coils and a three-stage harmonic filter at the output keep harmonics and spurious signals down 60 dB.

The little board measures 3" x 7½" x 2", and requires 13.6 volts dc at 400 mA for full output.

LPA2 Linear Power Amplifier

For the VHF and UHF enthusiast who needs that extra margin of power, I recommend a look at the Hamtronics line of linear power amplifier kits, starting at $59.95. Requiring only 1- to 2-Watts drive (and thus fully compatible with the T50 exciter and XV2 and XV4 transmitting converters, as well as with most commercial portables), these amplifiers may be ordered for outputs from 15 to 45 Watts! And they may be used on sideband, FM, CW, AM—you name it. They are available for the 50-, 144-, 220-, and 432-MHz bands.

Output transistors are fully vswr protected; they are high-gain, emitter-ballasted devices.

As with the T50, a 13.6-V dc power supply is required (but at 2 to 8 Amps, depending upon the amplifier chosen and the drive level). Heat sinks are provided with these kits.

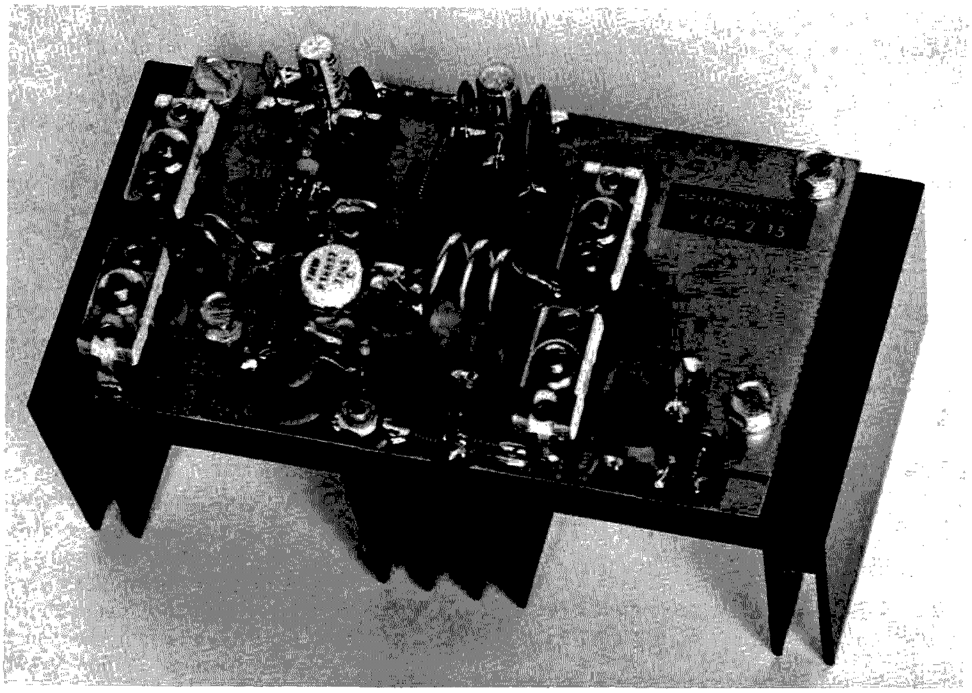

Photo B. LPA2-15 linear amplifier is typical of several Hamtronics power amplifiers for VHF applications.

R75 VHF FM Receiver

For the purist who wants only the best reception on two meters, the R75 single-channel strip receiver should fill the bill. Nominal i-f bandwidth is ±7 kHz, but filter cascading is available as an option to make passbands very narrow.

Selectivity options for the R75 include 4 increments, from an LC filter (±30 kHz at 60 dB down) to a razor-sharp 8-pole slicer (±9 kHz at 60 dB down). Prices are from $69.95 to $99.95 for these receiver kits.

I-f boards are available separately for $20 less than the full kit prices.

Sensitivity is an extraordinary 0.2 microvolts, making the R75 a natural for 136 MHz satellite reception of NOAA/ATS as well as for 143/149 MARS operation.

The low-noise FET front end is gate protected, and shielded double-tuned coils are featured to enhance single-signal reception. The crystal oscillator is voltage regulated, and a trimmer allows tight calibration.

Built-in test points assure optimum tune-up. The 2-board receiver (rf and i-f/audio) requires 13.6 V dc at 60-150 milliamps and will provide 2 Watts of audio—that's enough for virtually any application!

R85 UHF Receiver

For an additional $20 over the cost of the R75, you can be the proud owner of a UHF receiver with the same excellent specifications as the VHF version.

This UHF receiver affords an excellent opportunity for those ATV experimenters who don't wish to invest in an expensive commercially-assembled UHF receiver. A matching transmitter will be described shortly.

R110 Aircraft Receiver

With the increased interest among scanner enthusiasts, it isn't surprising that someone has finally offered a VHF aircraft-band receiver. The primary hitch that has prevented scanner manufacturers from including the aircraft band in their programmable scanners is the fact that while the land mobile services are all FM, aircraft still tenaciously hold on to the AM mode.

While Regency Electronics now offers their Digital Flight Scan receiver, only Bearcat has both land mobile FM and aircraft AM in one receiver (models BC-220 and BC-300).

The Hamtronics R110 receiver kit is an excellent accessory for the owner of FM-only scanners. It is designed for 110- to 130-MHz reception, but can also be used on virtually any frequency from 26- to 220-MHz.

Sensitivity is 0.2 microvolts for 10 dB signal-plus-noise to noise—(S+N)/N. Selectivity is not particularly a problem in the aircraft band, so the receiver has moderate selectivity.

The R110 features 2 Watts of audio, squelch, S-meter output, rf agc circuitry, and a dual-gate MOSFET front end. It is vir-

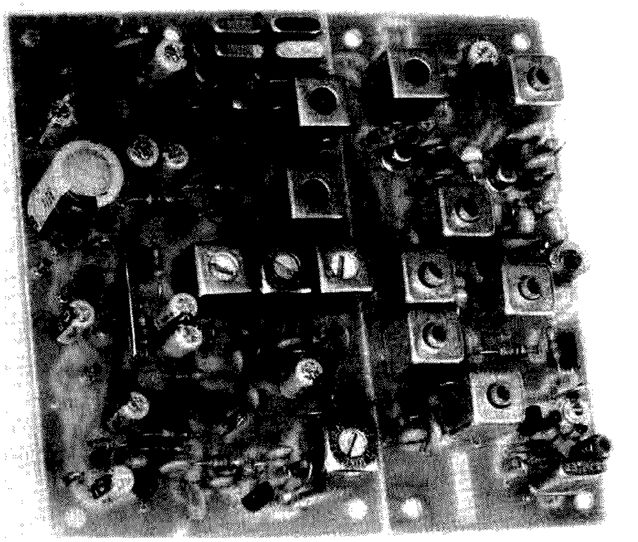

Photo C. R75 VHF single-channel receiver—a hot performer.

tually the same receiver kit as the R75, and sells for $74.95.

Preamplifier Kits

Not all receivers have the degree of sensitivity we would like. For that reason, Hamtronics offers a fine series of receiving preamplifiers to bring up the apparent sensitivities of those questionable front ends. Basically, all a preamp needs to do is to bring a weak signal up to a level that can ride over a receiver's inherent noise, and the job is done.

For receiving applications in the 20-to-230-MHz range, the P8 will probably fill the bill. It has two J-FETs in cascade, providing 20- to 25-dB gain with only 2.5 dB of noise! And it will continue to provide that gain within 6 dB with frequency excursions as much as 3% off center frequency.

One possible application of a preamp like the P8 is in the extension of frequency coverage of programmable scanner radios. It is well known that a listener can pick up images of frequencies lower than he can tune, but their signal levels are way down.

Suppose that you would like to hear the ATS satellite at 135.575 MHz; no programmable scanner covers that range in the FM mode. By using the P8 preamp tuned to that frequency, you would be able to pick up the image frequency (roughly 21.7-MHz higher) on your scanner! Simply double the i-f frequency and add that number to the received signal frequency. With Regency and Radio Shack programmables (10.7-MHz i-f), simply add 21.4 MHz (ATS would be tuned in at 156.976). For Bearcats, i-fs may be 10.8 or 10.85 MHz, so you would add 21.6 or 21.7 MHz. It's that simple.

The only drawback from such a system is when the preamp also increases signal levels of loud VHF stations on the normal rf passband of the receiver. This can cause intermod problems. But the technique is viable in a pinch!

The P8 kit costs only $10.95; a premium P9 is available for $12.95 ($21.95 wired) which boasts lower noise and sharper passband (6 dB bandwidth within 2% center frequency).

For UHF, try the P15 preamp with 20-dB gain and 5-dB noise figure for any 10-MHz segment between 380 and 520 MHz. ($18.95 kit; $27.95 wired).

Scanner enthusiasts may wish to try the image-enhancement receiving technique using this converter to tune in the elusive 406- to 420-MHz government band. As before, add twice the i-f frequency to the desired frequency, and punch up the total on your UHF scanner.

Accessories for the Receiver

For expanding the flexibility of your receiving installation, let me call your attention to several innovative circuits from Hamtronics. Their AS10 scanner adapter permits a four-channel scanning function to be added to any fixed-frequency receiver. Two adapters may be linked for 8 channels, and so on.

The P13 receiving multicoupler allows the use of two receivers simultaneously on one antenna. Any segments of the 26- to 230-MHz range may be selected. The P13 is modeled after the P9 VHF preamp, and provides 15-dB gain in each channel.

The A3 multichannel adapter allows a single-channel receiver or transmitter to be multichannelized. It accepts crystal fundamentals from 10 to 20 or 38 to 55 MHz (specify model). The A13 affords six-channel capacity.

XV4 UHF Transmitting Converter

OSCAR Phase III is a snap using this neat little $99.95 transmitting adapter with your 10-meter transceiver. The XV4 requires a minimum of only 1 milliwatt of drive. (An attenuator will be necessary with most exciters). Output power is 1-1½ Watts on SSB, CW, or FM. Image rejection is down 60 dB.

The circuit utilizes a double-balanced mixer to assure low spurious generation and guarantee easier alignment as well. Two oscillators are provided for remote switching of operating frequency ranges.

Frequency stability is good, too. Thermal drift is less than 200 Hz per hour at constant ambient temperature, or within 1 kHz for 10° F temperature change.

Several options of another version, the model XV2 transmitting converter, are available to allow outputs on 2 or 6 meters as well as 220 MHz. They may be driven by a CB or 10-meter rig.

A novel XV28 transmitter down-converter allows a two-meter rig to serve as an exciter to drive one of the other converters. For example, a two-meter transceiver connected to the XV28 will now have an output in the 28-MHz region. This signal may be injected into an XV4 for 432-MHz operation.

Hams who have not yet had the experience of operating 432 have a treat in store. OSCAR Phase III, amateur fast-scan TV, UHF repeaters, and other operating modes await the newcomer to UHF ham radio. It is especially active in metropolitan areas. The Hamtronics transmitting converters permit one of the most cost-effective ways I know of to get quality hands-on exposure to this interesting portion of the spectrum.

Hamtronics provides an unusual opportunity for the home builder to acquire quality equipment at wholesale prices. Try to buy the parts alone for one of these kits, and you'll see what I mean!

A copy of the new 1980 catalog can be obtained by writing: Hamtronics, 65F Moul Road, Hilton NY 14468.■

10 Meters for the SB-221

—add the "missing" band

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Shirley, L.I. NY 11967

When you finally decide to buy that new Heath amplifier, consider purchasing additional components from the SB-220 manual. These parts will be substituted into the SB-221 amplifier for TEN-meter operation.

Basically, the SB-221 is the same as the SB-220 amplifier. The tank circuits are similar; only the input network has been changed. What Heath has done to inhibit the 10-meter operation is to remove its input coil, then place low-pass filters across the other coils. In this way, this frequency of operation has been eliminated. When you do come to the input network assembly (SB-221), go to the SB-220 manual, add the additional parts, and wire according to those directions and the schematic.

The band switch must be the SB-220, with the SB-220 plate coil. You finish wiring the SB-221 following the directions of the SB-220 manual.

What I have given you is a direction to follow; from this you can make the necessary front panel modifications for that band we have lost.

It would be interesting for some enterprising individual to come up with a similar article dealing with the feasibility of placing this missing band on the SB-201!

I would like to thank George Sintchak WA2VNV for his assistance in preparation of this article.■

Parts List

Quantity	Heath Part	Description	Cost
1	595-1122	SB-220 manual	$3.00
2	40-964	10/15m input coil	1.00
1	40-966	40m input coil	1.15
1	40-968	Plate coil	5.50
2	20-124	115 pF capacitor	.90
1	20-103	150 pF capacitor	.40
1	20-120	220 pF capacitor	.45
2	20-113	470 pF capacitor	1.20
2	20-99	22 pF capacitor	.80
1	63-562	Rotary switch wafer	6.10
1	63-561	5-position rotary switch	6.90
		Total	$27.40

Name and address withheld by request

Another Place, Another Time

—working the paranormal band

It was ten years ago that Wayne wondered, in his editorial column, if any ham had ever experienced any supernatural contact in the operation of his hobby. I think I may have snickered at the time, but it wasn't three years later that it happened to me. I have asked Wayne not to release my name or address, as I fear that I would be swamped with letters—letters from parapsychologists right down to the ordinary garden-variety of nuts. I prefer not to get involved. The events I am about to reveal have not been polished into a story; names have been changed.

There were the three of us and our wives. We congregated on two meters every evening—145.1 MHz to be exact. This was back in the AM days, about 1971. How we originally got together, I cannot recall. This triumvirate consisted of Sam, a retired tool and die maker, and his wife, Stella. Then there was Doc, a general practitioner of medicine, and his wife, Margie. And, me, involved in electronic manufacturing, and my wife, Marian.

It was a rather curious group in that our wives seemed always to be present in the ham shack, offering their comments on the conversations held by the three of us males. At 8 o'clock promptly, you'd hear:

"You there, Doc? How about you, Sam?"

Invariably our QSOs would start in this informal way. Professionally, we could not have been further apart, but from a hobby standpoint we were three typical ham nuts. Over a period of three years we were involved with facsimile, RTTY, fast-scan TV, and just plain yacking into the mike.

Then one evening Sam broke some news. "I'm going to sell this place and head for Oregon. This LA smog is too much for me."

And that's exactly what happened. Sam moved to Oregon, with the comment that perhaps we'd better move our nightly QSOs to 75 phone so they might be continued.

Well, Doc and I, with the background comments of our wives, continued to prattle on each evening for about six months or so. His wife, Margie, like all Margies I have ever met, was vivacious, peppy, and had a sparkling sense of humor. However, I noticed less and less participation by Margie. One evening at 8 pm the phone rang just as I was about to go on the air. It was Doc.

"Glenn, I thought I had better tell you this on the telephone rather than on the air. Margie is a very sick girl and is in the hospital. It's leukemia and I'm afraid the prognosis is negative." I could hear a sob in his voice as he talked.

Doc was right; a few weeks later, Margie passed on. We, of course, attended the funeral. It was obvious that something within Doc died also when his beloved Margie left this world. I'd listen at 8 pm, and no Doc. After a few weeks went by, I called him and suggested that ham radio might be a therapy for his mind.

"No, Glenn," said Doc. "I'm selling out and am going to give up the practice of medicine. I'm tired of being a pill dispenser. There are more important things to be done. I'm going to find a cure for leukemia if I have to spend the rest of my life and my savings to do so."

As it turned out, Doc, through his professional friends, was given laboratory space in a large pharmaceutical manufacturing plant. Doc not only worked days, but far into the night. Our contacts were strictly by telephone—and few and far between.

The months rolled by. One day I persuaded Doc to have lunch with me. I was shocked at what he had done to himself, although I said nothing. He had lost a great deal of weight and was just a tired

shadow of himself.

Then it happened. Early one morning the phone rang. It was the plant. The night watchman, making his round about 1:00 am, found Doc on the floor in the laboratory. He detected a faint pulse and immediately called the paramedics. They arrived minutes later and did all they could, but Doc was a goner. He had just worn himself out and his heart gave up.

Doc's wishes for a brief and simple funeral were obeyed. His son and daughter came from back east—the only family he had, aside from a host of professional friends who filled the small church.

When my wife and I arrived home after the funeral, we simply sat down in the living room and stared at each other. We had lost our best friends in just one year's time. Life would not be the same.

Then things began to happen. That night the bedside telephone rang about 1 am. Or, at least, I thought it rang, for something woke me up. Half awake, I lifted the receiver. All I heard was a dial tone. No one was there. Wrong number, I thought.

The next night, and the night after that, it happened again, and always at the time Doc died, although this thought did not occur to me until much later. The morning after the third occurrence, I awoke and sat up, thinking about the bell I had heard ring. It was not a telephone bell, although similar in pitch. So that night I pulled the phone plug from the wall.

So now we have arrived at the weekend. It was a Friday night. We had concluded supper and the dishes were done. I walked into the ham shack, followed by my wife, who brought the evening paper with her. She sat down and began to read. I sat down at the operating desk and stared at my equipment. Probably from force of habit more than anything else, I flipped on the two-meter receiver and turned on the transmitter filaments. I looked at the receiver dial. 145.1 MHz, just where it had been anchored for more than three years. The S-meter was registering nothing but noise.

Then it happened. A voice seemed to come over the radio. It said: "Glenn . . . this is Doc . . . I have been trying so hard to reach you . . . are you conscious of my voice?"

I was terrified, to say the least. I turned and fairly shouted at my wife who was not more than ten feet away, reading her newspaper. "Did you hear? It's Doc!"

She looked up, staring at me as though I had taken leave of my senses. "I don't hear anything," was her comment.

"Come closer," I shouted, grabbing her by the hand. I no sooner touched her than her expression changed to fright. "I hear him . . . it's Doc talking . . . be quiet!"

We sat there in front of the receiver. I had not released my wife's hand. Doc's voice continued.

"Glenn, all my work will be for naught if those notes are lost. I was almost there . . . just a few more weeks and I would have achieved my goal . . . it's BCG, I am now sure . . . find my notes and give them to my doctor friend at the lab . . . he'll know what to do . . ." and his voice disappeared. But before that happened, I had looked at the S-meter. It had remained in the noise level.

I think my wife and I must have stared at each other in profound shock for more than a minute. Finally I said to her, "That was Doc alright, but his voice was not coming through the speaker!"

"That's right," she commented. "And I didn't hear him until you grabbed my hand."

"We didn't hear anything, really, did we, now? That message was a complete and instantaneous thought implanted in our minds. It did not have the variation in tonal quality that one hears when one is talking to you," I observed.

The wife agreed. A message had come through "from the other side" but it was not spoken to us as we had thought. Of that I am positive.

The next morning I called the company where Doc had been spending his time. I talked with the M.D. who was in charge of the laboratory and told him what happened. There was a silence, and then he asked me to have lunch with him.

"I've got to question you more about what happened," he said. "Please have lunch with me."

I agreed. We met and discussed the events of the previous evening over and over. My knowledge of medicine is restricted to the use of aspirin. I wasn't sure that Doc had said "BCG" or if I had heard just letters of a complete word. However, my host seemed to know what it meant. He thanked me for my time, and we parted, although I think he gave me a very curious over-the-shoulder glance as he left.

In the years that have now passed, I have learned that extensive experimentation with BCG vaccine has been undertaken by various agencies in trying to find a cure for leukemia. I hope they are successful and that Doc was right. ■

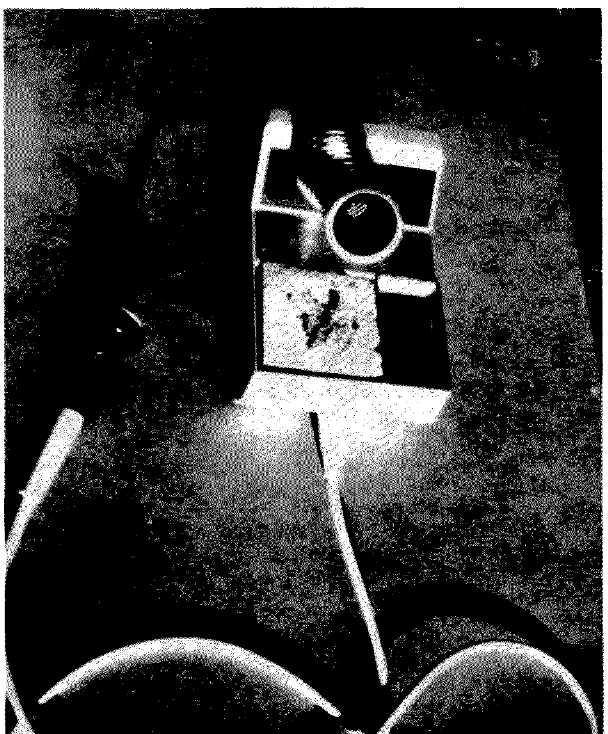
Who Needs a $40 Soldering Iron?

—here's why you may want to invest in one

73 Magazine *Staff*

Most amateurs probably start out by acquiring one of the standard, garden-variety soldering irons selling for $5 or so, and operating directly off 110 V ac. Such irons are probably fine to start off with, especially if one chooses a wattage suitable for the types of components being soldered, but after a period of time, one will start to notice various disadvantages. The tips will usually corrode rather quickly, the temperature of the iron will not be stable, and the heavy line-cord tends to curl or kink, making the iron unhandy to use. In some cases, these irons may even have such poor isolation from the ac line that sensitive components such as FET devices are damaged during the soldering process.

If one does a fair amount of soldering, it is worthwhile to consider the purchase of a more sophisticated type of soldering iron. Probably the ultimate would be a cordless iror with a constant-tempera ture regulator of some sort instant heat, and high ca pacity for extended period of soldering. Unfortunatel such an iron does not exis The cordless irons whic are available are exceller for many portable applic



This is the complete Weller "soldering station." The LED indicator which was added can be seen in the lower left-hand corner of the upper, sloping portion of the stand.

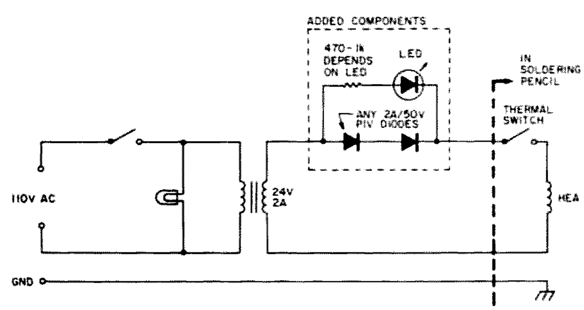


Fig. 1. Diagram of the soldering iron, including co ponents for a heater indicator light.

tions where a small number of connections have to be made. They are not suitable for most bench-type applications, however. The time an on/off sequence is gone through for a soldering operation, and the limited operating time per charge (10 minutes continuous operation for some cordless models), make this type of iron unsuitable.

Probably the best compromise for bench work which is available is one of the low-voltage irons which have a constant-temperature feature. This article describes one such iron, the Weller WTCPN series, and also includes some small modifications the author has found useful.

The Weller WTCPN is available as a "soldering station" for about $60.00. The station consists of a power unit or stand and a pencil-type soldering unit. The power unit houses a 24-volt, 2-Ampere transformer, a cleaning sponge compartment, and a metal tip tray to store extra tips. These features can be seen in the photograph.

The soldering pencil con-ıects to the power unit via ı very flexible, silicon, non-ɔurning cord. One still vishes, of course, that the :ord were not present, but ɔne hardly notices its pres-ɛnce, and even after long ısage, it will not kink in any ıanner. We have been us-ıg a similar but earlier ver-on of this iron for over five ears without any cord roblems.

The iron is wired so that ɪe tip is grounded. That is, e ground wire from the ac ɪe cord is wired through that it connects to the etal frame of the iron ɪich holds the tip in place. ɪe could, of course, ac-ss this wire in the stand d connect it to the ɔund foil on a PC board if ɪe especially sensitive mponents were being sol-ɛed.

A main feature of the iron is its temperature control system. It is rather unique, but won't be described in great detail since it is nothing that can be duplicated by the experimenter. Basically, each interchangeable tip used with the iron has a ferromagnetic disk on its base. The tips do not screw in but are simply dropped in place in front of the iron and held in place with a screw-down collar. The ferromagnetic disk loses its magnetic property when it reaches a specific temperature. This disk interacts with a spring-loaded permanent magnet and switch in the soldering iron assembly to turn on and off the heater element also contained in the assembly. So, one constantly hears a faint clicking noise as the tip calls for heat or shuts off the heating element so that it can maintain a constant temperature. The whole heat-control mechanism is self-contained in the soldering pencil.

A variety of Weller tips is available for the iron and probably will satisfy most needs. We have found on occasion, however, that the miniature screw-in tips made by other manufacturers such as Ungar have advantages. One of the Weller types was modified, therefore, by cutting it off just above the ridge on the tip which fits the hold-down collar. The body of the tip was tapped to accept the screw-in tips. This arrangement has worked very well since the ferromagnetic disk on the bottom of the Weller tip preserves the temperature-control feature while providing added versatility from a wider variety of tips.

Another feature that was found to be useful was the addition of an indicator showing that the heating element in the iron was being sequenced on and off. Such an indicator was added as shown by the dotted lines in Fig. 1. In this case, advantage was taken of the voltage drop across two ordinary power diodes to activate an LED. This scheme also, of course, half-wave rectifies the 24-volt ac supply. The iron possibly has to cycle "on" a bit longer because of this, but absolutely no effect on normal usage has been noted.

Another scheme would be to insert a small resistance in series with the circuit and place a lamp across it. A ½-Ohm resistance, composed of several standard 2.7-Ohm resistors in parallel, will produce about 1 volt when the heater is operating and can light a small 1.2-volt flashlight bulb such as a type #211. The LED indicator used was placed in the lower left corner of the upper part of the stand and can be seen in the photograph.

From an electrical viewpoint, the only thing the stand contains is a 24-volt transformer. One can, therefore, just purchase the soldering pencil and power it with any suitable transformer. The pencil is available separately as item TC-201, sells for about $20.00, and comes complete with one tip. In fact, we used an earlier iron of this type powered by some old 6.3-volt filament transformers wired in series to produce 18 volts, and it provided excellent service for years. We believe the whole soldering iron/stand assembly is worth the $40.00, but this way you can have essentially all of it for $20.00!

Weller products are manufactured by the Cooper Group, Electronics Division, P.O. Box 728, Apex NC 27502.■

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Outboard Power for the 820

—it's easy to connect a second set of ears to the Kenwood transceiver

For working DX, especially on CW and SSB, nothing can beat a separate receiver and transmitter or a transceiver with remote vfo for split-frequency operation. Many DX stations and DXpeditions operate split frequency for a variety of reasons.

If you own a TS-820 and a second receiver (Drake R-4A, in my case) and don't want to spend the extra bucks for the VFO-820, this change is for you.

Merging the 820 with a second receiver is simplicity itself and provides real versatility. The cost is minimal and, for most, will only involve the purchase of a connector from Kenwood.

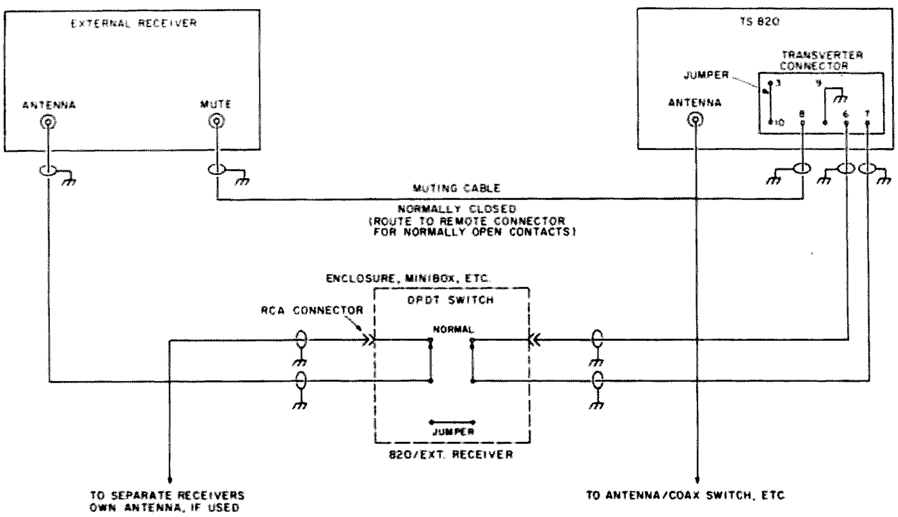

Fig. 1. Showing separate/combine switch, the configuration at KL7GRF/6 uses a separate 4BTV vertical antenna, switched on to the external receiver when the switch is in the NORMAL position. When going to the 820/EXT RECEIVER position, whatever antenna is on the 820 is also used on the external receiver.

The change is a no-holes modification, taking advantage of the transverter connector on the rear of the 820. At this connector, outputs are available to power the TV-502/506 transverters, antenna inputs, etc. Also included is a normally-closed relay contact.

Modification

1. Purchase a male connector from Trio-Kenwood, 1111 West Walnut Ave., Compton CA 90220. It is part #E09-1272-05 (formerly part #E09-1204-05).

2. Make the following connections to the new connector. All cables should be long enough to reach the external receive

and an externally mounted switch—see Fig. 1.

(a) Small shielded cable (RG-174, etc.), center conductor to pin 8, shield to pin 9. This is the "muting" cable for the external receiver (most receivers use closed-to-ground contacts for "normal" operation and open contacts for "muting"). Check your manual before making this modification. Normally-open contacts, if your receiver needs them, are available on pins 5 and 1 of the remote control socket on the rear of the TS-820.

(b) Shielded cable, center conductor to pin 7, shield to pin 9. This is the receive antenna relay contact output of the TS-820.

(c) Shielded cable, center conductor to pin 6, shield to pin 9. This is the TS-820 receiver antenna input.

(d) Jumper pins 3 and 10. This maintains 250 V dc within the TS-820.

(e) Close up and secure the connector.

3. Run external connections to a DPDT toggle/slide/rotary switch as desired. Connect as shown in Fig. 1. I mounted the switch in a small minibox, next to the TS-820 for convenience, with RCA connectors for inputs and outputs. The purist may choose to use PL-259, BNC, etc. The impedance bump in the line to the receivers caused by the switch and connectors should be minimal.

4. After making the connections, you are ready to try it out. Place the transverter switch on the rear of the 820 to ON and plug in the newly-wired connector. Place the external switch to NORMAL. The 820 receiver should operate normally. The external receiver will switch to its own antenna. Place the switch to 820-EXT RECEIVER. The 820 receiver should go quiet and the antenna on the 820 will be switched to the external receiver. Key the 820 transmitter and ensure that the external receiver mutes correctly (depending on your muting configuration). The external receiver will mute any time the 820 transmitter is keyed, either in normal or combined, guarding against any high incoming rf to the separate receiver.

To return the 820 to normal operation for resale, etc., merely pull out the connector, put the transverter switch to OFF again, and you are back to normal.

This change could also probably be applied to the TS-520. Check the TS-520 manual. One can still use the VFO-820 in this configuration with the TS-820 with no changes required, providing even more flexibility.

I have been using this change for some time and it works beautifully. Of course, no attempt has been made to make the 820 transceive with an external receiver. This is strictly for split-frequency operation or as a transmitter/receiver operation. My main interest in ham radio is RTTY operation, and this combination certainly makes it a pleasure when working drifting stations. RTTY with a transceiver can be a pain when two stations start leapfrogging down the band because one is drifting.

I claim no originality for this modification. There are any number of ways this could be accomplished and many probably already have done so. This is an economical way to do it and, best of all, involves no holes. ■

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CB to 6

—convert a 49-MHz HT into something

Do you need an inexpensive means of communications? Whether you hunt, fish, put up antennas, go to hamfests, or just have a need now and then for a wireless telephone, I think I have just the answer for you.

If you have ever owned or listened to the "toy" variety 100-mW CB handie-talkies, most of which were on channel 14, you probably will agree that they are worthless for doing much of anything—including monitoring channel 14! Well, great new things have happened in the CB handie-talkie 49-MHz band.

I purchased from Radio Shack a pair of Archer transceivers, catalog number 60-4001, with batteries, for just under $17. That was just before Thanksgiving, 1978. While these are not kW transmitters (50-mW rated, ¼-mile range), at least they are crystal controlled! The receivers are not multi-conversion masterpieces (superregenerative detectors), but they are more than adequate. Now for the bad news—and why I personalized mine.

First of all, the unit has no squelch. Being used to the serene silence of 2-meter FM, the "blowing" noise continually grinding forth from the speaker was going to drive rhe bananas. Next, to add to the noise problem, there is no volume control, either! Something had to change and fast. Adding a squelch to a radio that has only three transistors and draws 20 mA on receive seemed a bit much then (but open to future thought), so I added the next best thing—a volume control. Less noise is not no noise, but it beats bunches of noise hands down. The next question was where to put it.

If you have not looked at these little rigs, by all means do so. They are much smaller (5¼" x 2-11/16" x 1-5/8") and lighter (0.39 lbs/177 g) than their older, bulky, antique cousins on channel 14. *Real* shirt-pocket radio is here! They even use a 2-inch speaker/mic for reasonable quality sound. Not hi-fi, but nice. Small is nice—but crowded. There just was not anywhere to put a shaft-type volume control, miniature, sub-miniature, or otherwise. Therefore, the following compromise ensued.

I did find a corner down under the battery and foam rubber battery pad where I could hide a small screwdriver-type, multi-turn pot. If you use a Bourns trimpot, model 3006P-1-501 (500-Ohm), and follow the drilling diagram in Fig. 1, it just fits nicely. Start the hole with a #50 or smaller bit and finish very slowly with a #25 (or so) bit to just clear a small-blade screwdriver. Use Eastman 910™ adhesive (very few drops) to hold the pot down in the corner as shown—flush with the case side, front, and bottom. This will leave the pot's brass adjustment screw aligned in the hole you drilled, sticking out about half the thickness of the case. This is far enough to reach easily for adjustment, but not far enough to bump out of adjustment.

Follow the instructions in Fig. 1, and you will do just fine. I modified this part of two transceivers in exactly an hour, including time spent figuring out a place to put the pot, how to route wires, etc. The trimpot is a multi-turn unit, so you have a nice slow change in volume until you reach the level you want. Have a friend move out about 100 feet with one unit and transmit to you while you adjust the pot. You will be quite surprised at how low you can go and still not miss any calls.

Since there is virtually no one else on 49 MHz yet, you can instantly tell when someone calls just by the sudden low-level noise reduction. However, the sound level is now down far enough to make it hard to understand every word without literally holding the radio up to your ear. Break out the screwdriver? Not on your life! Read on.

If the code key on the HT really produced A1 telegraphy there might be a benefit to keeping its function as is, but A2 is what they make do with. It may teach a few kids the code, but for just about anything else, it is worthless. The key is a simple SPST leaf switch formed by a leaf contact in the case and a contact on the board. Fig. 1 includes instructions so you can free it up from its tone function and put it to good use: to short out the volume-control pot you just installed. Voila! We now have a push-to-receive switch for full receiver volume, without having to stand for the full-volume racket all the time!

While I was at it, I added an earphone jack for personal listening with the transceiver clipped down on my belt. This may be tough unless you have a female chassis-mount miniature phone plug close to the size of mine. I stole mine from an old pocket BC-band radio, so I can't really help you with part numbers. A lot of the similar jacks I have seen in stores are just too deep behind the panel to fit. Look around, and you're sure to find something if you want the addition badly enough (and I did!).

It is wired with the pink speaker wire going to the NC contacts (when no male plug from the earphone is inserted) to complete the speaker function. The center pin gets the audio when the plug is inserted. A new wire goes from where the pink wire was, near the PTT switch, to the jack's common switching pole (not the case or ground) to route audio, during receive, from the area of the PTT switch to either the speaker or earphone. This way the speaker operates normally until an earphone is plugged in.

Another addition was a tab-type belt hook to give hands-off listening ability while working on antennas or trotting around hamfests. It really goes hand-in-hand with the earphone modification. Be very careful with the mounting hardware and its placement, or you will either short out or break the PC board with the unit all closed up.

The rest of the modifications really make it a ham radio, if you so choose. I am still waiting for the proper crystal to arrive to complete this one myself. A big (too big, physically) crystal was tried on 50.7 MHz in its huge can-type holder (HC-6). The radio tuned right up using a field-strength meter by holding the radio very steady, and backing off on L2 a bit to get the 840-kHz increase in frequency. The FCC surely was nice when it moved the new CB HTs right next door to 6 meters (chuckle!). That's it—one adjustment and one new crystal of the KSS-T8B type. I'm sure that any of the crystal manufacturers can fix you up if you send the old crystal and the schematic along.

There are many like me who have jumped at the new multi-mode synthesized rigs for 2-meter home use, probably with a crystal rig for the car (unless you drag one rig back and forth), and just can't find the loot to have a handie-talkie as well. I hope this can be the answer to your personalized radio needs. Get a pair, and get a friend on. While on the 49-MHz CB band, they have to use the built-in antenna (it is nice and short), but once the HTs are moved to 6 meters, a 5/8-wavelength loaded antenna, or even a one- or two-stage trunk-mounted PA, would be legal. Now let's see, where can I fit in another jack for the antenna connector?

If you need any help, just send an SASE, but this one is so simple it should be all done and running before you know it. The

(1) Remove battery.
(2) Remove back cover screw.
(3) Squeeze top and bottom to remove back cover.
(4) Remove the one screw holding the board in place.
(5) Remove and keep the blue jumper, A-B.
(6) Drill #60 hole next to A.
(7) Solder new 6" leads into A and B and dress toward the battery compartment.
(8) Remove the brown lead at C and place in A—fold over and solder to A.
(9) Cut and remove the foil shown.
(10) Use blue jumper from B to switch pad X.
(11) Glue the pot in place and connect it to the added leads. Shorten the leads as required. Connect so that resistance decreases with clockwise rotation of the pot screw.
(12) Dress the foam and cardboard back over the pot connections.
(13) Check for lead dress clearance, solder bridges, etc.
(14) Temporarily hook up battery and check out the unit.
(15) Reverse steps 1 through 4 to re-assemble.
(16) Push the code button for full volume.

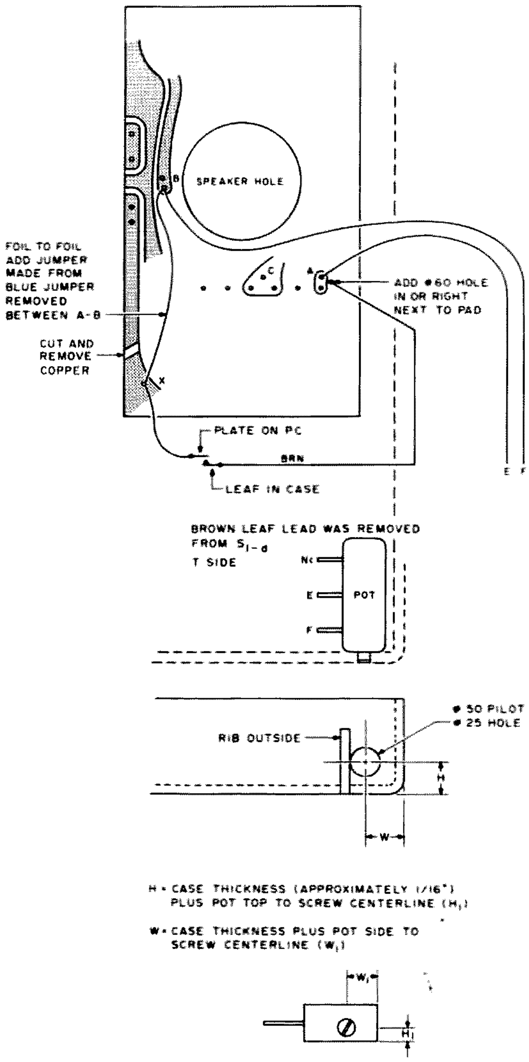

Fig. 1. Volume control and push-to-receive mods.

radios use a common 9-volt transistor radio battery available about anywhere, which is nice, and there are even 9-volt nicad batteries around in the same physical packages now. (Now let's see, if I throw out the radio PC board, I'll have room for one more jack for the charger!) Seriously, since 50.7 MHz was once more or less a standard spot for AM mobile/portable operations, I would like to suggest we all meet there. It would make it nice for hamfests and some QRP fun. Any takers?

Another ham friend of mine and I have contemplated buying another pair of HTs and using the telescoping antenna as a gamma-type rod built right onto a 3-element yagi antenna. We would keep the regular cases as spares for the first pair of radios, and build some kind of waterproof case (PVC tubing with end caps?) around the radio, mounting the whole thing right on the antenna. We would then add a resistor and zener in place of the battery and a small set of reed relays for T-R switch-over, sending the audio, switch-over control, and power up and down a rotor-type cable. I really think this use meets the letter, but not the spirit, of the FCC regulations on "built-in" antennas, so the FCC can relax!

We are going to 50.7 MHz before we try this part. 50 mW—wow! Anyone who can suggest a means of A1 keying a one-transistor rig like this would find his comments welcomed by me, and if you decide to join us on "flea-power" radio, by all means drop me a letter or card so we can listen for you. At least it shouldn't be a dull year on 6 meters. ■

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Digital Boat Anchor

—using pencil, paper, and a frequency counter for receiver readout

A while back, I found a real treasure at a local garage sale. It was an old HQ-145A receiver, a little the worse for wear but in operating condition. Besides, the price was right at $25 cash-and-carry.

After bringing the gear home, I found that it had been accumulating dust since it was new around 1960. After cleaning and retuning, it proved to be a pretty fine piece of equipment despite its age. The sensitivity was good and the selectivity, due to crystal phasing and slot filters, was acceptable for general listening.

The one thing that did bug me, however, was that I could not get the dial to read accurately even with its 100-kHz calibrator. On the ham bands, the calibration was fairly good on the calibrated bandspread for these bands. (At least you could tell where you were within 10 kHz.) But on the other bands there was not a calibrated bandspread, and without a book full of graph paper and the use of the logging scale as a reference, you were never sure just where you were listening.

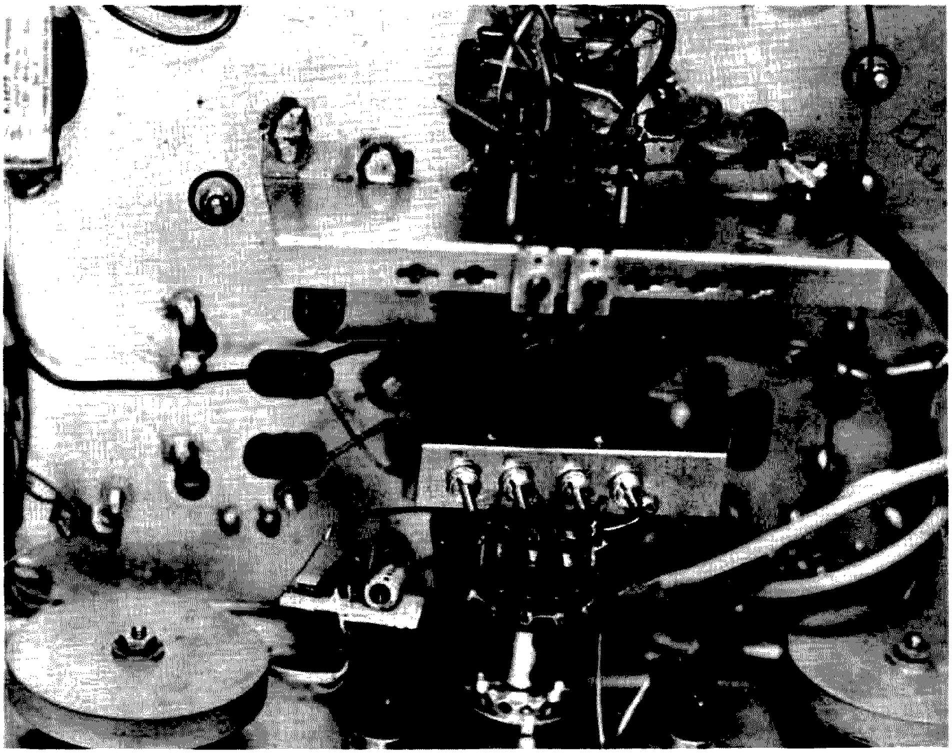


Photo A. The 1½" x 1½" buffer circuit board can be seen to the left of the bandswitch. The output phono jack can be seen below the buffer. Keep the leads from input and output as short as possible. The receiver may have to be realigned slightly after installation of the buffer.

By the way, the graph paper method has been used for years. It's simple, but time consuming and not as accurate as I really wanted. Besides, a graph has to be made for each band of frequencies because receivers, including the HQ-145A, are not linear in their tuning. As a result, when you get down to the lower frequencies, you can use quite a bit of graph paper. (See Fig. 1.)

The graph-paper method is as follows, in case you are interested in using it before you build a digital readout: First, mark the X axis, or the vertical lines of the graph paper, to correspond to the logging scale of your receiver (usually 0 to 100). Next, on the Y axis, or the horizontal lines along the left side of the paper, mark the frequencies in which you are interested, placing the lowest frequency on the

bottom line and proceeding up the paper. When your paper is ready, set your receiver to the lowest frequency on your graph, using your 100-kHz calibrator and the main tuning dial. Keep the bandspread set at 0.

Next, begin tuning up in frequency, using the bandspread dial only. Every time you come to a signal from the 100-kHz calibrator, mark it on the graph paper by finding the coordinates of the frequency and the logging scale number. After you have done this for every 100-kHz point between 0 and 100 on the logging scale, draw a line between the points. Now you can read any frequency in the range off the graph by following the frequency line over to the graph line and then down to the X axis to find the logging scale number. Conversely, you can determine an unknown frequency by following the logging scale number up to the graph line and then over to the frequency. You should be able to tell from the way the points lie on the graph that the receiver tuning is not very linear, even over a narrow band of frequencies. This contributes to the inaccuracy of the method, as does the resetting of the main tuning knob the *next* time you want to use the same graph.

Being spoiled after using many pieces of modern electronic gear with bright digital readouts, the calibration drawback to the HQ-145A annoyed me no end. Therefore, I decided something had to be done to fix this problem.

After searching through stacks of old magazines and reading various books, it suddenly dawned on me that to put a direct-reading digital readout on the HQ-145A was going to cost me quite a bit of money. And, let's face it, the receiver cost only $25.

It suddenly occurred to me that I did not need a direct-reading readout on the HQ-145A; all I needed was a way to determine what frequency I was listening to. The wheels started turning, and, before long, I had decided to read the oscillator frequency directly with my frequency counter, and to subtract, mathematically, the i-f of 455 kHz to give me the frequency of the received signal.

The first attempt at doing this failed miserably because, as I had expected, the addition of the frequency counter to the load on the oscillator drew the oscillator so far off frequency that I could not re-calibrate the receiver to the frequencies on the main dial. Therefore, I had to add a high-impedance input buffer between the oscillator output and the counter. This stopped the pulling problem completely, and the receiver retained calibration with the counter in or out of the circuit. So, if my counter was doing duty somewhere else, the receiver still functioned as it did before the modification.

The buffer, which is shown in Fig. 2, was built completely out of junk-box parts, but I am sure that if the parts were purchased new they would not cost more than a couple of dollars. It is also small enough to fit into any chassis (1½" x 1½"). The power for the buffer was stolen from the receiver filament supply (Fig. 3). A phono jack was mounted in a vacant spot on the chassis as near as possible to the mixer. This jack was connected to the output of the buffer and had easy access from the top of the receiver for the insertion and removal of the frequency-counter cord.

This scheme will work with any superheterodyne receiver with any i-f, be it 455 kHz, 1600 kHz, or what have you. Just remember to subtract the correct i-f for

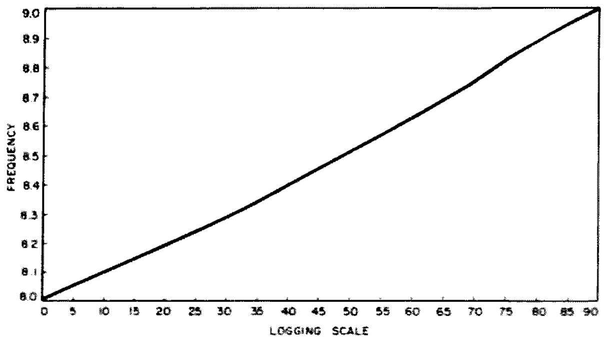


Fig. 1. Graph used to find, roughly, a wanted frequency. As can be seen, the line is not linear due to non-linear tuning of the receiver and to logging scale errors.

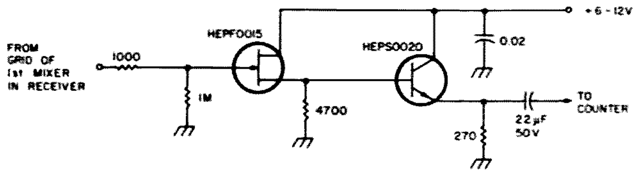


Fig. 2. Buffer circuit.

your receiver. In fact, the highest band of the HQ-145A is double-conversion, and the first i-f is 3035 kHz.

To find the frequency of a signal which is tuned in on the receiver, just subtract the i-f from the displayed figure. To set the receiver to a pre-determined frequency, just add the i-f to the frequency desired and then tune the receiver until that figure is displayed on the frequency counter. It's as simple as that. It's nice to be able to pre-tune the receiver for a desired frequency and know that you'll be right on the money.

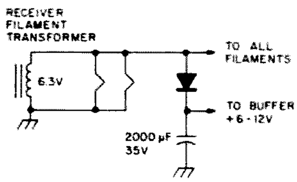


Fig. 3. Power supply for buffer, from the receiver filament supply.

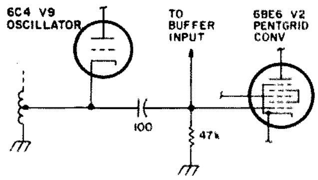


Fig. 4. Take-off point for HQ-145A receiver rf should be taken off the grid of the 1st mixer or converter tube.

As an example, suppose you have a receiver with an i-f of 455 kHz and you have a schedule on 7.235 MHz. To find the frequency, you would add the 7.235 MHz and .455 MHz and get the figure 7.690. Tune your receiver until this figure is displayed on the counter, and you will be listening on 7.235 MHz.

Suppose you are tuning across one of the international broadcasting bands and discover a signal which you can't identify. The display reads 10.445. By subtracting .455 you discover the actual received frequency is 9.990 MHz. You can then turn to a list of international broadcasting frequencies and have a big advantage in identifying the signal by knowing the frequency.

It takes a pencil and paper or a calculator to read the frequency accurately, but the price makes the little additional work seem very much worth it.■

New Products

from page 23

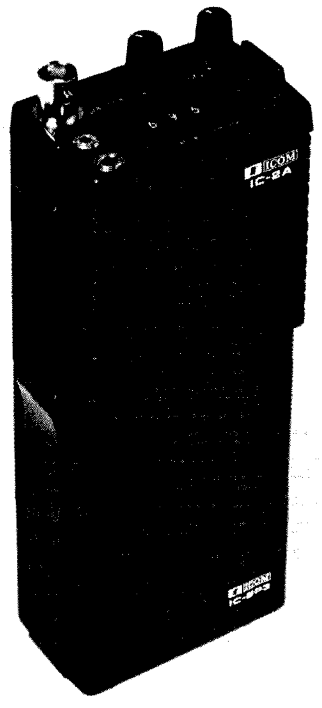
Government radio communications installations in the 2-420 MHz spectrum as released under the Freedom of Information Act.

The exhaustive volume comprises the entire unclassified computer file for that frequency range. It includes Justice, Treasury, NASA, FCC, FAA, Interior, Army, Navy, Air Force, Coast Guard, and many other Federal Government agency listings.

The entries are arranged in order of frequency, agency, and geographical location, and include installations in the 50 states, possessions and protectorates, and space satellites.

The *Federal Frequency Directory* is available for $14.95 postpaid from *Grove Enterprises, Box 156K, Brasstown NC 28902*, and from qualified dealers. Inquiries are invited. Reader Service number 481.

The Argonaut 515 from Ten-Tec.



Icom's new IC-2A.

NEW TEN-TEC "ARGONAUT" 515 UPDATES WORLD'S MOST POPULAR QRPp RIG

Latest in the famous Ten-Tec "Argonaut" QRPp line, the Model 515 brings the performance level of the '80s to low-power operation.

Featuring a new super-sensitive receiver front end, the 515 has 0.35-uV sensitivity, a 4-pole crystal lattice filter with 2.4 kHz bandwidth, a unique optional combination CW filter and variable notch filter in an outboard cabinet, and a new heterodyne vfo with a new permeability-tuned oscillator which provides increased calibration accuracy. Argonaut's band coverage (80-10m) has 10 meters split into new 500-kHz segments (others optional). Other features include offset tuning with LED indicator, resonate control, direct frequency readout, QSK instant CW break-in, adjustable sidetone level and pitch, "S"/swr meter, low-distortion audio, and built-in speaker.

The broad band transmitter section features a new design no-tune final for instant band change, 5 Watts input, new LED output indicator set for 2-Watt voice operation, TVI filter, automatic 750-Hz CW offset, automatic sideband selection (reversible), and PTT.

New styling in black and bronze colors with new knob design and new tilt-up bail make the Argonaut 515 a handsome addition to any QRPp enthusiast's operating position.

For full information, see your dealer or write *Ten-Tec, Inc., Highway 411 East, Sevierville TN 37862; (615)-453-7172.*

NEW HAND-HELD FROM ICOM

Icom's new hand-held is finally here! The IC-2A 2-meter hand-held covers 144.000 through 149.995 MHz in 800 synthesized T-R channels with selectable 1.5- or .15-Watt output. This unit is only slightly larger than a dollar bill (35mm thick, though) and weighs 450 grams (1 pound) including batteries and flexible antenna. Power may be supplied via an alkaline or nicad battery pack (8.4 volts). Audio is handled by a built-in speaker and condenser microphone, but an optional 600-Ohm dynamic microphone can be used. Sensitivity is rated at less than 0.4 μV (0.2 μV typical) for 20 dB of quieting. Approximate current requirements on transmit are 400 mA at 1.5 Watts and 160 mA at .15 Watts; on receive, at maximum audio, current drain is 140 mA and 20 mA squelched. Three sizes of snap-on nicad packs (250 mA standard) allow the IC-2A to carry the power you need.

IC-2A packages are available with alkaline battery pack (without batteries), nicad battery pack and wall charger, and nicad battery pack, wall charger, and built-in touch-tone™ pad. Options to the basic unit include a speaker/mike, drop-in desk charger, and leather case. *Icom America, Inc., 3311 Towerwood Dr., Suite 307, Dallas TX 75234; (214)-620-2780.*

Gene Smarte WB6TOV/1
News Editor

HAM SCAN-2

Frequency-scanning adapters for 2-meter radios have been on my mind quite a bit for the past year, especially since a lot of that time was spent designing and constructing two different scanners for the popular Icom IC-22S.

I learned from that experience that all of these scanners go about their business in much the same manner. So, when a friend asked me about scanning his Kenwood 7400A transceiver, I knew that any adapter, whether built by me or someone else, would be based on the principle of counting through the desired range of frequencies digitally—eliminating the need to spin the dials. By letting the little chips supply the necessary electrical bits, one can do other things and let the scanner take some of the drudgery out of life. I opted to purchase a ready-made unit.

Since they all start out the same way, there must be something which sets apart the various scanner products on the market. That something is features. So, after taking in all the literature that I could gather from the manufacturers, the product chosen for the 7400A had to be the Ham Scan-2.

It seems that this unit has all the user features that I would have built into a scanner and more. Furthermore, it is the only one that I could find which has them all.

Among the more important of these operator conveniences are:

•The front-panel dials on the radio do not have to be zeroed-out to scan through the desired range of frequencies.
•It will go through the whole 2-meter band in an amazing 20 seconds.
•The unique design allows for one channel of memory.
•No portion of the easily-selected scan range is skipped over or omitted.
•The frequency can be "bumped" in 10-kHz steps with the scan start/stop switch.
•Scanning cannot be engaged while the transmit button is depressed. This prevents one from accidentally kurchunking every repeater within range. (Repeater users have got to appreciate this benefit greatly.)
•The whole unit fits nicely inside the case of the radio.

The installation justified my high expectations of the product. There are a lot of wires in the frequency-determining sections of a digital phase-locked loop radio, and, if one is not given precise instruction, digging into them could prove disastrous. The Technical Clinic instructions left nothing out and were set up a la Heathkit®, with one thing being done and checked off at a time. The unit went into the radio without a hitch. The scan start/stop switch mounts in the microphone using existing wiring and a few jumpers. The scan on/off switch is an unused terminal of the 7400A tone selector.

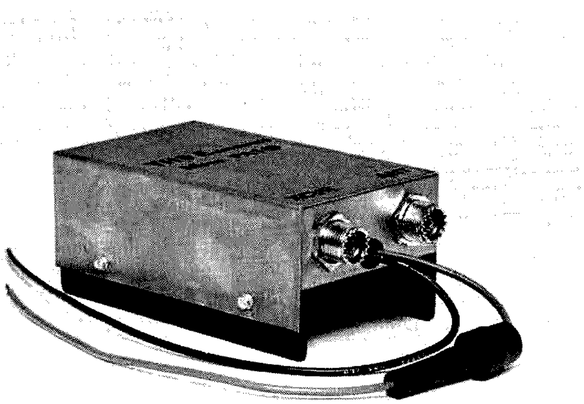
Operation is as smooth as the installation. With the scanner running, an occupied frequency stops it for 3 to 4 seconds, enough time to decide if you want to stay there and monitor/operate for a while. A flick of the start/stop switch is all that is needed. Should you get tired of listening around, a twist of the scan on/off switch brings the previously dialed-in panel frequency back on the radio; nothing to it. Everything is packed into two operator motions.

This particular unit has been in operation for several months without missing a beat, and many hams in my area report having used them for much longer with equal results. The reliability seems to be uniform.

Technical Clinic advises me that they have other types of products on the market and in the works. If these are as completely slick and functional as this unit, I look forward to trying them all.

One more thing: In these days of loophole-filled warranties, a good one is worth the price of the product, and Technical Clinic has a great one: "Should you install one of our units according to our instructions and it fails to work, just send us both pieces. If the unit hasn't been tampered with, you will get your radio back with an operating unit installed. Pronto." How about that? Solid! Just as solid as the product they make. *Technical Clinic, PO Box 636, Sterling Heights MI 48078; (313)-286-4836.* Reader Service number 482.

Mike Zedan WD8JLW
Attica MI



The PA 1-10 from THS.

PA 1-10, 2-METER CLASS C AMPLIFIER

The PA 1-10 is a solid state VHF power amplifier designed for fixed or mobile operation. The amplifier operates Class C for FM only. The PA 1-10 provides a nominal 10 Watts output for 1 Watt of input. T-R switching is accomplished by diodes and quarter-wave stubs which are ac-coupled to ground. The amplifier is factory tuned to operate in the 144-148 MHz amateur band plus or minus 1 MHz for MARS or CAP operation. Some retuning may be required for out-of-the-band operation.

This design uses rugged balanced emitter rf power transistors to ensure long life and high swr protection. The size and weight of this amplifier are kept to a minimum without sacrificing performance and reliability.

For more information, contact *THS Electronics, Rt. 1, Box 195, Greene NY 13778; (607)-656-8071.* Reader Service number 476.

Larsen Kulduckie KD-4 antenna.

LARSEN ELECTRONICS OFFERS FULL LINE OF ANTENNAS FOR HAND-HELD RADIOS

Larsen Electronics, Inc., of Vancouver, Washington, has developed a full line of Kulduckie antennas to mate with all the most commonly used hand-held radios.

Larsen offers eight helical type Kulduckie models which operate on low, high, and UHF band frequencies (136-174 MHz, 406-420 MHz, and 450-512 MHz). Eight quarter-wave models are also available to operate in the 406-420 and 450-512 MHz bands. They are all color coded by frequency for easy identification.

Larsen's Kulduckie antennas mate with Motorola, GE, RCA, REPCO, and many other popular hand-held models.

They are ruggedly constructed to take the rough usage common to this type of antenna. VHF and UHF models are spring-wound for flexibility and plated with high conductivity material for Larsen's maximum radiation efficiency.

They are also all-weather-protected by a tough heavy-duty coating of an exclusive step design which prevents detuning from shorting and adds flexibility. They handle a full 25 Watts and are flexible enough to bend 180 degrees in all directions.

For more information, write *Larsen Electronics, Inc., PO Box 1686, Vancouver WA 98663.* Reader Service number 480.

XITEX INTRODUCES "SMART TU" FOR ASCII/BAUDOT/MORSE

Xitex Corporation has just announced the addition of the UDT-170 (Universal Data Transceiver) to its data products line for RTTY and Morse operation. The UDT-170 connects directly between the user's ASCII or Baudot Teletype® or video terminal and the station transceiver. For the user who does not currently have a teletype or video terminal, the Xitex SKT-100 video terminal is recommended.

The UDT-170 is actually the combination of a microprocessor-based data converter plus a high performance RTTY terminal unit (TU). In the receive mode, the TU takes the RTTY or Morse signal from the receiver audio output and converts it to a dc signal which is fed to the data converter portion of the UDT-170. Here, two single-chip microcomputers are used to convert the ASCII/Baudot/Morse input signal into an RS-232 or 60-milliamp output signal which has been regenerated to match the mode (ASCII or Baudot), baud rate, and line length of the user's terminal.

In the transmit mode, the serial output signal from the keyboard on the user's terminal is fed into the data converter in the UDT-170 where it is continuously buffered and regenerated in the desired output mode (ASCII, Baudot, or Morse) and data rate.

The UDT-170 from Xitex.

The UDT-170 will operate at any FSK shift from less than 100 Hz to over 1000 Hz, Baudot rates of 60, 67, 75, and 100 wpm, ASCII rates of 110 or 300 baud, Morse rates from 1 to 150 wpm with "Auto Track," and line lengths from 40 to 80 characters. Other features include a 2-digit LED display for the copy wpm rate (Morse only) and buffer states, and an optional CW "indent" feature for RTTY operation.

The UDT-170 is packaged in an RFI-protected metal enclosure measuring 12" x 7¼" x 3½" and operates on either 115 or 230 V ac, 50/60 Hz. For additional information, contact *Xitex Corporation, 9861 Chartwell Dr., Dallas TX 75243; (214)-349-2490.* Dealer inquiries and overseas orders welcome. Reader Service number 478.

Looking West

from page 10

formed ARC Security employee told me.

"But when I returned to the same checkpoint after seeing my wife onto her plane, I asked the supervising guard under what authority the demand had been made. The supervisor, an ARC sergeant, toned the 'demand' down to a 'request,' which he claimed is routinely made on behalf of the airlines which contract for ARC's services at the Atlanta airport.

"Contacted by mail, Delta Air Lines (the largest carrier headquartered in Atlanta) confirmed that even such a 'request' has no legal basis. Wayne G. Reel, director of Delta's Atlanta station, wrote that 'ARC Security, Incorporated, employees have been advised that there are no laws or statutes presently in force that prevent radio communication on our concourses.'

"ARC management, in a telephone interview, acknowledged that their employees had made errors in the incident both by demanding that the handie-talkie be disabled and in claiming that amateur communications were prohibited beyond the checkpoints. 'Our officers make millions of judgment calls every month,' said Tom Cleary, regional manager for ARC Security. 'They must assure themselves that any item carried past the checkpoints is okay. Radios are okay. The guard only had to assure himself it was a radio.'

"Cleary said that ARC checkpoint guards do not receive explicit instructions on how to ascertain that a radio is just that and not a bomb or gun. Every guard asked to pass a radio through a checkpoint makes a decision based on his or her own knowledge and experience. 'If a guard is uncertain about an item, he will ask the owner to wait and defer the judgment to a supervising guard, an airline employee, or law enforcement personnel.' In the deadly serious business of searching for harmful items in American airports, such double checks are agreeably endured by most people.

"The ARC executive confirmed that the contracted security guards have no authority to detain anyone. That authority is limited to law enforcement personnel with legal cause. ARC employees can and occasionally do escort persons with suspicious or unusual hand baggage to the gate areas to report that baggage to airline employees or flight crews. Such a report might be made if a security guard believed a traveler intended to use a radio on board an airliner without proper permission. Such use is banned."

THE WINTER OLYMPICS DEPARTMENT

Amateur radio played a rather important role at the Lake Placid Winter Olympics.

Depending on whom you speak with, any one of three separate groups was the "official" Olympics station. I had an *unofficial* Westlink correspondent covering the games, concentrating his reports on the amateur radio activity related to the event. Thanks to Ray Thill WA9EXP, we were able to ascertain exactly what was going on.

An organization known as the "Winter Olympics Radio Amateur Network" was the official station, operating from the athletes village. There was only one problem. Due to the station location, it was impossible for the average amateur to wander by and utilize the equipment. The main function of WORAN was to handle traffic in and out of the Olympic village, and reports are that Lincoln Dixon and his crew did a splendid job. I do not have a total count of the number of pieces of traffic handled, but I understand it was enormous. Contrary to earlier reports we received, the "torch run communications" was not a WORAN operation. They were a part of it, but the actual operation was put together by staffers from ARRL headquarters. Dubbed "Operation Rollerball" by those participating, a caravan of amateurs escorted the Olympic torch from the moment it landed in the USA until it entered the Olympic stadium. According to Steve Mendelsohn WA2DHF, one of the amateurs who helped put the network together, the entire operation ran flawlessly, even though the schedule kept changing on a moment's notice.

The final amateur station at the Winter Olympics was actually a joint effort by members of the press corps covering the event—particularly the technical people from the television operations. Since the FCC had stopped issuing special event callsigns, the group obtained the callsign VE3OLP from the Canadian DOC and operated it "/2" from a number of locations as a commemorative station. Their goal was to provide a recreational station that would be accessible to as many amateurs as possible, and for this reason stations were set up at the International Broadcast Center, the Ramada Inn, and Howard Johnson's. If you worked VE3OLP/2 during the Olympics and wish to QSL with them, try sending your own QSL to Box 307, Sunland CA 91504. By the way, if you haven't fig-

ured it out yet, VE3OLP stood for VE3 "Olympics Lake Placid."

As if this were not enough, a group from within this group also provided a number of special event repeaters for the duration of the event. They were built in California with equipment supplied by the Sober Radio Empire of Los Angeles. Both were open systems operating under the callsign WD6DYZ/2/RPT; they were placed in operation by engineers from ABC-TV.

While the Olympics only recognized one of the three, WORAN, as the "official" Winter Olympics amateur station, I doubt if anyone would really mind if Looking West proclaims all three as having provided a truly outstanding "official" service. We congratulate all on a splendid job.

One closing comment: Plans are already being formulated here in Los Angeles for the 1984 Summer Olympics. The Los Angeles Council of Amateur Radio Clubs has appointed Bill Principe AJ6J to spearhead amateur radio's participation in the event. Amateurs with ideas on the project should write to '84 Olympics Communications, c/o TASMA, PO Box 444, Northridge CA 91328.

Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, Attn: Social Events.

MANASSAS VA
JUN 1

The Ole Virginia Hams Amateur Radio Club, Inc., will hold its seventh annual Manassas Hamfest on Sunday, June 1, 1980, at the Prince William County Fairgrounds, Route 234, Manassas VA. Booths are available. Admission is $3.00, children under 12 are free, and tailgaters are $2.00. Talk-in on 146.37/146.97 repeater (WB4HHN) and 146.52 simplex. For further information, contact Joseph A. Schlatter K4FPT, Ole Virginia Hams ARC, Inc., PO Box 1255, Manassas VA 22110.

BRAINTREE MA
JUN 1

The South Shore Amateur Radio Club will hold its annual auction on Sunday, June 1, 1980, at the Viking Club, 410 Quincy Avenue (Route 53), Braintree MA. A flea market will precede the auction from 10:00 am to 2:00 pm in the Viking Club parking lot, weather permitting. Space is $3.00; bring your own table. No reservations are necessary. The auction will start at 2:00 pm and admission is free. There will be a 15 percent club commission on auction items only. For further information, contact The South Shore Amateur Radio Club, c/o Kristen Johnson K1WQ, 86 Alton Road, Quincy MA 02169.

CHELSEA MI
JUN 1

The Chelsea Swap and Shop will be held on Sunday, June 1, 1980, at the Chelsea Fairgrounds, Chelsea MI. Gates will open for sellers at 5:00 am and for the public from 8:00 am until 2:00 pm. Admission is $1.50 in advance or $2.00 at the gate. Children under 12 and non-ham spouses are admitted free. Talk-in on .52 and .37/.97. For more information, write William Altenberndt, 3132 Timberline, Jackson MI 49201.

WILMINGTON OH
JUN 1

Clinton County area amateurs will sponsor the first annual Clinton County area Hamfest 1980 on June 1, 1980, 8:00 am to 5:00 pm, at the Clinton County Fairgrounds, Wilmington OH. Admission will be $3.00; 12 and under are free. Fleamarket space is free. There will be door prizes and free parking. Food and drinks will be available. Talk-in on .72/.12. For more info, send an SASE to CCARA c/o Russ Eidemiller WD8NPZ, 310 Bethel Lane, Wilmington OH 45177.

MUNCIE IN
JUN 1

The Muncie Area Amateur Radio Club Amateur Spectacular will be held on Sunday, June 1, 1980, on the Ball State University campus with over one acre of indoor space. Advance tickets are $2.00; $3.00 at the door, with children under 12 free. Features will include food prices of the 1960s, over $2,000.00 in prizes, forums on traffic and nets, computers, ARRL, etc. Talk-in on .13/.73, 223.30/224.90, and .52/.52. For information and registration, please contact MAARC, PO Box 3111, Muncie IN 47302.

GUELPH ONT CAN
JUN 7

The Guelph Amateur Radio Club will hold the Central Ontario Amateur Radio Fleamarket and Computer Fest on Saturday, June 7, 1980, from 8:00 am until 4:00 pm at the Centennial Arena, College Avenue West, Guelph, Ontario, Canada. Admission is $1.00, with children 12 years and under admitted free. Admission for vendors is an additional $2.00. There will be commercial displays, home-computer displays, and the Sidebanders dinner at 5:00 pm (contact Jack Kirby VE3AFN). Refreshments will be available during the day. Talk-in on .52/.52, .37/.97 KSR, and .96/.36 ZMG. For further information, contact Rocco Furfaro VE3HGZ, Guelph Amateur Radio Club, PO Box 1305, Guelph, Ontario, Canada N1H 6N9 or call (519)-824-1157.

GREELEY CO
JUN 7

The Northern Colorado Amateur Radio Club will hold its Superfest II hamfest on Saturday, June 7, 1980, from 7:00 am to 4:30 pm in the Weld County Exhibition Building, Greeley CO. Features will include an operating satellite television receiving station, the Colorado Code Contest, and an auction. Additional special events are planned for families. Registration will be $3.00, with exhibition space and swap tables included at no extra cost. For further information, including details about commercial exhibit space, contact Gus Fox, PO Box 895, Greeley CO 80632.

HUNTINGTON WV
JUN 7-8

The Tri-State Amateur Radio Association will hold its 18th annual hamfest on June 7-8, 1980, at the Huntington Civic Center, Huntington WV. Admission is $3.00 for both days, with additional prize tickets $1.00 each. Prizes will be awarded both days. Commercial and flea market spaces are available at reasonable prices. Activities will include forums, hidden-transmitter hunts, a left-footed CW contest, a Saturday-night banquet, and lots of demonstrations and activities for the non-amateurs, XYLs and harmonics. Hotels, restaurants, shopping areas, and a limited number of RV hookups are within walking distance. Talk-in on 146.04/146.64. For more information, contact the Tri-State Amateur Radio Association, c/o Phil Jones WD8OTJ, 309 22nd Street West, Huntington WV 25704.

MAYVILLE ND
JUN 8

The Goose River Amateur Radio Club will hold its annual hamfest on June 8, 1980, at Island Park, Mayville ND. Features will include a flea market, an auction, door prizes, free coffee, and camping facilities. For more information, call or write Mary Carlson, Route 2, Hatton ND, (701)-543-3287.

JEFFERSON CITY MO
JUN 8

The Missouri Single Side Band Net Picnic will be held on Sunday, June 8, 1980, at Binder Lake, Jefferson City MO. There will be a covered dish dinner served at noon and drinks will be furnished by the Net. For information, contact Benton C. Smith KØPCK, net manager, Prairie Home MO 65068.

ALLENWOOD PA
JUN 8

The 9th annual Milton Amateur Radio Club Hamfest will be held on June 8, 1980, rain or shine, at the Allenwood Firemen's Fairgrounds, located on US Route 15, 4 miles north of I-80, Allenwood PA. Hours are from 8:00 am to 5:00 pm. Registration for sellers is $2.50 in advance or $3.00 at the gate. XYLs and children are free. Featured will be a flea market, an auction, contests, cash door prizes, a

free portable and mobile FM clinic, and supervised children's activities. There will be an indoor area available, plus food and beverages. Camping and motels are located nearby. Talk-in on .37/.97 and .52 simplex. For further details, write Kenneth E. Hering WA3IJU, RD #1, Box 381, Allenwood PA 17810, or phone (717)-538-9168.

GRANITE CITY IL
JUN 8

The Egyptian Radio Club will hold a hamfest and flea market on June 8, 1980, beginning at 8:00 am at the ERC Clubhouse, Slough Road, Granite City IL. Tickets are $1.50. Refreshments, activities for women and children, and overnight camping are available. Prizes will be awarded. Talk-in on 146.16/.76 and 146.52.

AKRON OH
JUN 8

The Goodyear Amateur Radio Club will hold its 13th annual hamfest picnic and flea market on Sunday, June 8, 1980, from 10:00 am to 5:00 pm at Goodyear Wingfoot Lake Park, near Rtes. 224 and 43, east of Akron OH. There will be five main prizes, including a Kenwood TS-120S with PS-30, a Tempo S1, a Hy-Gain TH3-MK3 antenna, a Den-Tron Super Tuner Plus, and a Bird wattmeter. Featured will be a large flea market, auction, and picnic area. Tickets are $3.00. Talk-in on 146.04/.64. For more information, contact D. W. Rogers WA8SXJ, 161 South Hawkins Avenue, Akron OH 44313.

MONROE MI
JUN 8

The annual Monroe County Radio Communications hamfest will be held on June 8, 1980, from 8:00 am to 4:00 pm at the Monroe Community College on Raisinville Road, Monroe MI. Tickets are $1.50, with XYLs and children free. There will be free parking and plenty of table spaces available. Features will include a contest, an auction, and displays. Talk-in on 146.13/.73 and .52. For information, contact Fred Lux WD8ITZ, PO Box 982, Monroe MI 48161, or call (313)-243-1088.

STEVENS POINT WI
JUN 8

The Central Wisconsin Radio Amateurs, Ltd., will hold its 3rd annual swapfest and family picnic on Sunday, June 8, 1980, at Bukolt Park, Stevens Point WI. Admission will be $2.00 for adults, children will be admitted free. Swap tables and tailgate sales will be $2.50. At 8:00 am, rolls and coffee will be served and at 11:00 am, a BBQ lunch will begin. At 3:00 pm, a raffle drawing will be held with a grand prize for hams of a Yaesu FT-202R 2-meter HT. Also featured will be a beverage stand, an indoor lodge, outdoor grills, horseshoe courts, picnic tables, and a kiddie korner. Talk-in on .07/.67 and .22/.82 (WB9QFW).

BETHEL OH
JUN 8

The Bethel Amateur Radio Klub will hold the second annual Bethel Ham Trade Around on Sunday, June 8, 1980, at the Bethel Middle School grounds, SR 222 Angel Drive, Bethel OH. Activities will begin at noon. There will be a small tailgating fee. Bring your own tables. The flea market will be in a large wooded area and will be for radio and electronic items. If it rains, it will be held inside the school auditorium. There will be prizes, refreshments, restrooms inside, displays, and surprises. Talk-in on 146.825/.225. For further information, contact Russ Canter WB8SID, 129 Morris Street, Bethel OH 45106.

WILLOW SPRINGS IL
JUN 8

The Six Meter Club of Chicago, Inc., will sponsor the 23rd annual ABC Hamfest on Sunday, June 8, 1980, at Santa Fe Park, southwest of Chicago, 91st and Wolfe Road, Willow Springs IL. Advance registration is $1.50 or $2.00 at the gate. There will be picnic grounds, refreshments, and parking available. Featured will be a large swappers' row, displays in the pavilion, an AFMARS meeting, and prizes of a color TV and IC-215 or Bearcat 210. Talk-in on 146.94 or WR9ABC .37/.97 (PL2A). For more information and advance tickets, contact Val Hellwig K9ZWV, 3420 South 60th Court, Cicero IL 60650.

BARRIE ONT CAN
JUN 13-15

The Lake Simcoe Hamfest will be held on June 13-15, 1980, at Molson's Park, Barrie, Ontario, Canada. Doors will open at 12:00 noon on Friday, June 13. Registration at the gate is $5.00 and pre-registration is $4.00, with children under the age of 18 admitted free. Talk-in on VE3LSR 146.85, 146.52 simplex, and 3780 kHz. For information, reservations, or tickets, write to Lake Simcoe Hamfest, PO Box 2283, Orillia ONT, Canada L3V 6S1.

WOLF POINT MT
JUN 14-15

The twenty-fifth annual NE Montana Hamfest will be held on Saturday and Sunday, June 14-15, 1980, at the Lewis and Clark Bridge Park, south of Wolf Point MT. Free overnight parking and camping spaces will be available. Features will include a flea market, a used-gear auction, door prizes, and a potluck picnic on Sunday. Talk-in on .52 simplex and 3900 kHz. For more information, contact WB7QDL or WB7QDN.

CROWN POINT IN
JUN 15

The Lake County Amateur Radio Club will hold its annual Dad's Day Hamfest on June 15, 1980, at the Lake County Fairgrounds in Crown Point IN. The event will be held indoors again this year in the Industrial Arts Building. Take I-65 to exit S.R. 231 west (Crown Point) to S.R. 55 south and follow the signs. Tickets are $1.50 in advance and $2.00 at the door. Talk-in on 147.84/.24 or 146.52 simplex. For more information and tickets, write Tickets, PO Box 1909, Gary IN 46409.

FREDERICK MD
JUN 15

The Frederick Amateur Radio Club will hold its 3rd annual hamfest on June 15, 1980, at the Frederick Fairgrounds, East Patrick Street, Frederick MD. Grounds open at 6:00 am for commercial and tailgating; breakfast will be available. The hamfest opens at 8:00 am for general admission. Donation is $3; $2 extra for tailgating. YLs and children are free. There will be plenty of on-grounds food, drink, and parking. Talk-in on 146.52 simplex (K3ERM). For more information, contact Mike Staley WB3LJK, New Market MD 21774, or Hamfest Committee, PO Box 1260, Frederick MD 21701.

JACKSONVILLE IL
JUN 15

The Jacksonville Area Amateur Radio Club will hold its 15th annual hamfest and flea market on June 15, 1980, at the Morgan County Fairgrounds, Jacksonville IL. Tickets are $1.50 each or four for $5.00. Featured will be free coffee and doughnuts from 8:00 am to 9:00 am, food on the grounds, and indoor facilities. Talk-in on .52/.52.

TERRE HAUTE IN
JUN 15

The 34th annual WVARA Hamfest will be held on June 15, 1980, at the Vigo County Fairgrounds, one mile south of I-70 on US 41, Terre Haute IN. Overnight camping will be available. There will be a free outdoor flea market, a covered flea market at $2.00 for a 12' x 12' space, with some tables and ac available, XYL bingo, food, refreshments, and valuable prizes. Advance ticket sales are $2.00 or 3 for $5.00. Tickets at the gate are $3.00, with children under 12 free. Talk-in on .25/.85 and .52 simplex. For tickets and information, send an SASE to WVARA Hamfest, PO Box 81, Terre Haute IN 47808.

VANDENBERG AFB CA
JUN 15

The 1980 Santa Maria Swapfest and BBQ will be held on Sunday, June 15, 1980, at Union Oil's Newlove Picnic Grounds, south of Santa Maria, off US 101. Tickets are $7.00 for adults and $3.50 for children 6 to 12, with children under 6 free. Extra drawing tickets are $1.00 each or 6 for $5.00. Featured will be prizes, including a new Yaesu FT-707, QLF and QBK contest, and swap tables. Swap tables are $2.50 each. Talk-in on WR6ASW, 146.34/.94. For tickets or more information, write Santa Maria Swapfest, PO Box 1615, Vandenberg AFB CA 93437, or contact KA6AKC at (805)-734-1380.

MIDLAND MI
JUN 21

The Central Michigan Amateur Repeater Association, Inc., will hold its sixth annual Swap and Shop on Saturday, June 21, 1980, from 8:00 am until 2:00 pm at the Midland County Fairgrounds, Midland MI. There will be computer displays and demonstrations, door prizes, and an auction held at 1:00 pm for gear that isn't sold. Tickets are a donation of $3.00 or 2 for $5.00, with XYL and junior op free on the OM's ticket. Talk-in on 146.73 WR8ARB and 146.52 simplex. For more information

and tickets, send an SASE to R. L. Wert W8QOI, 309 E. Gordonville Road, Rte. 12, Midland MI 48640.

DUNELLEN NJ
JUN 21

The Raritan Valley Radio Club will hold its ninth annual hamfest and flea market on Saturday, June 21, 1980, from 8:30 am to 4:00 pm at Columbia Park, Dunellen NJ. Registration for sellers is $3.00, donation for lookers is $2.00, and spouses and children are free. Prizes will be awarded, including a first prize of a Tempo S1 and a second prize of a frequency counter. Refreshments will be available. Talk-in on 146.025/.625 and 146.52. For details, write RVRC, RD #3, Box 317, Somerset NJ 08873, or phone (201)-356-8435.

BLACKSBURG VA
JUN 23-27

A workshop entitled, "TRS-80 Interfacing and Programming for Instrumentation and Control" will be held on June 23-27, 1980, at the Virginia Polytechnic Institute and State University, Blacksburg VA. This is a hands-on workshop with the participants working with and designing interfaces for the TRS-80 microcomputer. For more information, contact Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg VA 24061, or phone (703)-961-5241.

DUNKIRK NY
JUN 28

The Northern Chautauqua Amateur Radio Club will hold its second annual Lake Erie International Hamfest and Flea Market on Saturday, June 28, 1980, at the Chautauqua County Fairgrounds, Dunkirk NY. Registration is $3.00 in advance and $4.00 at the gate. Flea market space is $1.00. There will be radio dealers, door prizes, and refreshments. Talk-in on hamfest station W2SB, .25/.85 and .52 simplex. For more information and an easy-to-follow map, write Mike Samuelson WB2DFM, General Chairman, PO Box 319, Brocton NY 14716.

OXFORD ME
JUN 28

The Yankee Radio Club, Inc., of Maine, will hold its Yankee Hamfest '80 on Saturday, June 28, 1980, at the Oxford County Fairgrounds in Oxford ME. Featured will be computer displays, talks on selected subjects, a ladies' program, a youth program, swap tables, door prizes, and a buffet dinner in the evening. Registration will be $8.00, complete with a dinner and door prize chances; $7.00 for early registrations. For admission only, at the gate, the cost is $2.50. Camper hookups will be available for Friday and Saturday nights at $2.00 per night. Talk-in will be on 146.28/.88 and on 146.52. For information and registration, send an SASE to Lynda Mount, 198 Cony Extension, Augusta ME 04330.

BELLE CENTER OH
JUN 29

The Champaign-Logan Amateur Radio Club, Inc., will hold its annual hamfest on Sunday, June 29, 1980, at the Memorial Hall in Belle Center OH. A special grand prize, as well as many door prizes, will be given away. Tickets are $1.50 in advance, $2.00 at the door, and trunk and table sales space are $3.00. Talk-in on 146.52 simplex. For more information, contact CLARC, Inc., PO Box 637, Bellefontaine OH 43311.

BOWLING GREEN OH
JUN 29

The 16th annual Wood County Ham-A-Rama will be held on Sunday, June 29, 1980, at the Wood County Fairgrounds, Bowling Green OH. Gates will open at 10:00 am, with free admission and parking. Tickets are $1.50 in advance and $2.00 at the door. There will be drawings for prizes, and tables and trunk sales space will be available. There will be advance table rentals to dealers only. Talk-in on .52. For more information, write to Wood County ARC, c/o C. Falls, 201 Martendale, Walbridge OH 43465.

HARRISBURG PA
JUL 4

The Harrisburg RAC Annual Firecracker Hamfest will be held on Friday, July 4, 1980, at the Shellsville VFW Picnic Grounds. Take exit 27 off I-81 north of Harrisburg at PA route 39, then follow the signs for one mile or call for talk-in information. There are shade trees and a pavilion. Parking for 1,000 cars will be available. Food will be available or bring your own picnic. Admission is $3.00; XYLs and children are free. Tailgating is $1.50. Many valuable prizes will be awarded.

BURLINGTON ONT CAN
JUL 5

The Burlington Amateur Radio Club will hold its 6th annual Ontario Hamfest 1980 on Saturday, July 5, 1980, at the Milton Fairgrounds, just south of the intersection of Highways 401 and 25 (Exit 39). General admission is $3.00; children and ladies are free. Pre-registration before June 15, 1980, is $2.00. Gates will open Friday, July 4, 1980, at 12:00 noon and Saturday, July 5, 1980, at 7:00 am. The flea market opens at 8:00 am and tables are free. There will be camping available and food and prizes. Talk-in on 147.81/.21 VE3RSB. For information, write BARC, Box 836, Burlington ONT, CAN L7R 3Y7.

OAK CREEK WI
JUL 12

The South Milwaukee Amateur Radio Club will hold its annual Swapfest '80 on Saturday, July 12, 1980, at the American Legion Post #434, 9327 S. Shepard Avenue, Oak Creek WI. Admission is $2.00 and includes a happy hour with free beverages. Prizes include a $100 first prize, a $50 second prize, and a variety of other prizes. Activities will begin at 7:00 am and continue until 5:00 pm. Parking, a picnic area, and hot and cold sandwiches, as well as liquid refreshments, will be available on the grounds. Overnight camping is also available. Talk-in on 146.94. More details, including a map, may be obtained from the South Milwaukee Amateur Radio Club, Inc., Robert Kastelic WB9TIK, Secretary, PO Box 102, South Milwaukee WI 53172.

WILKES-BARRE PA
JUL 13

The Broadcasters' Amateur Radio Club will hold its third annual hamfest on July 13, 1980, from 9:00 am to 4:00 pm at the Pocono Downs Race Track, Rte. 315, Plains Twp., 1½ miles north of Wilkes-Barre PA. Admission is $2.50, XYLs and children are free, and there will be no additional charge for sellers. Gates will open at 8:00 am for set-up. There will be unlimited outdoor and indoor space, refreshments, prizes, a free FM clinic, and ac power available. Talk-in on 147.66/.06 and 146.52 simplex. For more information, contact Charles Baltimore WA3NUT, BARC, 62 South Franklin Street, Wilkes-Barre PA 18773, or phone (717)-823-3101.

INDIANAPOLIS IN
JUL 13

The Indianapolis Amateur Radio Convention and Hamfest will be held on Sunday, July 13, 1980, at the Marion County Fairgrounds. For further information, write Indianapolis Amateur Radio Association, Box 11086, Indianapolis IN 46201.

WAUKESHA WI
JUL 19

The Kettle Moraine Radio Amateur Club (KMRA) will hold its annual hamfest on Saturday, July 19, 1980, beginning at 7:00 am, at the Badger Raceway, Waukesha WI. The Badger Raceway is located west of Dousman on U.S. 18, 3½ miles from the intersection of I-94 and State Highway 67. There will be overnight camping on the grounds on Friday. Tickets are $1.50 in advance and $2.00 at the door. Talk-in on 146.52, 52.525, and 28.650 MHz. For additional information and advance tickets, write KMRA Hamfest, 108 Shepard Ct., Mukwonago WI 53149.

CARY NC
JUL 19

The Cary Amateur Radio Club will hold its 8th annual Mid-Summer Swapfest on Saturday, July 19, 1980 (rain or shine), at the Cary Lions Club Shelter (next to the Cary Senior High School). Gates will open at 9:00 am. There will be an auction (no fees) from 1:00 pm to 2:00 pm. Prize drawings will be held from 2:00 pm to 2:15 pm and will include a Kenwood TS-520SE, a Yaesu FT-202 with nicads and charger, a CDE Tailtwister® rotor, a Hy-Gain TH3 Sr., and others. Registration is $3.00. Tables will be rented or bring your own. Talk-in on 146.28/.88 and 146.52/.52. For more information, write CARC, Box 53, Cary NC 27511.

BLYTHEVILLE AR
JUL 19-20

The 1980 Arkansas Army MARS Convention will be held on July 19-20, 1980, at the National Guard Armory, Highway 61 south, Blytheville AR. Registration is $7.50 and includes a catfish supper and pancake breakfast. Talk-in on 148.01 and .07/.67. For more information, contact Richard Duncan

WB5CNV/AAR6SH, 209 Wilson Street, Dell AR 72426.

BELVIDERE IL
JUL 20

The annual Big Thunder ARC Hamfest will be held on Sunday, July 20, 1980, at the Boone County Fairgrounds. There will be a large indoor facility and plenty of outdoor space available, as well as camping after 6:00 pm on Saturday. Talk-in on 146.52 simplex and 147.375 repeater. For more information, write Mike George, 6159 Broadview, Belvidere IL 61008.

CANTON OH
JUL 20

The Canton Amateur Radio Club and the Tusco Amateur Radio Club will hold the 6th annual Hall of Fame Hamfest on Sunday, July 20, 1980, at the Nimishillen Grange near Louisville OH, just off of Route 62, East of Canton OH. Admission is $2.50 in advance and $3.00 at the gate. Talk-in on .52/.52, .19/.79, and .72/.12. for reservations and information, contact Max Lebold WA8SHP, 10877 Hazelview Avenue, Alliance OH 44601, or phone (216)-821-8794.

DETROIT LAKES MN
JUL 20

The Detroit Lakes Amateur Radio Club will hold its 4th annual picnic and swapfest on Sunday, July 20, 1980, from 10:00 am to 4:00 pm at Long Lake Park, 1½ miles west of Detroit Lakes on Highway 10. Tickets for the drawing are $1.00. Picnic and swap tables will be available. Talk-in on 146.22/.82 and 146.52/.52. For additional information, contact Russ Berger NØARZ, 1406 Long Avenue, Detroit Lakes MN 56501.

LOGANSPORT IN
JUL 20

The Cass County Amateur Radio Club's third annual hamfest will be held on Sunday, July 20, 1980, from 7:00 am to 4:00 pm at the 4-H Fairgrounds. Go north of Logansport on Highway 25, turn right at Road 100, and follow the QSY signs. Advance tickets are $1.50; $2.00 at the gate. Outside setup is free; undercover is $1.00. Bring your own tables. Free overnight camping, refreshments, and door prizes will be available. Talk-in on 146.52 and Logansport Repeater 147.78/.18. For information, write Roy E. Mannikko WB9PKN, 530 North Cicott Street, Logansport IN 46947.

GOLDEN CO
JUL 20

The RMRL will hold its annual Field Day Demonstration and Swapfest on Sunday, July 20, 1980, at 10:00 am at Karl Ramstetter's (WAØHJZ) Ranch. It is located on top of Guy Hill, Highway 93, Golden CO. Signs will be posted. There will be door prizes. It would be appreciated if everyone would make his contribution to the potluck lunch by bringing his favorite dish and chairs and/or blankets. Soft drinks will be provided. Talk-in on .34 and .94.

MCKEESPORT PA
JUL 20

The Two Rivers Amateur Radio Club will hold its annual hamfest on Sunday, July 20, 1980, at the Penn State University, McKeesport Campus, McKeesport PA. A flea market will be held outside on the hard surface and car spaces will be $5.00. There will be food and drink, door prizes, and free admission. Talk-in on 146.22/.82.

WASHINGTON MO
JUL 20

The Zero-Beaters ARC will sponsor the Washington Hamfest on Sunday, July 20, 1980, at the Washington Fairgrounds, Washington MO. There will be prizes and good buys for the ham, and bingo and a candy scramble for other family members. Features will include a commercial dealer exhibit, a large traders' row, and delicious food. Talk-in on .52 simplex. For more information on tickets, prizes, and camping, write ZBARC, Box 24, Dutzow MO 63342.

MONACA PA
JUL 20

The Beaver Valley Amateur Radio Association will hold its third annual hamfest on Sunday, July 20, 1980, at the Community College of Beaver County from 9:00 am to 5:00 pm. Registration is $2.00 each or 3 for $5.00; children under 12 will be admitted free. Refreshments will be available, as well as free parking, indoor vendor space, and a paved outdoor flea market. There will be a drawing at 4:00 pm and door prizes all day, including a first prize of a Kenwood TS-520SE transceiver, a second prize of a Kenwood TS-2400 synthesized hand-held, and a third prize of a Cushcraft ATB-34 triband beam. Talk-in on 146.25/.85 WR3AAA, 223.26/.86 WR3AAA, and 146.52 simplex. For further information and advance registration, contact either Gary Mohrbacher WB3FKE, 3417 47th Street, New Brighton PA 15066, (412)-843-9546, or Adam Horniak WB3JZN, 182 Edgewood Street, Aliquippa PA 15001, (412)-378-9667.

WRIGHTSTOWN NJ
JUL 20

The West Jersey Radio Amateurs, Inc., hamfest will be held on July 20, 1980, at McGuire AFB, Wrightstown NJ, from 9:00 am to 4:00 pm. Admission is $2.50 and advance orders receive an additional chance at door prizes. Spouses and children are free. Tailgate or table space is $2.50 per space; bring your own table. Refreshments and activities will be available. Door prizes will be awarded continuously and a major door prize of a 2-meter transceiver will be drawn at 3:30. Talk-in on .52 and 146.925. Advance tickets are available from club members or send an SASE to Mary Lou Shontz WB2QIU, 107 Spruce Lane, Route 16, Mt. Holly NJ 08060. For additional Information, call Mark Millman N2ME at (609)-871-6691.

RAPID CITY SD
JUL 25-27

The Black Hills Amateur Radio Club will hold its 1980 South Dakota Hamfest and Picnic on Friday, July 25, through Sunday, July 27, 1980, at the Surbeck Center, South Dakota School of Mines campus, Rapid City SD. Registration will be $6.50 before July 1st, and $7.00 after July 1st and at the door beginning at 4:00 pm on Friday, July 25th. Door prizes will be awarded along with a pre-registration prize. There will be forums, tours, exhibits, a transmitter hunt, a flea market, contests, and YL activities. Flea-market tables are free. A Sunday noon meal will be catered and tickets will be available at the door. Assistance will be provided In obtaining lodging or trailer parking facilities. Talk-in on 146.34/.94, or contact WØBLK. To pre-register or obtain further information, contact Black Hills Amateur Radio Club, PO Box 1014, Rapid City SD 57709.

OKLAHOMA CITY OK
JUL 25-27

The Central Oklahoma Radio Amateurs will hold the Oklahoma State ARRL Convention and "Ham Holiday" on July 25-27, 1980, at Lincoln Plaza, 4445 Lincoln Boulevard, Oklahoma City OK. The program will include an ARRL forum and technical talks. In addition, a full program is scheduled for the ladies. Pre-registration will be $5.00 if received before July 19. After that date, it will be $6.00. A special award is being given to encourage pre-registration. There will be many other awards. Adequate rooms are available for commercial exhibitors and flea market swappers. Unlimited parking space is also available. Mail your registration to CORA, PO Box 15013, Oklahoma City OK 73155.

SEATTLE WA
JUL 25-27

The 26th National ARRL Convention will be held on July 25-27, 1980, at the SEA-TAC Airport Red Lion Motor Inn, 18740 Pacific Highway South, Seattle WA 98188. Basic registration is $7.00 before July 1, 1980, $9.00 after that date; additional family registration is $6.00, $7.00 after July 1, and student registration Is $7.00. Features will include prize drawings, forums, displays and new equipment exhibits, tours, and much more. Roy Neal K6DUE of NBC News will be the featured Saturday-night banquet speaker. For additional details, write John H. Brown W7CKZ, Promotion Chairman, SEANARC '80, PO Box 68534, Seattle WA 98168.

NASHVILLE TN
JUL 27

The Nashville Hamfest will be held on Sunday, July 27, 1980, beginning at 8:00 am CDT at the National Guard Armory, Sidco Drive, Nashville TN. Admission is $1.00 and tables are $3.00. Refreshments will be available and the hamfest will be all indoors. Talk-in on .90/.30. For more information, contact Radio Amateur Transmitting Society (RATS), PO Box 2892, Nashville TN 37219.

WEST FRIENDSHIP MD
JUL 27

The Baltimore Radio Amateur

Television Society will hold its annual BRATS Maryland Hamfest on Sunday, July 27, 1980, at the Howard County Fairgrounds, just off I-70 and Route 32 at Route 144, West Friendship MD. Beginning at 8:00 am, activities will be held rain or shine. Talk-in on .63/.03, .16/.76, and .52 simplex. For information or table reservations, write BRATS, Box 5915, Baltimore MD 21208.

JACKSONVILLE FL
AUG 2-3

The Jacksonville Hamfest Association is pleased to announce that the 1980 Jacksonville Hamfest and ARRL Florida State Convention will be held on August 2-3, 1980, at a new location, The Orange Park Kennel Club at the intersection of I-295 and US Highway 17. Advance registration is $3.00 and is available from Jacksonville Hamfest, 1249 Cape Charles Avenue, Atlantic Beach FL 32233. Price at the door will be $3.50. A large indoor swap mart will be featured, with tables available at $5.00 per day. The table reservations can be ordered from Andy Burton WA4TUB, 5101 Younis Road, Jacksonville FL 32218. Interesting programs and forums are planned and many manufacturer and dealer exhibits will be displayed, as well as new equipment. Plenty of family activities are available close by and hotels with special rates and a good selection of accommodations are within walking distance. For more information, write JHA, 911 Rio St. Johns Drive, Jacksonville FL 32211.

ANGOLA IN
AUG 3

The Steuben County Radio Amateurs will hold their 22nd annual FM Picnic and Hamfest on Sunday, August 3, 1980, at Crooked Lake, Angola IN. Admission is $2.00. There will be prizes, picnic-style BBQ chicken, inside tables for vendors and exhibitors, and overnight camping (with a fee charged by the county park). Talk-in on 146.52 and 147.81/.21.

NORTH HAVEN CT
AUG 16-17

The South Central Connecticut Amateur Radio Association will hold its Super Scarafest '80 on August 16-17, 1980, at the Ramada Inn, at Exit 12 of I-91, North Haven CT 06473. Booths will be available. Features will include a ham and computer flea market, an auction, special events for non-ham spouses and children, and drawings for prizes throughout the show. Prizes will include a solid-state low-band transceiver, a synthesized two-meter HT, a microcomputer, and a 600-MHz frequency counter. Admission will be $4.00, pre-registration before July 1, and $5.00 at the door for both days. Talk-in on 146.01/146.61. For further information, write Super Scarafest '80, PO Box 5265, Hamden CT 06518, or call Jeff Wayne K1YLV at (203)-281-6038 between 9:00 am and 9:00 pm EST.

PENSACOLA FL
AUG 31

The Five Flags Amateur Radio Association, Inc., will hold its 1980 Ham-A-Rama on August 31, 1980, from 8:00 am to 4:00 pm at the Pensacola Municipal Auditorium, Pensacola FL. Admission will be $1.00 and swap tables will be available for $5.00 each. Additional information can be obtained by writing to the FFARA, PO Box 17343, Pensacola FL 32522.

MELBOURNE FL
SEP 6-7

The Platinum Coast Amateur Radio Society will hold its 15th annual hamfest and indoor swap-and-shop flea market on September 6-7, 1980, at the Melbourne Civic Auditorium. Admission is $3.00 in advance and $4.00 at the door. Swap tables are $5.00 per day. There will be food and plenty of free parking available, as well as awards, forums, and meetings. Talk-in on .25/.85 and .52/.52. For reservations, tables, and information, write PCARS, PO Box 1004, Melbourne FL 32901.

BOULDER CO
SEP 28

The Boulder Amateur Radio Club will hold Barcfest '80 on September 28, 1980, beginning at 9:00 am at the Boulder National Guard Armory, North Broadway, at the city limits, Boulder CO. There will be an auction and a snack bar. Admission is $2.00 per family and includes a door prize drawing and swap space. Talk-in on 146.10/.70 and .52/.52. For further information, contact Mark Call NØMC, 4297 Redwood Ct., Boulder CO 80301, or phone (303)-442-2616.

CHICAGO IL
OCT 16-19

National Computer Shows (formerly Northeast Expositions) will hold the Midwest Personal and Business Computer Show from Thursday, October 16, through Sunday, October 19, 1980, at McCormack Place, Chicago IL. Show hours are: Thursday through Saturday, 11:00 am to 9:30 pm and Sunday, 11:00 am to 6:00 pm. General adult admission is $5.00. For further information, contact National Computer Shows, PO Box 678 Brookline Village MA 02147, or phone (617)-524-0000.

Ham Help

I'm looking for a dial drum and S-meter for a Heath RX-1 Mohawk receiver.

L. Chapin K8ZJV
10442 Hart Avenue
Huntington Woods MI 48070

I would like to contact any teenagers who are interested in forming a net on the 15-meter Novice band.

Dave Mihelcic
41 Morrison
Belleville IL 62221

I need to locate a source of old callbooks dating back to 1945. Any old odd years would help.

Carl A. Mitchell K1JDJ
Box 1003
Fairfield CT 06430

I need help in altering a Bearcat 220 to receive outside of its pre-programmed bands. I have reached only multiple dead ends, so far. If you know a way or have an idea, please let me know. Thanks.

Si Davis
Box 3704
APO NY 09009

I'd appreciate a schematic, manual, or any info on a Hallicrafters Model S-38C communications receiver. I will pay copying charges and postage or do the copying and return to you postpaid. Thanks very much.

R. L. Foster N5BUW
PO Box 1296
Albany TX 76430

I need a 6907 tube for local repeater control (450 MHz), but *not* at $35! Would anyone like to trade one for six UX-120 tubes, tested for af and rf oscillation? I'll pay all shipping.

H. Eddy W2BU
3 N. Belmont
Oneonta NY 13820

I have an impedance bridge made by Clough/Brengle, military nomenclature ZM-11. I have not been able to find any sort of instruction manual for it. Does anyone have any information on this unit?

Richard Need WB4YOD
PO Box 248
Waxhaw NC 28173

I'm looking for ham call license plates for my collection. I would like to swap for or buy plates from other states and provinces.

Bryan Hastings KA1HY
64 Concord Street
Peterborough NH 03458
(603)-924-6902

I need a schematic of a filter (300-3000 Hz), a CW reception method using a simulated stereo technique, and an EIMAC transmitting-tube catalog, 1976 or 1977. I also would appreciate any help from American radio amateurs (books, surplus, etc.).

Santos Henri 6W8HS
ARAS B.P. 971
Dakar, Senegal

I am interested in the future employment opportunities for persons holding a 2nd class radio telegraph ticket with aircraft endorsement (especially in the maritime field). Thanks for any assistance.

SSG. Gary S. O'Neal
138th Ord Co
APO NY 09253

I am trying to start a chess players net, evenings, on 75 meters.

Charles E. Martin AB4Y
PO Box 3370
Bowling Green KY 42101

OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR JUNE

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
25361	1	0131:59	93.7
25373	2	0031:18	78.5
25386	3	0125:33	92.1
25398	4	0024:52	77.0
25411	5	0119:08	90.6
25423	6	0018:26	75.4
25436	7	0112:42	89.0
25448	8	0012:01	73.8
25461	9	0106:16	87.4
25473	10	0005:35	72.3
25486	11	0059:50	85.9
25499	12	0154:06	99.5
25511	13	0053:25	84.3
25524	14	0147:40	97.9
25536	15	0046:59	82.7
25549	16	0141:14	96.3
25561	17	0040:33	81.2
25574	18	0134:48	94.8
25586	19	0034:07	79.6
25599	20	0128:22	93.2
25611	21	0027:41	78.1
25624	22	0121:57	91.6
25636	23	0021:15	76.5
25649	24	0115:31	90.1
25661	25	0014:50	74.9
25674	26	0109:05	88.5
25686	27	0008:24	73.4
25699	28	0102:39	86.9
25711	29	0001:58	71.8
25724	30	0056:13	85.4

OSCAR 8 ORBITAL INFORMATION FOR JUNE

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
11416	1	0058:12	66.3
11430	2	0103:03	67.6
11444	3	0107:53	68.8
11458	4	0112:44	70.0
11472	5	0117:34	71.3
11486	6	0122:25	72.5
11500	7	0127:15	73.7
11514	8	0132:05	75.0
11528	9	0136:55	76.2
11542	10	0141:46	77.4
11555	11	0003:24	52.9
11569	12	0008:14	54.1
11583	13	0013:04	55.3
11597	14	0017:54	56.6
11611	15	0022:44	57.8
11625	16	0027:33	59.0
11639	17	0032:23	60.2
11653	18	0037:13	61.5
11667	19	0042:03	62.7
11681	20	0046:53	63.9
11695	21	0051:42	65.2
11709	22	0056:32	66.4
11723	23	0101:21	67.6
11737	24	0106:11	68.9
11751	25	0111:00	70.1
11765	26	0115:50	71.3
11779	27	0120:39	72.5
11793	28	0125:28	73.8
11807	29	0130:17	75.0
11821	30	0135:07	76.2

OSCAR 7 ORBITAL INFORMATION FOR JULY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
25737	1	0150:29	99.0
25749	2	0049:47	83.8
25762	3	0144:03	97.4
25774	4	0043:21	82.3
25787	5	0137:37	95.8
25799	6	0036:56	80.7
25812	7	0131:11	94.3
25824	8	0030:30	79.1
25837	9	0124:45	92.7
25849	10	0024:04	77.6
25862	11	0118:19	91.2
25874	12	0017:38	76.0
25887	13	0111:53	89.6
25899	14	0011:12	74.4
25912	15	0105:27	88.0
25924	16	0004:46	72.9
25937	17	0059:01	86.5
25950	18	0153:17	*100.0
25962	19	0052:35	84.9
25975	20	0146:51	98.5
25987	21	0046:09	83.3
26000	22	0140:25	96.9
26012	23	0039:43	81.8
26025	24	0133:59	95.4
26037	25	0033:17	80.2
26050	26	0127:33	93.8
26062	27	0026:51	78.6
26075	28	0121:07	92.2
26087	29	0020:25	77.1
26100	30	0114:41	90.7
26112	31	0013:59	75.5

OSCAR 8 ORBITAL INFORMATION FOR JULY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
11835	1	0139:56	77.4
11848	2	0001:33	52.9
11862	3	0006:22	54.1
11876	4	0011:11	55.3
11890	5	0016:00	56.6
11904	6	0020:49	57.8
11918	7	0025:37	59.0
11932	8	0030:26	60.2
11946	9	0035:15	61.5
11960	10	0040:04	62.7
11974	11	0044:52	63.9
11988	12	0049:41	65.1
12002	13	0054:29	66.4
12016	14	0059:18	67.6
12030	15	0104:06	68.8
12044	16	0108:54	70.0
12058	17	0113:43	71.3
12072	18	0118:31	72.5
12086	19	0123:19	73.7
12100	20	0128:07	74.9
12114	21	0132:55	76.2
12128	22	0137:44	77.4
12142	23	0142:32	78.6
12155	24	0004:08	54.0
12169	25	0008:55	55.3
12183	26	0013:43	56.5
12197	27	0018:31	57.7
12211	28	0023:19	58.9
12225	29	0028:06	60.1
12239	30	0032:54	61.4
12253	31	0037:42	62.6

RTTY Loop

from page 12

several sample columns were presented to the staff of *73*. A favorable reception was enjoyed, and the material was rewritten and the column renamed "RTTY Loop." At about that time, another shift in the club paper resulted in the abolition of "Tele-Tips," so now only the offspring remains.

What's the lesson? Simple. When the editor of your club newsletter sends out a plea for material—and they all do that every month—*answer it!* Without good input, any club or local publication will fold. Give it good stuff and you may find more there than you thought. OK?

Now, where were we? Before interrupting our line for ASCII last month, we were about to conclude our look at home-brew demodulators. Let's start this month with Fig. 1. This was called a "drift-free TU" when J. C. Cain VE7DBK published it in the September, 1977, issue of *73*. Why "drift-free"? Well, after limiting and passage through a bandpass filter tuned for 2200 Hz, a phase locked loop (an LM565) is used to decode the audio input. As pointed out several months ago, the PLL has the ability to "track" input, by "locking on" to the signal. Thus, drift, as a disturbing factor, is minimized. A rather nice feature of this design is the use of a squelch circuit to provide "mark-hold" in the absence of a signal. This locks up mechanical teleprinters to prevent their "running open." A high-voltage transistor is used to directly key the loop, as we are seeing more and more in demodulators designed these days.

Just as integrated circuits can replace discrete circuitry, as with the PLL above, so they can be used to redesign previous techniques. Such is the case with the demodulator presented in the November, 1978, issue of *73*. Winford Rister WB4MBL's design uses 741 op amps as active filters to select mark and space signals. Fig. 2 shows the basic circuit, minus required power supplies of +5 V dc, +8 V dc, +160 V dc, and ±7.5 dc. A sample power supply schematic is illustrated in the original article. All of those various voltages are necessitated by the mix of TTL, op amps, and transistors. Whew! With this demodulator, after selection by the active filters, the derived signal is fed through TTL logic to produce the desired keying waveform. Again, a sturdy transistor does the keying. It is interesting to reflect on how we have come—from using the receiver bfo to select the tone, to TV width coils, to toroids (which represented state of the art for a long time), to active filters. Through use of op-amp active filters, selectivity unmatched except by carefully-matched, read "expensive," networks can be achieved cheaply and in a small package.

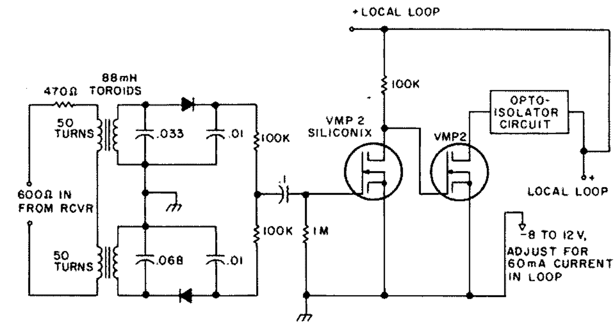


Fig. 3.

Speaking of small packages, we will close our look at home-brew (or home-brewable) converters with the demodulator of Fig. 3. Also from the November, 1978, issue of *73*, this design by Lauren Colby is one of the most intriguing of all we have looked at. It needs no power supply, won't fry external components, and contains a grand total of two active components, and they are identical! What Lauren did was to couple two standard toroids to a MOSFET discriminator by adding a second coil to each toroid, producing a transformer. The discriminator is able to derive power from the loop while keying it. Now, granted, you are not going to key a 150 V, 60 mA loop with this one, but for keying a computer or TVT input, this is not that bad. Sure looks interesting!

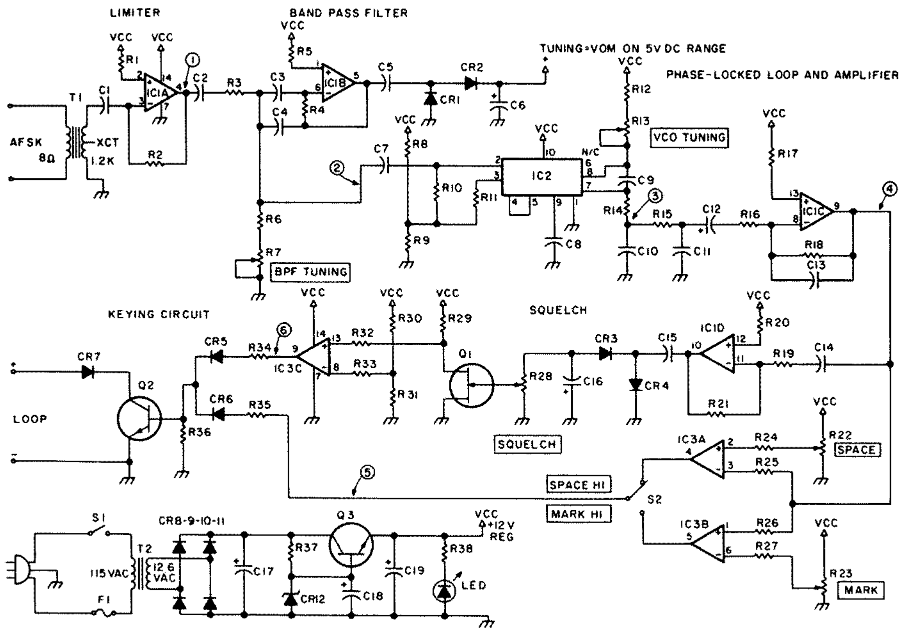


Fig. 2.

And now . . . ASCII update. Last month, we covered the early information and some speculation about the new ASCII rules and regs. The FCC has released the full wording of the docket, and there is more to it than we originally thought. Not only does the rule allow transmission of ASCII with baud restrictions as outlined last month, but it also frees us from the 60 wpm (45.45 baud) limitation on Baudot communication. Five-level information may now be passed at 60 wpm (45.45 baud), 67 wpm (50 baud), 75 wpm (56.25 baud), or 100 wpm (75 baud). Also, the door has been left open to use of other non-standard modes of data exchange, such as binary-coded decimal or the old IBM favorite, EBCDIC (Extended BCD Decimal Interchange). Maybe even Selectric will be allowed. Now, these are not presently authorized, and international (ITU) regulations may prevent international use until those regulations are updated, but it appears that the FCC is looking into allowing us to use pretty much whatever we want to here.

And now, it's resource time for all the fans of the Loop! I have a note here from Dave Lundquist WA2UWK, who has acquired a Lenkurt model 25-A demodulator. While he would like to get the thing up and running, he is having a time interfacing it with his equipment. He requests any information be forwarded to him at 23 Three Village Lane, Setauket, New York 11733. Drop me a line, too, if you send over anything, OK?

The giant Greater Baltimore Hamboree and Computerfest is now history. Wayne W2NSD/1 gave two talks to the crowd, and one item stood out: RTTY stands alone as the vanguard of new communications techniques. All the skills we have developed on RTTY can be put to good use on other digital communications circuits. Let us here at *73* know what you are working on. Write up that circuit or program so that more can benefit. If you would like, send RTTY programs to RTTY Loop, and they will be published for all to benefit.

Next month, the spotlight will remain on reception techniques. We will start to shift our focus, however, toward those many commercial devices available on the market. I will try to relay information made available from manufacturers, other individuals, and my personal observations on that equipment I have used. I won't forget your questions, either, here in RTTY Loop.

LETTERS

from page 18

bands. SSB was far preferable except for rare occasions when one might take advantage of the better fidelity of some AM rigs . . . and when something more than a four-inch speaker was being used.

3. I found most operators able to cope quite well with SSB after a few minutes instruction. There were problems until they learned the use of the rf gain control, admittedly.

And 4. We could do without some of the signal shaping and processing.

Though I am in most ways a conservative, I think my record of trying new ideas and promoting those with promise is an enviable one. I started building RTTY equipment in 1948 . . . got in on NBFM experiments in the very early days of 1946, when that was first invented by a chap not far from me. I was an enthusiastic and early supporter of SSTV, of moonbounce communications, of OSCAR, repeaters, FM . . . etc. There are few experiences in amateur radio that I have not personally experienced and enjoyed. And when I find something which I think is good, I do all I can to get others to share this enjoyment with me.

With the work schedule and the traveling I do these days, it is not possible for me to do everything personally as I used to, so yes . . . I am "too busy" to set up and spend weeks evaluating new ideas. But I did work closely with Tim on this and read all of the material submitted . . . listened to the tests, both on tape and live . . . read reports, talked with some of the people involved over the air and on the phone. I recognized the pioneering effort by Henry Radio to bring this system to the hams and for that reason I was all the more hopeful that it would prove to be all the promoters said it was . . . and more. We need new ideas and new modes of communications in amateur radio, for they are fun and help generate enthusiasm. I think Ted Henry should get a lot of credit for putting up the venture money to give this NBVM system a try.

I can be much more critical of the League . . . as usual . . . but am I unjustified? They apparently promoted the system without even trying it, going on the basis of the claims of the promoters. They sold the idea, without trial, to trusting QST *readers through articles and even a chapter in the* Handbook! *Now, when we checked with the ARRL about this, I understand that they are "unable to find" the equipment in their labs and that the "whole issue is dead."*

Tim Daniel did a massive amount of work on the project, funded by 73 Magazine. *He worked for many weeks on it last summer and his aim was to try to make it work, not to debunk it. His final report was cautious and conservative, if perhaps discouraging as far as the future of NBVM is concerned. But then the NBVM promoters must be used to that by now, for most of the recent reports I've seen have not been encouraging. I can understand their enthusiasm . . . if they had been able to make something work out and then been able to sell it to the industry, they could all have been multimillionaires. Getting hams to prove the worth of new modes of communications is a well tested and proven route. We did it with FM, SSB, NBFM, SSTV, etc. There are some new modes in the wings and perhaps they will turn out to be more practical than NBVM. Or perhaps the NBVM people will come up with some improvements and yet win the day.*

In talking with Ted Henry, I found that a great many of the units he was selling were going to commercial and government labs. They, too, are interested in results and will beat a path to the door of the successful pioneer of useful new techniques. We'll see what comes of their tests of NBVM.—Wayne.

HAM POWER

- 10-meter amplifier ban
- Elimination of club, military, and RACES licenses
- HF CB
- Proposed "type acceptance" of ham gear
- Elimination of secondary station, repeater, and special-event callsigns
- Ending of hamfest license examinations
- Crazy callsigns
- Quiet zones
- Monitor station protection
- and on and on and on . . .

Enough is enough! Where will the FCC stop? When the Amateur Service is a jungle like CB?

After decades of peaceful cooperation with radio amateurs, the FCC has recently embarked on a course committed to destroying amateur radio as we all know and love it. In a series of misguided attempts to rectify problems in another radio service and in a self-centered effort to reduce their own workload, the Commission has seen fit to ransack and pillage the very foundations of amateur radio.

Editorials in *QST, CQ, 73, World Radio,* and *Ham Radio Horizons* have all blasted the Commission's treatment of amateur radio. *QST* even went so far as to title their November, 1979, editorial, "The FCC: Public Servant, or Public Enemy?" While ham magazines have rarely agreed on any topic, all are currently united in their criticism of the FCC.

This letter is being sent by a group of concerned radio amateurs who are fed up with being choked by an insensitive and unresponsive FCC bureaucracy. We think it's time that ham radio operators take their gripes right to the Commission's doorstep. Perhaps, if the FCC had visible proof of the frustration and resentment held by most amateurs today, they wouldn't be so cavalier in their rulings. In the great tradition of the First Amendment to the U.S. Constitution, it's time for hams "peaceably to assemble and to petition the government for a redress of grievances."

On August 23rd, 1980, we want to see hams come to Washington by the bus-, train-, and plane-load for a day-long rally against the FCC's amateur policies. We want to hold a mammoth demonstration somewhere within the Capitol (right outside FCC Headquarters, if we can get the police permit, or on the steps of the Capitol) and publicly express our anger with the Commission.

Just think of the publicity. With, say, 10,000 hams protesting recent FCC rulings, the news media will never again confuse us with CBers. In addition, there will be speakers, entertainment, and a general effort made to educate the public about amateur radio and our plight. We'll even have representatives of our group meet with selected congressmen, senators, and other government officials. By sunset on August 23rd, the entire nation will know what amateur radio is and how the FCC is killing us.

Now, what can you do to help make our plan a reality? We don't want your money; we need your support. Write your ARRL Director and the ARRL President, Vice Presidents, and General Manager. Send letters of support to ham magazines. Most of all, talk up the August 23rd rally on the air.

The farmers do it and war protesters do it—now we can do it, too. There is strength in unity

and unity in numbers. After August 23rd, the FCC will think twice before dreaming up another stupid rule change.

The August 23rd Rally Committee
AG2U and WB2IBE, Co-chairmen
Glendale NY

Hey, how come one of the chairmen has a funny call? Silver to you, too. But, about the rally . . . if I thought it would do any good, I would be pushing the hell out of it. Actually, I think it would do a lot of harm. Oh, there are some things that should be done, but amassing hams in Washington during August, when everyone is on vacation, is not a priority item. Right now, the main problem that we have is a very serious image problem with the FCC commissioners. Getting the League to can their Washington counsel should be number one on the list of ways to improve the image of amateur radio with the Commission. I've already written about the inexcusable incident where he patronizingly lectured the new commissioners and, to my view, made the linear ban inevitable. The further action to take the Commission into court over it was just more arrogance and hurt us badly. The continuous pressures to get the FCC to try to stem the tide of jamming and bad language on the ham bands should be stopped immediately. We need good vibes, not constant bad ones. A staged media event, which is what you are proposing, is unlikely to bring joy to the commissioners. We should be working on letting them know about our good points and our value to the country, not making their lives miserable. They just have too many ways to get even. — Wayne.

THE HUMAN FACTOR

I am not yet a ham, the price of most equipment keeping me from being one, but I do occasionally pick up a ham magazine just to keep current in some of the things going on.

My ship was on a port visit to Athens, Greece, and I found myself with nothing to read. I discovered, on one of my wanderings, a bookstore calling itself the "American Bookstore" and, indeed, most of the books carried were in English. Your magazine was among the many on ham radio and electronics in general. If you are interested, right now in Athens, the price for *73 Magazine* is 190 drachmas, or an even $5.00.

The issue I picked up was the January, 1980, issue, and the articles in it were very interesting. I wish to compliment you on a fine magazine—the best in the field, I feel.

The editorial by Wayne Green has to be one of the most comprehensive ones that I have ever read and I agree wholeheartedly with most of his views. As a naval communicator and as a person interested in ham radio, most of his propositions make a good deal of sense. However, I disagree with him on one point.

In the latter part of his editorial, he discusses the "bandwidth problem." His views on time-sharing, or automated contacts, while being innovative in the technological sense, take much of the human factor out of operating. Sure, the bands may be congested in particular spots, but if DXing rare contacts is reduced to a two-second exchange between machines, what is the point of being a ham? One can get just as much satisfaction and more information exchanged by having a pen pal.

As I said earlier, I am not a ham, so I do not really know the thrill of contacting a remote and hard-to-find station, but I am the shipboard MARS operator and I know the thrill of having my 100-Watt transmitter make a connection good enough for phone patches when we are floating off the coast of Turkey. It must be somewhat similar. I can't see how Wayne can, in the same editorial, speak of the joys of rag chewing and then discuss manners in how one can eliminate same.

If, by some chance, I get lucky and find your February or March issue in one of these backwater Mediterranean ports we pull into, I'll buy it. If not, I will delay my continued readership until we return home. You have a most interesting magazine.

J. E. Richardson
FPO NY

Just in case some amateur might not think your letter through and might have the question unanswered about automated contacts, I'd better reply. Anyone who has done much DXing will tell you that there is little rag chewing going on with DX stations . . . particularly the rare ones. The pressure is on to make contacts as short as possible so that as many stations as desire can make a contact with the rare station. By automating this nonsense, we will end up with a lot more rag chewing and, I think, a much better amateur radio. The country hunters can rack up their silly scores (I have well over 300 countries confirmed) and the hams in rare spots will be able to give these contacts without having to spend months or even years fighting pileups to satisfy the demand. Their automatic station will grind out the thousands of duty contacts, leaving them free to sit back and rag chew when they have the desire. I think amateur radio will grow faster in rare spots if it is fun for the local operator . . . and constant pileups and screaming angry hams demanding QSLs are hardly enjoyable for the long run. — Wayne.

MEDICAL STATION

Under the direction of Dr. Steven H. Posner WB2QET/8, a station has been set up at the United States Public Health Service office in Cleveland OH for the purpose of handling emergency and priority medical traffic from any maritime or land-based station. The station has phone-patch capability to any medical facility in the U.S.

Begun on March 17, 1980, the station operates Monday through Friday, monitoring 28.911 MHz for the first 5 minutes of each hour, 0800 to 1600 hours Eastern Time.

Dr. Steven H. Posner WB2QET
Lakewood OH

PURE LIBEL

Allow me to take this time to express to you, Wayne, what a great job you and your staff are doing with *73 Magazine*. Personally, I find that it covers a wide variety of subjects in the greatest of detail. With technology increasing so rapidly, this type of information can be most helpful to today's ham.

Because the quality of *73 Magazine* is so high, I am left disgusted with *Ham Radio Horizons'* comment about your magazine. To me, it seems to be pure libel. Additionally, if I were a newcomer to ham radio and unaware of the true content of *73*, I probably would not subscribe to it after reading those comments.

In conclusion, I would like to say I think *73 Magazine* is great. In fact, I will probably scrape up enough money for a lifetime subscription when renewal time comes. It's too bad that people get away with libelous comments which could have a detrimental effect on others.

Bradley F. Hardin KB8OC
Sugar Grove WV

Thanks for the nice letter. The referenced libel has to do with my editorials, which I think have stood the test of time. But, if you think it over, can you point to anyone in history who has tried to move things along who hasn't been put down with petty libel like that?—Wayne.

FULL OF WHAT?

I have a feeling that the New Product Review of John Meshna's Viet Nam surplus transmitters may have something to do with the first day of April.

However, I was impressed by the apparent unintentional play on words in the description of the transmitter's usefulness in detecting "troop movements."

Keep up the good work. I don't mind a little crap in *73* once a year. After all, *QST* is full of it every month!

Michael W. Babb N4PF
Louisville KY

BOO AND YEA

It would be interesting to know how many other licensed hams have found that some snake in the grass is using their call letters to work DX. Or is my case unusual?

For hams outside the US, I would like to acknowledge cards received through the 7th District Portland QSL office from TI9CF, I0RDJ, I3GJZ, SM5AQD, DK5AX, and SW listeners OK3-915 and DL-H11/1631274. None of the frequencies or times of contact coincides with the log at W7AR during 1978 and 1979. The only clue to the illegal operation is the

name Doug and the state of Oregon. We may be seeing only the tip of the iceberg.

On the positive side, to counter the bellyaching over shabby sales and service, I'd like to recommend Brodie Electronics, one of your advertisers in Moore OK, for friendly service beyond the call of duty.

F. W. Anderson W7AR
Seattle WA

Well, Andy, it wouldn't be so bad if the chap would work some decent DX and get you some rare cards. In the meanwhile, perhaps everyone can keep an ear peeled for "Doug" and his crummy signal. And Doug, if you're reading this, either get your own call or work some rare stuff for Andy. Regarding Brodie Electronics: Three Cheers!—Wayne.

BLUEBERRY QSL

The Black River Amateur Radio Club will be operating a special event station during the National Blueberry Festival in South Haven MI on July 16-20, 1980 (Monday through Saturday). The call of the station will be WD8AGC and the frequencies used will be on or near 3.975, 7.275, 14.275, 21.375, and 28.375 MHz. CW operations will be conducted randomly throughout the Novice/Technician subbands. Any station working WD8AGC during this period can receive a colorful postpaid certificate by mailing a QSL card to The National Blueberry Festival, PO Box 224, South Haven MI 49090.

Charlie Harrell
Secretary, BRARC
Watervliet MI

117 BIG ONES

Any ham in the world who works a West Virginia amateur the week of the state's 117th birthday celebration will receive a beautiful certificate from the Secretary of State of West Virginia bearing the West Virginia seal and signed by the Secretary.

Simply send your QSL report of the contact to the attention of the Secretary of State, the Honorable A. James Manchin, Room 157, State Capitol Building, Charleston WV 25305, and simply wish West Virginia a happy 117th birthday. This event starts Flag Day, June 14, and ends at midnight EST June 20, West Virginia's birthday. Look for West Virginia's hams 15 kHz up from the bottom of each General band segment.

Lovell Webb N8LW
President, Kanawha Amateur Radio Club
Charleston WV

Awards

from page 24

NEW ZEALAND AWARD

The NZA award is available to all radio amateurs other than ZL. A total of 101 contacts are required to qualify for this award. All contacts must be made after December 8, 1945.

Applicant must make the following contacts: 35 ZL1 contacts, 35 ZL2 contacts, 20 ZL3 contacts, 10 ZL4 contacts, plus 1 contact with a ZL "territory" (either New Zealand, Antarctica, Chatham Island, Kermadec Island, or Campbell Island). This one contact may be substituted by 20 additional ZL contacts not already claimed.

Fee for this award is **US $.50** or 2 IRCs.

WORKED ALL NEW ZEALAND AWARD

The WAZL Award requires that contact be made with 45 different branches of NZART—except for overseas applicants, for whom only 35 contacts are required.

A special endorsement is given if the WAZL Award is accomplished within a 12-month period of time. Mobiles operating outside their regular branch area must sign the branch from which they are mobile while operating. Endorsements are also given for single band or mode. All contacts must be made after November 1, 1945, to qualify.

NZART branches are as follows:

01 Ashburton, 02 Auckland, 03 Western Suburbs, 04 Cambridge, 05 Christchurch, 06 Dannevirke, 07 Blank, 08 East Southland, 09 Egmont, 10 Franklin, 11 Gisborne, 12 Hamilton, 13 Hastings, 14 Hawera, 15 Hawke's Bay Central, 16 Horowhenua, 17 Huntly, 18 Hutt Valley, 19 Inglewood, 20 Manawatu, 21 Manukau, 22 Marlborough, 23 Marton, 24 Motueka, 25 Napier, 26 Nelson, 27 New Plymouth, 28 Northland, 29 North Shore, 30 Otago, 31 Pahiatua, 32 Rahotu Coastal, 33 Rotorua, 34 South Canterbury, 35 South Otago, 36 South Westland, 37 Southland, 38 Taumarunui, 39 Tauranga, 40 Te Awamutu, 41 Thames Valley, 42 Titahi Bay, 43 Waihi, 44 Matamata Radio Club, 45 Waimarino, 46 Wairarapa, 47 Waitara, 48 Wanganui, 49 Westland, 50 Wellington, 51 Eastern Bay of Plenty, 52 Wairoa, 53 Te Puke, 54 Patea, 55 Waitomo, 56 Hornby, 57 Tokoroa, 58 Helenville, 59 Mangakino, 60 Taupo, 61 Central Otago, 62 Reefton Buller, 63 Upper Hutt, 64 North Otago, 65 Papakura, 66 Auckland VHF, 67 Kawerau, 68 North Canterbury, 69 Kapiti, 70 Fielding, 71 Rodney, 72 Opotiki, 73 Hobson, 74 Western VHF.

NEW ZEALAND COUNTIES AWARD

The Basic NZC Award requires contacts with 20 different New Zealand counties. Endorsements for 40, 60, 80, and 100 are made with a special certificate for 112. A map showing the counties is available by writing NZART (ZL2GX) directly. Enclose 10 cents or 1 IRC to cover handling.

The initial award with any or all endorsements costs 45 cents or 3 IRCs. Separate endorsements thereafter cost 10 cents or 1 IRC. The special NZC 112 Award costs 45 cents.

Contacts may be made single band or any mode to qualify. GCR apply. Applicants *must* provide a list of contacts detailing the usual logbook data.

5 × 5 AWARD

This premier award has been instituted to recognize the increasing interest in 5-band DX operation. The initial award requires that the same station be contacted on 5 bands repeated with 5 different countries.

A certified list with full QSO data and fee of $1.00 is required. The certificate is outstanding and is overprinted in embossed gold. Contacts must date from 1945.

ZLA AWARD

To qualify for this award, applicants must contact Auckland City ZL1, Wellington City ZL2, Christchurch City ZL3, Dunedin City ZL4, Antarctica ZL5, Campbell Island, Chatham Island, and Kermadec Island. There are endorsements given for single band or mode.

Award fee is 45 cents or 3 IRCs. GCR rules apply.

INDIVIDUAL ZL DISTRICT AWARDS

All ZL district awards are 35 cents each or 3 IRCs. Later endorsements are accessed at 10 cents or 1 IRC apiece. All contacts must be dated post war.

ZL1 Award—Contact 125 different ZL1 stations. Endorsements are recognized for 175 and 250 contacts.

ZL2 Award—Basic award requires contact with 100 different ZL2 stations, with endorsements given for 150 and 200.

ZL3 Award—Basic award requires 50 ZL3 contacts, and endorsements are *given* applicants claiming 75 and 100.

ZL4 Award—This award requires only 25 ZL4s be worked, with endorsements given for 35 and 50.

CAPTAIN JAMES COOK AWARD

The CJC award, as it is called, is to perpetuate the memory of this world famous navigator and seaman—in three classes. 1. The basic "Sailor" class requires contacts with G in Yorkshire, FO8, ZL2, VK2, and KH6. 2. For "Officer" class, applicant must first possess all the Sailor class contacts plus ZL1, ZL3, ZL4, VK3, VK4, VK9 New Guinea, and any Antarctica station. 3. For "Command" class, both the previous classes must be earned plus five of the following—VE2, VO, A35, YJ8, FK8, CE0, and KL7.

Cost of this award is 45 cents in stamps or IRCs. GCR rules apply.

YL ZL AWARD

The Women Amateur Radio Operator Award (WARO) requires VK and ZL stations to work at least 12 members of the WARO. DX stations must work

at least 5 members. All contacts must be made after June 1, 1969, and must include one each from ZL1, 2, 3, and ZL4.

Net contacts do not qualify. There are no band or mode limitations; however, all contacts must be made from the same QTH for all.

Unlike all the previous awards shown so far, send your list of contacts along with your QSL cards to the Award Custodian, Thelma Souper ZL2LO, 62 Kirk Street, Otaki, New Zealand.

There was no mention of an award fee, but to be safe and courteous, it is advisable to enclose at least an amount for sufficient postage to return your cards.

In the event you missed the address for all applicants for NZART awards, please forward your requests to Mr. Jock White ZL2GX, 152 Lytton Road, Gisborne, New Zealand. Be sure to tell Jock you heard about the NZART awards from *73 Magazine*.

CANADIAN AWARDS FROM CARF

The Canadian Amateur Radio Federation, Inc. (CARF) is pleased to announce the following radio amateur awards available to operators worldwide.

CANADAWARD

A colorful certificate will be issued to any amateur who confirms two-way contact with all Canadian provinces and territories. Awards will be issued for any band six to one-sixty meters and any mode via OSCAR satellite. Modes may be mixed, CW, SSB, RTTY, SSTV, or any other authorized emission.

All contacts must be made after July 1, 1977. To qualify, applicant must forward QSL cards with $2.00 or 10 IRCs plus sufficient funds for the safe return of your cards. CARF members need only submit sufficient funds for returning your QSLs. Mail your fee, application, and QSLs to: CANADAWARDS, PO Box 76752, Vancouver BC, Canada V5R 5S7.

List of Canadian provinces and territories which qualify for this award: VO1/VO2 Newfoundland and Labrador, VE1 Prince Edward Island, VE1 Nova Scotia, VE1 New Brunswick, VE2 Quebec, VE3 Ontario, VE4 Manitoba, VE5 Saskatchewan, VE6 Alberta, VE7 British Columbia, VE8 Yukon Territory, VE8 Northwest Territories. Note: VO1 or VO2 count as one required contact.

5 BAND CANADAWARD

A special plaque will be issued to any amateur who confirms two-way contact with all Canadian provinces and territories on each of five separate bands (12 cards per band for a total of 60 cards). All contacts must be made after July 1, 1977. Submit the 60 cards with $10.00 or 70 IRCs plus sufficient postage for the safe return of your OSLs. Should you work 6 or 7 bands using the same CANADAWARD criteria, special endorsements will be provided upon proof of your claim. As with the basic CANADAWARD, forward your applications to PO Box 76752, Vancouver BC, Canada V5R 5S7.

DX

from page 15

been worked previously. Four US stations had tried and failed to make contact on Monday; none attempted Tuesday.

Futile attempts to steer the VK0RM crew to some radio equipment purportedly left on Heard some 20 years ago were made on Wednesday, 19 March.VK1PG had been on Heard at that time. P29JS and VK0RM moved to 21205, but no contact was made there. Nothing was heard of VK0RM after about 1300 UTC on Wednesday, 19 March.

• • • • •

Does this story make you start thinking about your solid-state rig and its limitations? What if the Heard boys had taken a Collins KWM-2 or a Drake pair? Better yet, what if they had taken *two* Kenwood TS-120 radios, one for a spare? When there's no Radio Shack on an island, having only one rig (with transistors in the final) is risky, at best. Convenient, yes, but . . .

We began the April column with a comment about the beginning of the new decade ("unless you're progressive and follow the decade-begins-in-'81 theory"). That was bound to bring at least one response, as indeed it did:

Dear Editor:

This letter refers to the first sentence in your article in *73*'s issue for April, 1980, and reflects my dismay in discovering that the writer who has earned my respect with his intelligent, pleasurable reports not only holds to an absurd version of the meaning of "decade," but also persists in publishing it. I am dissappointed in you.

Any dictionary you might consult will tell you that a decade is a "group, set or collection of ten things, especially a period of ten years." When you count any ten things, even years, you begin your counting with "one" (not "zero") and end with "ten" (and you insist on getting ten singles for a ten-dollar bill, don't you?). When you count your toes, you wind up with ten; if you continue the count on your fingers, you wind up *with twenty* . . . or, to put it another way, your second decade of digital appendages *includes* the twentieth. Carrying this further: The Christian Era began with the "Year One" (not "Year Zero"), the first century ended with the year 100, the nineteenth century ended with the year 1900, the twentieth century began with the year 1901, its seventy decade ends with *1980*, and that its eighth decade begins in '81 (to quote you) is just the most simple, methematical fact—not "theory."

Will you have the goodness to correct your published statement in one of your subsequent articles, not for me, but for the sake of other readers whose own misunderstanding may have been enhanced by yours?

Most sincerely,
Herbert Schwartz K2LVU
Professor Emeritus, NYU

• • • • •

Well, darn it, at least my admonishment came from an academic. Nice to hear from you, Herb. I was thinking of things like measuring . . . a yardstick begins with zero, doesn't it? And if I give you a ten-dollar bill and ask for *change*, don't I start with zero dollars, until you hand me the first one back? And did the sixties end with the murders of Robert Kennedy and Martin Luther King in 1968, or did they end with the pullout from Viet Nam and the abolishing of the Selective Service in 1973?

As you can see, we thrive on letters, opinions, even criticism. And photos for the column, too. Letters make fun reading while scanning the bands for DX. We'd like to hear from you—good, bad, indifferent.

All of the material for this column came from *The DX Bulletin* out of Vernon CT.

Corrections

In my article, "A Micro-Controlled Ham Station" (April, p. 76), Fig. 1 on page 77 inadvertently shows a Small System Hardware TRS-232 Converter between the TRS-80 Expansion Interface and Western I/O Selectric Printer. The TRS-232 Converter is totally unnecessary as the Western I/O printer works *directly* off the expansion interface.

Robert M. Richardson W4UCH/2
Chautauqua Lake NY

In regard to "The Paper, the Station, and the Man" (February, p. 54), a few errors occurred which you might want to correct:

On page 56: The flier's name in the N.Y.-to-Norway flight was Thor Solberg. He later became the owner and operator of an airfield near Morristown NJ.

On page 58: The call letters of the Louise Boyd Expedition were LA9Z; they operated in the amateur bands.

On page 59: I retired on June 1, 1969, after 69 years with the *Times*.

Incidentally, my name is IVERSEN.

Reginald Iversen K4QZ
St. Petersburg FL

Contests

from page 21

tors.

EXCHANGE:

RST, QSO number from 001, WAB area and county. Book numbers and districts may be requested but are not mandatory as part of the exchange.

SCORING:

Score 5 points for each completed QSO. Stations may be worked on other bands for extra points.

Multipliers for UK contestants are each WAB area and each overseas country (DXCC list). In addition, Aiderney, Guernsey, Jersey, and Sark count as separate countries. The remainder of G, GD, GI, GM, and GW count as one multiplier only.

Multipliers for overseas contestants are each WAB area, county, and each G prefix (G, GD, GI, GM, and GW). Multipliers count on each band, i.e., a station worked on three bands = 3 multipliers.

For mobile entries, every contact made from a different area will count five points, but the multiplier counts once only (i.e., mobile station from ten different areas – score is 10 times 5 points, but only one multiplier for the mobile station).

AWARDS:

Certificates for the leading contestant in each class or entry. For awards, each G prefix is separate. There will also be certificates issued to the leading contestants from each DXCC country and also to SWLs. Certificates for 2nd and 3rd will be issued if there are 10 or 25 entries from a particular country or call area.

ENTRIES:

Logs must show the title of the contest, name and full postal address of contestant, QSO details, total points claimed, multipliers claimed, and the full details of all operators when multi-operator entry is submitted. Logs must be sent to the contest manager: R. L. Senter G4BFY, 27 Station Road, Thurnby, Leicester LE7 9PW, England.

Entries must be postmarked not later than one calendar month following the date of the contest and must be received by the contest manager not later than 40 days following the said contest. A signed declaration that the station was operated in accordance with the current licensing conditions must accompany all entries. It is a condition of entry that the decision of the WAB Contest Manager and the WAB Committee shall be absolute in the case of dispute. For SWLs, all stations logged must be participating in the contest and giving serial numbers which must be logged. The RSGB will be notified of the results and the Contest Manager will supply a detailed result sheet on receipt of an SAE on or after November 1st.

QRP FIELD DAY

Starts: 1800 GMT June 28
Ends: 2100 GMT June 29
(same dates/times as the ARRL contest if they should change!)

Sponsored by the QRP Amateur Radio Club International, Inc., the contest is open to all amateurs and all are eligible for awards. Portable stations may operate the 27-hour span if setup is after the start of the contest. Non-portable stations may operate a 24-hour period only. All modes are accepted, but no repeater QSOs and no pre-arranged contacts. Stations can be worked for credit once per band. No multi-transmitter stations are allowed.

EXCHANGE:

RS(T) and ARRL section.

SCORING:

Each QSO counts 2 points. Bonus points are +500 for portable (in field, non-commercial power source), +100 for all battery power, and +300 for all solar power. Multipliers are as follows: more than 100 Watts dc output power = x1; 30.1 W to 100 Watts dc output = x1.5; 10.1 W to 30 = x2; 3.1 W to 10 = x4; 1.1 W to 3 = x6; 0.1 W to 1 = x10.

Final score is QSO points times power multiplier; then add bonus points. Multi-operator stations divide by the number of operators.

AWARDS:

Certificates to the highest-scoring 1st, 2nd, and 3rd place stations overall.

ENTRIES:

Send full log data, including name, address, and call used. Also equipment, power input only, antennas, and bonus information (battery, solar, portable). Results will be published in the QRP International *Newsletter*, etc. Entrants desiring results sheet and scores, please enclose a business size SASE. Logs must be received by July 30th to qualify. Address entries to: QRP ARCI Contest Chairman, Edwin R. Lappi WD4LOO, 203 Lynn Drive, Carrboro NC 27510.

CANADA DAY CONTEST

Starts: 0001 GMT July 1
Ends: 2359 GMT July 1

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all and everybody works everybody. Use all bands from 160 to 2 meters on CW and phone combined. Entry classes include single-operator, allband; single-operator, single band; and multi-

Results

RESULTS OF THE 1979 PENNSYLVANIA QSO PARTY

PENNSYLVANIA STATIONS

Call	County	Total QSOs	PA QSOs	Out-of State QSOs	Sections	Counties	Score
N3AOT	Perry	687	45	642	62	28	122,202
K3ONW	Adams	359	75	284	61	29	56,547
K3NB	Schuylkill	410	101	309	48	32	49,344
WB3GZV	Columbia	265	89	196	33	27	21,681
WA3UNX*	Erie	187	55	132	37	23	16,687
WB3KCK	Delaware	135	35	100	23	23	7,705
W3HDH	Centre	104	35	69	27	18	6,534
AD8J/3	Allegheny	77	13	64	31	10	6,355
N3RJ	Pike	92	25	67	28	20	6,328
W3ADE	Dauphin	128	53	75	22	22	6,116
K3SWZ	York	125	57	68	21	23	5,481
K3HWL	Crawford	97	32	65	24	16	5,448
W3ZX	Centre	112	44	68	19	24	4,712
KA3DGT	Centre	59	5	54	28	5	4,676
W3CNS	Lancaster	85	25	60	22	12	4,510
AD3O	Tioga	85	30	55	22	19	4,290
K3VX/3	Mercer	80	24	58	21	16	4,032
W3CEI	Dauphin	72	28	44	19	16	3,040
W3TEF	Blair	74	35	39	19	20	2,888
WB3CAI	Luzerne	74	32	42	17	22	2,686
N3ASB	Beaver	37	15	22	15	12	1,215

*Western Pennsylvania Winner

THE TOP TEN OUT OF STATE

Call	QSOs	Counties	Points
VE3DAP	95	33	3135
VE3KK	75	30	2250
W2IMO	75	29	2175
WA2OTC	65	27	1755
W1TEE	64	27	1728
K1ITS	62	26	1612
W3PYZ	55	23	1265
N2RT	52	24	1248
K1VUT	50	23	1150
W5WG	48	21	1008
WA2NPP	48	21	1008

PENNSYLVANIA COUNTIES MISSING

Clarion	Potter
Clinton	Snyder
Fayette	Sullivan
Forest	Susquehanna
Fulton	Union
Lebanon	Warren
McKean	Wayne

53 of the 67 counties were represented. Let's hope for a clean sweep next year.

operator, single transmitter, all-band. All contacts with amateur stations are valid. Stations may be worked twice on each band, once on CW and once on phone.

EXCHANGE:

Signal report and consecutive serial number; VE1 stations should also send their province.

SCORING:

Score 10 points for each contact with Canada, 1 point for contacts with others. Score 20 points for the first contact with any CARF official news station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band and mode (12 provinces/territories × 8 bands × 2 modes for a maximum of 192 possible multipliers). Contacts with stations outside Canada count for points but not multipliers.

FREQUENCIES:

Phone—1810, 3770, 3900, 7090, 7230, 14150, 14300, 21200, 21400, 28500, 50.1, 146.52.

CW—1810, 7025, 14025, 21025, 28025, 50.1, 144.1.

Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS & ENTRIES:

The CARF Canada Day Contest Trophy will be awarded to the highest-scoring single-operator entry. Certificates will be awarded to the highest score in each category in each province/territory, US call area, and DX country. Send all logs including dupe sheets, summary sheet, and comments to: Canadian Amateur Radio Federation, Box 76752, Vancouver B.C. V5R 5S7, Canada. Entries should be postmarked before July 31st and include an SASE for a copy of the results.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

WHISTLING

My interest in police radar detectors should not be news to you, since I have been writing about them off and on for some time now. The array in the *73* mobile office (a Dodge van... the performance of which has convinced me that efforts to keep Chrysler in business are against our national interests) has risen to seven these days. Talk about overkill! When a police car is passed, the van lights up like a busy pinball game, with hoots and buzzers sounding and lights of all colors flashing.

I've written about the Cincinnati Microwave Escort unit. It is about 20 dB better than the diode models which have been sold for the last few years. This was put together by some refugees from Drake and was the first superheterodyne receiver for the 10.5- and 26-GHz bands. That 20-dB difference is a big one, amounting to about one hundred times the gain. This means that the receiver detects radar signals substantially before the diode units.

The Whistler company is not far from Peterborough, just over the border, down in Massachusetts. Sherry and I drove down there the other day to see how they were doing with their detectors... and in particular their new superheterodyne receiver, the Model Q-1000. Well, they're still selling the diode units in good numbers, with the Q-1000 sales still just a small percentage of the production. I have a feeling that once people understand what is at stake, they will not accept anything less than a superhet.

A couple weeks after the visit, my turn came up to get a test Q-1000 from their production. I went right out and checked it against the Escort. It seemed to be about the same in sensitivity... which means that it sounds off as soon as there is a police car anywhere in the neighborhood. With the diode units, you have to develop the ability to instantly brake when the detector sounds, for you often have less than one second to slow down if you happen to be lead-footed (as I am). Radar units are unable to lock on your car if you are changing speed, so a fast response will avoid anything worse than a scowl from the fuzz. If you get a blast from the detector and you start looking to see where the radar unit is, you're in trouble. You really have to develop a completely automatic braking action.

With the superheterodyne models (sometimes called quadradyne), you have the luxury of a few seconds to ponder the location of the radar unit. My reflexes are automatic, so now I ponder as I drive along about ten miles under the speed limit... instead of ten miles over. I have read enough about radar units to know that you should leave a healthy margin for their error. Once you get used to the efficiency of the superhet, you feel almost naked with one of the old diode detector types. I really hate to drive without one of the good detectors.

Whistler called the other day to see if I would be interested in doing some tests on their diode unit in comparison with the brand new and highly touted Fuzzbuster Elite. Sure, I was game for that. They brought up the unit and we set it up in the *73* van alongside the other detectors (Fuzzbuster, Bearfinder, Super Snooper, Fox, Q-1000, Escort, and Micronta). They had a K-band radar unit with them and I got out my X-band Sport Radar Gun (a present from Chuck of Tufts Electronics). We ran tests in the spots where the local police have found their radar units the most effective in generating income for the town... such as the hill out in front of our Instant Software building and a sharp road curve a mile beyond that.

There was no question but that the regular diode Whistler unit was able to pick up the radar signals before the new Fuzzbuster Elite... about one second ahead under normal driving speeds. Considering the short time you have for slowing down with the diode detectors, this is significant. But none of the units even came close to the warning given by the Q-1000 and the Escort. There is a long hill coming out of the only stoplight in Peterborough. The radar was set up out of sight just over the top of this hill. The Q-1000 picked it up halfway up the hill and the diode unit got it just as the radar car came into view as we crested the hill. The difference between the various diode detectors was a matter of perhaps 100 feet in sounding off, while the Q-1000 got all excited over 1000 feet before that. It was picking up the signals bouncing off traffic signs, passing cars, trees, etc., and announcing the radar from way down the hill... and around corners.

The Whistler people feel that the difference in price is such that it will be a lot more difficult to sell the superhet units (they run around $250-$300). Considering the expense and the psychological damage of a ticket, not to mention the problems with keeping a driver's license, the cost of the detector is hardly significant. Of course, if you haven't yet gotten a radar-inspired ticket (even if you weren't speeding), you may not really care about all this... yet.

The Fuzzbuster Elite certainly was a disappointment. I wonder why they are not getting into business with a superhet instead of coming out with just another diode gadget. The "Elite" name on it may confuse some people with the Escort name. I don't know what's with those people... the firm, Electrolert, has done a fantastic job of fighting legal battles over radar detectors and they were one of the first with a detector which worked well enough to be of real value. But since then they have done some disappointing things... like that fake "new model" with an Escort unit in it sent to a magazine for test. Their legal kit for people wanting to fight radar tickets is superb.

The Whistler Q-1000 is available from any Whistler dealer. The Escort is only available direct from Cincinnati Microwave, 255 Northland Blvd., Cincinnati OH 45246.

CLEANING UP COMPUTERS

With some 30,000 microcomputers already in the hands of hams, about the only thing that stands between our having 30,000 RTTY fans and reality is the horrendous noise these computers generate and radiate into our radios. It is high time that some hams tackled this problem and solved it.

Despite many warnings, the manufacturers of microcomput-

ers took the easy way out and built systems which generated severe radio frequency interference. Noise generation is a logical result of the type of construction used for most computers, where a bus structure is at the heart of the system. This means that there are a bunch of wires going all through the computer which are carrying high-frequency radio signals, so of course they are going to radiate.

One possible approach to the problem is to seal the computer unit in a shielded box, filtering all cables entering the box. The Cromemco computer uses this system with a good deal of success. This does increase the weight, size, and cost of the computer significantly.

Another approach from the manufacturing end is to shield each individual module of the system, which Atari has done with success. This, too, increases the cost of manufacture. And remember that every manufacturing cost is magnified substantially as it goes through the marketing chain, reflecting an increase to the customer on the order of three to five times the increase in manufacturing cost.

There is a need for experimentation in the field of reducing the interference from computers. I'd like to see you tackle this problem and solve it. I don't know how much can be helped by lining the Inside of a TRS-80 keyboard box with aluminum foil and grounding it, or whether the only answer is a separate shielded box for the CPU section. I do think that we can work out a reasonable solution which will allow microcomputers to be used in the ham shack.

73 is thus soliciting articles on RFI cures for the various microcomputer systems. We're also interested in further articles on using these computers for RTTY communications, ASCII communications, etc. Here is a subject you can tackle and get your teeth into. If we have any less than ten times the number of articles on this subject than all other ham magazines combined, I am going to be disappointed.

THE FUTURE ARRIVES

Sometimes I get impatient for technological changes which are obviously going to arrive. Last fall, when I finally got my hands on a Yaesu FT-207R, I felt a great sense of satisfaction . . . the future had arrived.

Large scale integrated circuits and the resultant microprocessor have made it possible for us to have a radio transceiver which is about the size of our smaller hand transceivers, yet Includes the features of a scanner and synthesizer.

Those few FMers who were around ten years ago may remember one of the first FM rigs on the market. It was a unit put out by Galaxy and it had four crystal-controlled receiver and four transmitter channels. The unit had long wires running around and switches which had to be banged now and then to make good contact; in general, the equipment was prehistoric. Stability was not a big feature.

Rigs grew more stable and required vast amounts of crystals through the mid-70s. Finally Icom broke through with the IC-230 synthesized rig. Now we have a hand-held programmable transceiver. It will scan the entire band looking for active channels . . . or it will scan programmed channels. You can use it with 600-kHz offset or program in the offset you desire for repeaters.

Remember when the first digital readouts arrived? That wasn't very long ago, and now there they are even on my hand unit! The 207 seems to have just about everything the sophisticated base station transceiver would have, plus a belt clip. I think we'll be seeing these used not only for hand use, but also, with a power supply and amplifier, for use in the shack and in the car. I know I've put an amplifier in the car and taken out the old mobile rig. Now I don't have to worry about the rig being ripped out some night or while I'm in doing shopping somewhere.

The 207 has a jack for a remote microphone. That's most useful at hamfests where you don't want to have to wrest it from your belt every time someone calls. I find it handy for skiing, too, where the rig is in a pocket and only the clip-on mike is out there on my coat collar for easy use.

This isn't an advertisement for the 207, so I won't go into all of the features. There are plenty and the rig is incredibly flexible. Frankly, I'm hard put to look a lot further ahead for any significant technological improvements. What is there left to do? I can see some little details which might be added, but when just about everything you can get in the most sophisticated base station is built into a hand transceiver, it seems like a dead end.

You can be sure of one thing . . . my 207 is with me just about everywhere I go . . . and, if I'm in your town, I'm listening to your repeaters. There is no way to hide them from a synthesized scanner.

NEW CALLSIGN RUMOR

A letter came in from one of our better authors in the midwest . . . and he was all upset. He'd been talking on 40 meters and three of the hams on the round table had personal friends who were Engineers In Charge of local FCC facilities and they all had the same story: In the near future, all callsigns would be reassigned by the FCC computer every time a license was renewed. Further, the ARRL was warned about this a year ago, but they ignored it.

My reaction was . . . balderdash. But, just to make sure, I called the FCC and checked with the horse's mouth. Balderdash was the correct response. This silly rumor probably got started as a result of the policy of the FCC to permit changes of callsigns at renewal time if your class of license permits same.

The FCC used to have all sorts of hassles about callsigns. Now that almost anything goes, the beefing Is almost zero, so it is highly unlikely that they would go out of their way to stir up that hornet's nest again. They haven't.

Here's a good rule: If you hear a rumor that sounds like baloney, the chances are good that it is. If the rumor would entail a lot of controversy and expense for the Commission, it has a high probability of being unfounded.

PRICE INCREASE

It will probably come as no surprise at all that the *73* cover price will be going up with the July issue. So will the subscription rate. It'll be $2.95 per copy, I expect, and a one year rate of $25 (US).

You can stave off the higher prices if you get busy and extend your subscription for three years at the current rate of $45 (in the US). That would save you $30 over the next three years, unless it becomes necessary to put another increase in the interim, which is not at all unlikely, considering the rate of our inflation.

Remember, too, that your money is devaluing rapidly, so the more things you buy now, the better off you are. If you try to save your money, it will shrivel up in your pocket.

There is little likelihood of printing, paper, or postage costs going down, so subscription rates are unlikely to go down . . . just up.

Procrastination is the thief of money.

Ham Help

I am studying for my Technician and have purchased a Hammarlund HQ-110 receiver to help build up my code speed. I need an operating manual and schematic for this rig. I will be glad to pay copying expenses and postage. Thanks very much for any help.

Edward J. Hannigan, Jr.
20551 Salt Air Circle
Huntington Beach CA 92646

I need a 2AC Crystal Calibrator for my Drake 2B. If you can get your hands on a new one, I'll pay the new price. Any help would be appreciated.

Frank M. Shelton W8NYH
Box 156
Jenkinjones WV 24848

I will be vacationing in the Eureka-Arcata, California, area in August, 1980. I would like to meet some of the local hams during my stay.

Herb Lipson W8FBH
17597 Tracey
Detroit Mi 48235

Does anyone have a manual or schematic for a National NC-98 receiver? If you can lend me yours, please let me know. I'll send you a mailing envelope, and then burn a copy of yours and return it to you along with reimbursement of your mailing cost. Thanks.

John Yares KA4IMM
9660 Coachman Court
Pensacola FL 32504

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propagation

by

J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	21	14	14	14	7	14	21	21	21A	21A	21A
AUSTRALIA	14A	14	14	14	7B	7B	7	7	7B	7B	14	14
CANAL ZONE	21	21	14	14	7A	7A	14	21	21	21	21A	21A
ENGLAND	14	14	7	7	7	14	14	14A	21	21	14	14
HAWAII	21	14A	14	7A	7	7	7	14	14	14	14A	14A
INDIA	14	14	7B	7B	7B	7B	14	14	14	14	14	14
JAPAN	14	14	14	7B	7	7B	7B	7B	14	14	14	14
MEXICO	14A	14	14	14	7	7	14	14	14	14	21	21
PHILIPPINES	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14A	21
SOUTH AFRICA	14	7B	7B	14	14	21	21	21	21A	21A	21A	14
U. S. S. R.	14	7A	7A	7	7	14	14	14	14	14	14	14
WEST COAST	21	14A	14	14	7	7	7A	14	14	14A	21	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7A	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14	14	14	7	14	21	21	21A	21A	21A
AUSTRALIA	21	21	14	14	14	7B	7	7	7B	7B	14	14A
CANAL ZONE	21	21	14	14	7A	7A	14	21	21	21	21A	21A
ENGLAND	14	7A	7	7	7	7	7A	14	14A	14A	14	14
HAWAII	21	21	14A	14	14	7	7	14	14	14A	21	21
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	14	14	14	14	7	7B	7B	7B	14	14	14	14
MEXICO	14A	14	14	7	7	7	7	14	14	14	14	14A
PHILIPPINES	14	14	14	14B	7B	7B	7B	7B	14	14	14	14
PUERTO RICO	21	14A	14	14	7	7	14	14	14A	21	21	21
SOUTH AFRICA	14	7B	7B	14	14B	14B	14	14	21	21	21	14
U. S. S. R.	14	7A	7A	7	7	7	7A	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7A	7	7	7	7	14	14	14	14
ARGENTINA	21A	21	14	14	14	7	14	21	21	21A	21A	21A
AUSTRALIA	21A	21A	21	14A	14A	14	14	7	7B	7B	21	21
CANAL ZONE	21	21	14	14	7A	7A	14	14	21	21	21A	21A
ENGLAND	14	7B	7	7	7	7	7	7	14	14A	14	14
HAWAII	21A	21A	21A	21	14	14	14	14	14A	21	21	21
INDIA	14	14	14	14	7B	7B	7B	7B	14	14	14	14
JAPAN	14	14	14	14	14	7A	7B	7B	14	14	14	14
MEXICO	14A	14	14	14	7	7	7	14	14	14	14A	21
PHILIPPINES	14	14	14	14	14	14B	7B	7B	14	14	14	14
PUERTO RICO	21	14A	14	14	7	7	14	14	14	21	21	21
SOUTH AFRICA	14	7B	7B	14	14B	7B	14B	14	14	14	21	14
U. S. S. R.	14	7A	7A	7	7	7	7A	7A	14	14	14	14
EAST COAST	21	14A	14	14	7	7	7A	14	14	14A	21	21

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

june

sun	mon	tue	wed	thu	fri	sat
1 G	2 G	3 F	4 G	5 G	6 G	7 G
8 G	9 G	10 G	11 G	12 G	13 G	14 G
15 F	16 F	17 F	18 F	19 G	20 G	21 G
22 G	23 G	24 G	25 G	26 G	27 G	28 G
29 G	30 G					

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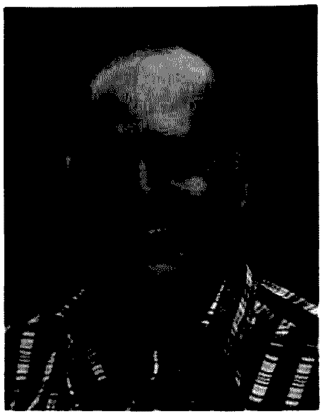


W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

BOYCOTT

The Russian ham stations may clam up a bit after the recent bout with Dave Clark K8MPF. He was on 15 meters talking to RZ3AJA, a special Olympic prefix station, and he explained to them about the US boycott of the Olympics, much to their amazement. They expressed frustration and this was echoed by several other Russian stations which broke in on frequency. The Russians seem not to have any idea that their country has actually invaded Afghanistan and thus they were astounded to learn of the US boycott in retaliation.

This could throw quite a crimp in the Russian plans. It appears that they were going to field quite a bunch of ham stations using the special "R" calls in order to promote the Moscow '80 Olympics and that they had an objective of talking with every US amateur . . . and others around the world.

Dave suggests that it would be appropriate for US amateurs to refrain from contacting these special Olympic stations, but that normal contacts with Russian stations be encouraged since this is one of the few ways for information to reach the people of that country.

The text of a letter sent by Dave to Dr. Zbigniew Brzezinski follows:

March 26, 1980

Dr. Brzezinski
White House
Washington DC 20500
Dear Dr. Brzezinski:

As requested by your office on March 25, 1980, I'm submitting the following communication detailing events that occurred via amateur radio contacts I had with Soviet amateurs during the afternoon of March 25th.

Contacts with Soviet amateurs are most common; however, few of their amateurs discuss issues beyond stating location, name, signal report, weather, and descriptions of their radio equipment. Most of the Soviet amateurs are interested in exchanging QSL cards and do so through the Central Radio Club, Box 88, Moscow.

On March 25th, Soviet station RZ3AJA contacted me and the usual exchange was made with some notice on my part that this individual was fluent in English. I inquired as to the special call prefix RZ3 and got a detailed explanation of how the special prefixes were a part of Olympics '80 to be held in Moscow. He further explained, as most amateurs are aware, that several prefixes have been assigned with R (instead of the normal U) especially for the Olympics. He further explained in detail about the preparations Moscow is making for the Olympics and that amateur radio will play an important part through special calls and awards for contacting these designated prefixes.

I explained to this amateur that the US probably would not be attending the Olympic events and the reasons for this action by our government. Not only did the station I was contacting show obvious emotional reaction, but he also was joined by several other Soviet stations who expressed great frustration with my comments.

It is my opinion that USSR amateur radio operators will continue to combine this popular hobby with an effort to promote Moscow '80. These stations have as an objective talking with and exchanging data regarding Moscow '80 with the more than 400,000 US amateurs as well as thousands of amateurs around the world.

It seems appropriate, therefore, that US amateurs be asked to refrain from communications with the special Moscow '80 R prefixes and their associated activities. A news release from your office would make an immediate impact on hundreds of Soviet stations seeking exchanges with US amateurs.

Normal communications with the Soviet U prefixes should be encouraged since amateur radio does provide a system of direct communication to all parts of the world regardless of political relations. Amateur radio should not be restricted by

government sanction since it provides emergency communication in times of crisis and need.

Your comments and feelings concerning this issue will be communicated to the major amateur radio publications and organizations.
Respectfully,
(s) Dave Clark K8MPF
2508 Rusridge
Kalamazoo MI 49007

Having visited and operated from Afghanistan (YA1NSD), I can understand the anger about the Russian invasion of those people who have visited this primitive country. I doubt if hopes for a Viet Nam-like problem will be realized. Yes, the Afghans are independent and fierce, but they do not have the endless supplies and training that the troops from North Viet Nam had behind them . . . unless the US manages to cook something up. That seems very unlikely, since we are not on that good terms with the surrounding countries. No, I think Afghanistan will go the way of Hungary and Czechoslovakia.

Should we contact the special events stations? I'm inclined to go along with Dave on this and boycott them. But I do think that it is important to bypass Pravda and talk directly with the other Russian hams to explain why our country has taken this unusual stand.

PHOOTLOOSE PHOTOGRAPHER WANTED

Perhaps you have seen some of the dirty grimy pictures accompanying DX articles in some of the other ham magazines. I think it's about time for DXpeditions to get the press they should have. Believe me, if I weren't tied down, I'd be volunteering to go out there and take the pictures and write the articles. Unfortunately, I have discovered that I really can't do everything.

Is there an Extra Class (or even Advanced) with a good background in photography and writing who might be available to accompany DXpeditions as a stringer for *73 Magazine*? We would pay the travel expenses . . . anywhere in the world . . . in return for top-notch articles for *73* with good photographs.

The line starts at the right.

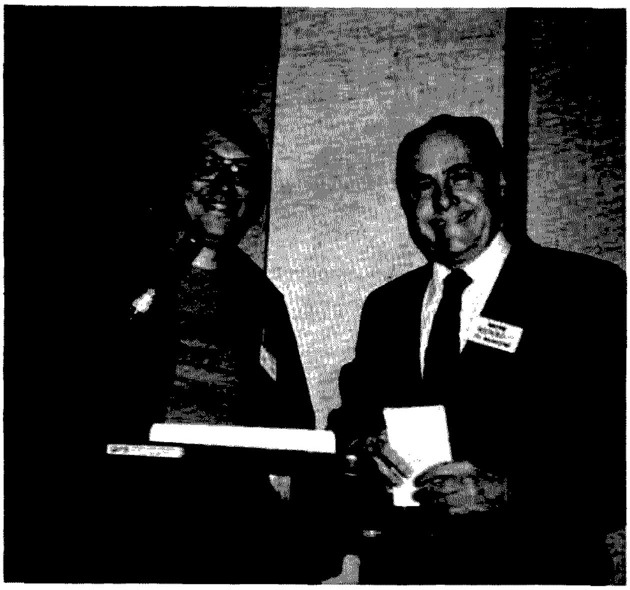
One of the problems I have encountered on DXpeditions is the lack of foresight on the part of the other DXpeditioners. They get so wrapped up in what they are doing and what has to be done that they forget the importance of documentation. The Documentation Officer on a DXpedition should not be required to carry, lift, haul, erect, or otherwise spend his valuable documentation time doing routine work. He should be busy working out angles for pictures, setting up shots, making tape recordings, making notes, and planning the movies of the trip.

By the time you have worked out a 16mm movie, covered the trip with a color 35mm transparencies, and shot plenty of black and white 35mm photos, plus made notes for the article and tape recordings of interesting background, there is little time left except for some operating . . . mostly at night.

I managed to shoot a 16mm film of the 1958 Dxpedition to Navassa . . . which everyone fought me on at the time. Later, the film was in tremendous demand—and I still get calls for it. Having learned my lesson, I did not take a movie camera on the 1972 DXpedition to Navassa, but covered it as best I could with 35mm color shots. It isn't the same. In the future, I would go back to 16mm or else use a good video recorder.

On my DXpeditions to Africa, the Middle East, Asia, and the Pacific, I really didn't have time to shoot enough movie film to make it worthwhile to show. The 35mm slides were shown to dozens of clubs and at hamfests and conventions all around the world. I tried a Super-8 camera on one trip, but will never do that again in a case when I want first-rate films.

If I am able to find someone with the time and experience to go out on DXpeditions, we will be able to do a first-rate job of publishing articles on these trips . . . and perhaps come up with some film or tape which can be used on television.



Rol Anders K3RA, president of the Baltimore Amateur Radio Club (BARC), introduced W2NSD/1 at the Greater Baltimore Hamboree and Computerfest in Timonium MD. Photo by W3VBM.

JAPAN MAGAZINES

Though my ability to read Japanese is somewhat limited (I know one Kanji character so far), there is enough English for me to get quite a kick out of getting the Japanese *CQ Ham Radio* magazine every month. It is enormous, usually well over 500 pages, and packed with beautiful color pictures of the latest in Japanese ham gear. They have many more hams than we . . . perhaps twice as many active hams . . . so their market for ham gear is much larger than ours. The result of this is that they have a far greater selection of ham gear than we do.

A few of the Japanese firms are exporting their equipment for sale here and we are familiar with them. But there are a lot more smaller firms which are

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Looking West

Bill Pasternak WA6ITF
24854-C Newhall Ave.
Newhall CA 91321

It's about 2:00 pm Pacific time or thereabouts. We are at 35,000 feet somewhere above Kansas aboard a Boeing 727 jetliner headed home to Los Angeles. We left Dayton about an hour ago and will shortly be landing in Kansas City for about a 45-minute layover. Seated next to me is Joe Merdler N6AHU, and a few rows toward the front of the aircraft is Dr. Wayne Overbeck N6NB and his XYL. It's been quite a hectic weekend for all of us, but a special one for Joe and Wayne. We are returning from the 1980 Dayton Hamvention, and what made it special for Joe and Wayne were the awards presented to them at last night's banquet. In case you have not yet heard, Wayne Overbeck was named "Ham of the Year" because of his continuing contributions to the overall picture of amateur radio communications. DARA's "Special Achievement Award" for 1980 went to Joe, for his leadership in the fight against malicious interference in amateur communications.

By the way, this is the first time in the history of these awards that two amateurs from the same call district (other than "8"-land) have been chosen to receive awards in the same calendar year. Even more coincidental, both are residents of the San Fernando Valley and both are members of the same amateur radio club. What's really important is that DARA saw fit to honor both these men for their outstanding contributions to the amateur service; I cannot think of any two people who were more deserving of such honors. To both, Looking West offers its heartiest congratulations.

Joe and I decided to fly in together, and the flight to Dayton was far better than this one going home. When I booked our tickets, I was told that the aircraft on the return trip would be a "wide-body" Lockheed 1011, but for some reason this smaller plane is what showed up. When we left the other evening, we had a Boeing 747 for the main leg of the trip and spent only 45 minutes on board a smaller plane for a connecting flight out of Chicago. Not that there is anything wrong with a 727, except trying to sleep on it. That's where a 747 or 1011 is really nice, and what I need right now is about 10 hours of sleep. Oh, well, one cannot win them all, can one?

Next month, we will have a complete story about the Hamvention, but right now I want to tell you a bit about the truly wonderful people who were our hosts during the past three days. We arrived in Dayton the morning of April 25th at about 9:00 am local time. Waiting for us were two of the nicest people I have ever had the pleasure of meeting: Bob McKay N8ADA and Bob Roettele W8UNV. Both are active DARA members, and both worked very hard to make Hamvention '80 the overwhelming success it turned out to be. We loaded our bags into Bob Roettele's red station wagon and headed to our hotel, only to learn that our rooms would not be available till about noon. Undaunted, Bob McKay suggested that we head over to his house for breakfast. Let me tell you, it was some breakfast! I literally "pigged out." Bob's wife whipped up the biggest platters of bacon and eggs I have ever seen, and did so in what must have been record time. Boy, can that lady cook!

Since it would still be a while before we could get into our rooms, Joe decided to see if he could hear his friend Dave Gardner K6LPL, who at that time was operating a DXpedition from Johnson Island in the Pacific. We swung Bob's beam out in that direction, but Joe never did hear Dave. Sometime during all this, I must have dozed off, because the next thing I remember was Joe telling me it was time to try again at the hotel. This time the room was ready, and while Joe and the two Bobs headed out to the Hara Arena, I elected to catch up on some lost sleep. Having been to Dayton before, I kind of knew that this might be the best approach. I had slept for 3 hours between Los Angeles and Chicago, but this darn hypoglycemia I suffer from really requires about 8 hours of sleep so that I can function properly for the next 16.

It was about 6:00 pm local time when Joe returned, and he had with him yet another Bob. This was his cousin Bob Merdler K8AQA from Saginaw, Michigan. Joe introduced us, and we took off for dinner.

It was when we returned that I finally met Noel and Marilyn McKeown and their 8-month-old daughter. Noel is WB8QQC and was the General Chairman of Hamvention '80. Ever meet someone for the first time and feel you have known him for a lifetime? That's the way it was with Noel and Marilyn. I can only say that in my book, they are super. So, while Bob and Joe hit the snore shelf, Noel, Marilyn and I, along with a number of other members of DARA, sat in the DARA suite talking into the wee hours of the morning. I never did get much sleep that night, but I had, as you know, taken precautions to cover just such a happening. About 1:00 am, Noel and Marilyn excused themselves, since they both had to be at the arena early to open for the next day's events, so we rambled downstairs to the hotel's pub with the rest of the crew. As I sipped my Diet-Rite Cola and chatted with Vic Stauder WA2KOO/8 and the rest of the people, I knew deep inside that I had made new friendships that would last a lifetime. Vic was interested in possibly videotaping some of next year's convention, and we spent a good two hours debating the pros and cons about how to do this.

Saturday morning at about 8:00 am, Bob picked us up and we headed out to the Hara Arena, stopping along the way for a rather healthy midwest breakfast. I thought we would be among the first to arrive, but I was in for a rude awakening. By the time we arrived, the parking lots were loaded with cars bearing callsign plates from almost every state in the Union. If there is a gasoline shortage, you would never have known it here. The place was buzzing with activity. Since Joe was not scheduled to speak till noon, I left him in Bob's capable hands and made my way toward the flea market. I had a specific destination and a specific person to meet with.

You have not seen an amateur radio flea market until you see the one at the Hamvention. This year, they opened the flea market a day earlier than usual, and by mid-Friday it was already packed full. By the time I arrived on Saturday, it was both unbelievable and breathtaking. There is no way I can tell you how many buyers and sellers there were. Maybe DARA has figures on this, but if the place was crowded in 1976 when I last attended, it was twice as crowded this year. Even with the mass of humanity I had to wade through, it took only 10 minutes to locate the person for whom I was searching. After all, how many people come to the Hamvention with a 10-meter ground plane on a push-up mast? I had been told to watch for this "landmark" by its owner and had spotted it almost immediately. Its owner was Bob Heil K9EID of Marissa, Illinois.

In the past year, Bob and I have become friends over the phone, though we had yet to eyeball. Actually, Wayne Green sort of introduced us by suggesting that I give Bob a call in early 1979. That phone call led to many others and finally to our meeting face-to-face at Dayton. Bob is the guy who put the town of Marissa on the map with regard to amateur radio. As he explains it, Marissa has about 2,000 residents of which close to 170 are active amateur radio operators. Virtually all of these are members of "MARC," the Marissa Amateur Radio Club, one of the most active radio clubs in the nation. They own one of the most elaborate amateur repeater systems in the nation, with satellite receivers, satellite transmitters, and remote links to other bands—including 10-meter SSB! How was this accomplished? That's for Bob to tell, and the story is told partially in a slide show that MARC makes available which details the development of WD9GOE . . . "The Mighty Marissa Machine." I've seen this slide and audio tape presentation, and it's one worthy of showing at any radio club meeting. I suggest that you contact MARC at PO Box 68, Marissa IL 62257, for information on its availability.

Back to the narrative. I arrived at Bob's van and was introduced to his wife Judy and another friend of theirs who made the 400-plus-mile trek to the Hamvention together. Bob's latest interest is getting more people on

Continued on page 167

RTTY Loop

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

This month, the spotlight shifts from the home-brew to the commercial. We shall begin examining "store-bought" RTTY equipment available to the amateur. I plan to cover only equipment I have bought and used personally or been able to get my hands on for a while. I will not echo manufacturers' spec sheets or promotional literature; that would be a disservice to you all.

I guess it is best to start with something popular that many of you have had experience with. We have been talking about demodulators for a few months, and one of the most popular commercial demodulators of recent times is the ST-6, manufactured by HAL Communications Corp., Urbana, Illinois 61801. Now, HAL has come out with many new models, with all kinds of bells and whistles, but the ST-6 has been the anchor for many a RTTY enthusiast.

You can trace the ancestry of the ST-6 back to at least August, 1965, when Irv Hoff W6FFC, then K8DKC, published a description of his "Mainline TT/L FSK Demodulator" in *QST*. Although built with tubes and requiring a hefty power supply to match, this is the granddaddy of the ST-6, with most of the same operating features. The design was upgraded in a few years to the TT/L-2, and then solid state appeared. Irv went to work and a whole series of begats ran from the ST-1 to the ST-6, the latter published in *Ham Radio*, January, 1971.

The ST-6 uses 709 operational amplifiers throughout and employs well-designed Butterworth input filters. As supplied, it comes equipped for 850-Hz and 170-Hz operation; 425-Hz operation is available as an option. The filters are quite narrow, which allows for sharp selectivity under difficult conditions. By straddle tuning, shifts of ten Hz to 1100 Hz are copyable with a stock unit. Autostart, however, is functional only on the nominal shifts.

Using the ST-6 is relatively straightforward. The loop connector is a molex™ plug on the rear skirt and provides the standard 60-mA loop current. An RS-232 output is also available and may be used to drive a video display or transmitting FSK circuit. A key jack is provided which, when used with the FSK output, can provide narrow-shift CW identification. The teleprinter may be plugged into a switched ac receptacle, also on the rear skirt.

A signal is tuned in by peaking the built-in meter so that minimum flicker of the needle is observed. The meter deflects upward for both mark and space, so when the signal is tuned correctly, assuming equal strengths for mark and space, the deflection remains constant. Alternately, a conventional oscilloscope may be connected to a jack and a cross pattern used for tuning. The demodulator may be used in "FM" (limiter) or "AM" (limiterless) mode. The autostart only works when the limiter is *on* FM.

Now, a few problems. Many people buy the ST-6 as a kit. The circuit is assembled mostly on several printed circuit boards, so this is not too much of a chore. But, wiring at least seven (more if extra shifts or AFSK is added) edge connectors is hard enough without being forced to use the wire supplied. Typically, a coil of fine stranded wire is supplied, all one color. If you like your eyes and plan to assemble this kit, go out and find some multi-colored wire to do the connectors with and ditch what they send you. Almost every mistake I have seen in an ST-6 built from kit form (and there have been quite a few) has been traced to an error in wiring those edge connectors, an error that could have been prevented, or at least found easily, if coded wiring was used. I mentioned that a discriminator for 425-Hz shift is available. This shift is a common commercial shift, but is rarely used in amateur work. Nonetheless, the front panel is marked for all three shifts. If you have only two, 850 Hz and 170 Hz, the switch used has a different arc, so the pointer lines up with neither label. A neater way would be to stamp the case for two shifts and offer an escutcheon to users to the three-shift option. Finally, I am not fully versed enough on the circuit to know why, but it sure would be nice to be able to use autostart while in limiterless mode. As it is, the machine runs open without a signal in limiterless mode, while in limiter (FM) there is mark-hold.

Continued on page 163

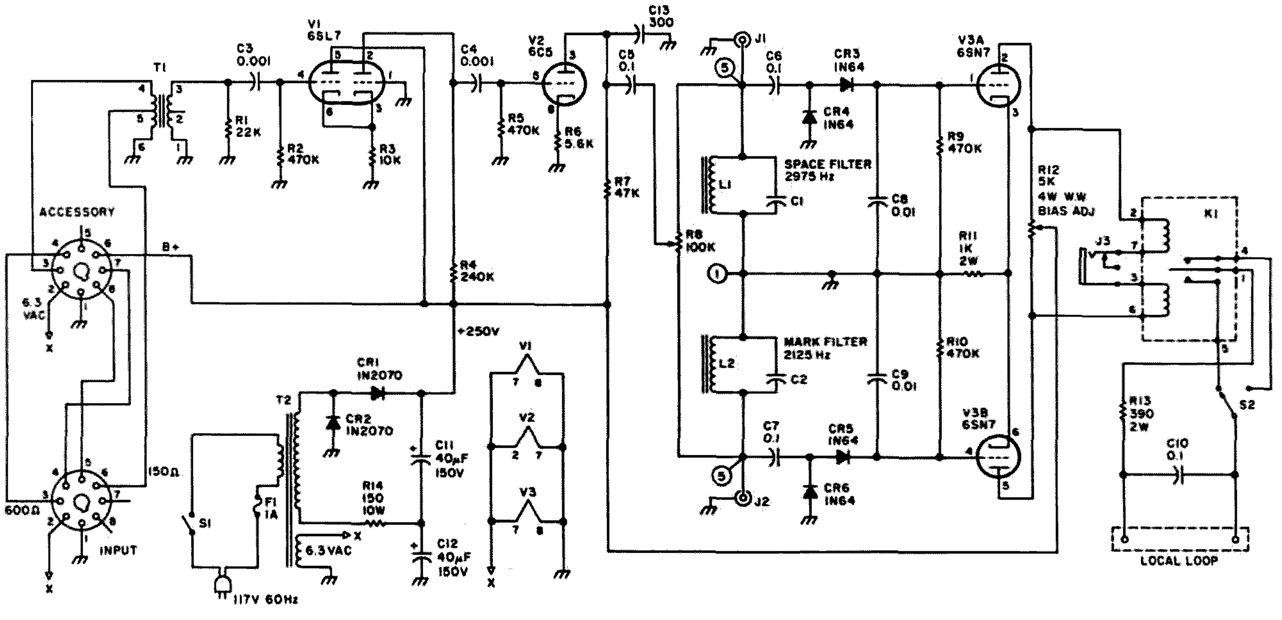


Fig. 1. The Twin Cities TU: Parts List. C1—0.033 mF, approx., to resonate with L1 to 2975 cycles. C2—0.066 mF, approx., to resonate with L2 to 2125 cycles. C3, C4—500 V, disc ceramic. C5, C6, C7, C10—400 V, paper. C8, C9—500 V, disc ceramic. C11, C12—electrolytic. C13—500 V, mica. CR1, CR2—400 piv silicon diode. CR3, CR4, CR5, CR6—1N64 or 1N69 diode. F1—1 Ampere, 250 V fuse. J1, J2—Auto radio antenna jacks, Motorola type. J3—Phone jack, closed circuit, with insulating washers. K1—255 A polar relay. L1, L2—88 mH toroid telephone loading coil. R1—½ Watt. R2, R5, R9, R10—½ Watt. R3—½ Watt. R4—½ Watt. R6—½ Watt. R7—½ Watt. R8—potentiometer, linear taper. R14—wire-wound. S1—SPST toggle switch. S2—SPDT toggle switch. T1—150/600 to 19,000 Ohm, surplus; #GH-1202-2. T2—150 V @ 50 mA, 6.3 V @ 2 A, Stancor PA-8421. V1—6SL7 tube. V2—6C5 tube. V3—6SN7 tube.

DX

James D. Cain K1TN
306 Vernon Avenue
Vernon CT 06066

DXING IN THE EIGHTIES

Unlike other phases of amateur radio, DXing depends on the world political situation and on each country's relationship with other countries. A world war is the extreme example when amateur radio simply ceases to exist. Luckily, this has not happened for nearly forty years. Otherwise, during times of political normalcy, when only three or four world crises are in progress at a time, DXing is affected but not completely precluded. In 1980, there's the Russian "woodpecker," that dratted over-the-horizon radar which trashes various HF bands. The woodpecker has engendered worldwide anger among hams since it is the greatest obstacle to DXing in memory. The frustration is compounded by the fact that the woodpecker comes from a country which has, and encourages, a dynamic amateur radio program. In addition, that same country was "on our side" at the World Administrative Radio Conference.

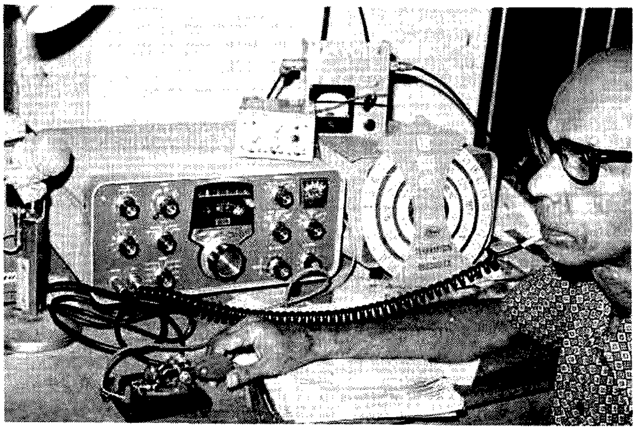
Another example of what we are going to face in the coming decade is that amateur radio may no longer be the international diplomat it has been in recent years, at least not from America's point of view. Already this year, several expeditions have been mounted to rare DXCC countries by non-US amateurs after attempts to operate from the same spots by Americans have been flatly turned down. Take Europeans in Africa, for example, or Canadians in Asia. Where one sells arms of war to another country, amateur radio operators are inevitably present and likely to obtain permission to operate if anyone can. The US has traded businessmen/hams in Iran for Naval personnel/hams on Diego Garcia. Now Iran is rare and VQ9s are everywhere.

QST published its May issue with a full-color cover photo of radio operations for the Winter Olympics at Lake Placid, New York, in February, 1980. That is wonderful publicity for amateurs, but, since mostly amateurs read *QST*, we wonder why that cover was chosen. Hams worldwide will get that issue of *QST* just as the last hopes for the Summer Games in Moscow are dying. A few copies of *QST* make their way to the USSR, too. We are sure the May issue will be allowed in, as the propaganda value will be great. If some sort of "alternate games" are held this summer, will amateur radio be there? Would amateur radio have played a part in the Moscow Games? As a matter of fact, it already does, in the form of special amateur radio callsigns being used by amateurs in the USSR. And wait until their QSL cards come through the various QSL bureaus: You can bet the Olympics will be portrayed on those cards in the "People's Glory of Sport" motif.

Which brings us to the next step in this somewhat circuitous route to an important point. Why do you think we called the new IARU (International Amateur Radio Union) contest which began in 1977 the "Radiosport Championship"? I say "we" because this author wrote the rules for the activity, and the name was chosen because "radiosport" is a term used in the Communist-bloc countries as well as much of the rest of the world. It seemed like a nice change from the wrung-out term "contest." It was an attempt to show support for the concept of "radiosports," which in many countries means strapping a radio on one's back, running miles and miles, stopping at certain checkpoints to make contacts, and hoping to finish the course or find the hidden transmitter first, before one's heart bursts. Try to forget that in North America a transmitter hunt means climbing into a gas-guzzling automobile with a case of beer and a couple thousand dollars worth of commercial radio equipment.

Listen to the talk on 20 meters among hams ostensibly furthering international goodwill—amateurs in the "have" countries talking to amateurs in other "have" countries about their next six-month tour of still another "have" country. When was the last time one of these self-appointed diplomats asked a radio contact in a Third-World country what he did for a living (or, even more remotely, got an answer)? Telling a friend in Japan how much you like your new Kenwood or Yaesu radio, or discussing the fine points of fuel injection on your Porsche with a German is great fun, but hardly encouraging to the African with his "WARC Special" single conversion radio who is listening in. We might put a better foot forward by discussing how, for example, that half of the world's population which goes to bed hungry might be fed. Or don't hams care?

In 1970, author Alvin Toffler stunned the world with his book *Future Shock*; he followed it this spring with *The Third Wave*, which reminds us that his predictions ten years ago are coming true and that those who roll with the punches of a changing society and a changing world will make it; those who don't, won't. If a DXer burns wood for heat, cuts his driving, grows a garden, starts a business because the industrial state no longer seems relevant (much less efficient), how can that DXer continue operating his radio station in the same manner as when times were simpler?



Kris VU2KMK is very active on 20-meter CW almost daily, looking for the North Americans. The SB-101 is hooked to a dipole and usually puts a good signal into the States and Canada. Thanks to Doug Hendricks N7UT, who is manager for VU2KMK QSLs, for sending the photo.

For years we have heard amateur radio's leaders tell us that our ability to communicate around the world is a unique privilege to be guarded and cherished. Indeed. But it is also a privilege to be utilized in the best possible manner for the good of mankind. Speaking to citizens of other countries remains a thrill to us, after twenty years of hamming, and will remain a thrill probably for the rest of our lives. But the topics of conversation will change, as will the entire concept of amateur radio. Why not? Everything else has changed in the ten years since we walked out of college, long-haired, bearded, drafted, and with lumps on the head from Mayor Daley's storm troopers. And those who yearn for ham radio to remain the one last stable part of their lives in a storm of change had best look elsewhere. Amateur radio is a personal, human reflection of the other parts of our psychological makeup. The old-timers on the bands who hoot at thoughts such as these will not be around ten years hence to witness the changes they oppose. Pity. The changes are inevitable.

Already, signs are on the horizon. There is an entirely new breed of DXers on the bands, a crop of neophytes spawned by the League's training program of a few years ago. They don't think like we "old-timers" do. They didn't come up through the ranks of DX-20 transmitters and "All American Five" blooper shortwave radios, those stations where finally working a G3 on 20 CW was worthy of a three-day celebration and a news item in the local paper ("13-Year-Old Boy Earns FCC Radio License"). Nowadays, get a ticket, hook your FT-101 to a trap vertical, and make DXCC in a month. And that's great! But such a growing up in radio results in an attitude which removes much of the mystique of wireless communications and, ultimately, an atti-

tude toward DXing which took some of us decades to cultivate. Oh, the newcomers still listen to their elders on the bands; witness the KA1 "calling CQ ten and carefully tuning for any possible call." No matter he has a locked-in transceiver and his "any possible callers" are fully aware that he is on 10 meters without being told! He/she is sure to wish us best of best regardses (best 73s) and he/she will learn. If we do the teaching.

So the bands are sounding different: newcomers, hippies, lists, hams who don't know the code, operators tied into computers or playing chess, outcasts from the amateur radio establishment. Not everyone on the bands voted for Nixon, has short hair, holds a job, is male, has freedom of choice, and is married with 2.3 children, a dog, and a station wagon. Talk to a ham in San Francisco and odds are one in three he/she isn't even heterosexual. But who cares? Let's talk!

An important person in amateur radio passed away in April and we should record his passing. Jim Fisk W1HR, Editor-in-Chief of *Ham Radio* and *Ham Radio Horizons* magazines, succumbed to a heart attack on April 18, 1980, at age 45. Jim was a true ham: technically knowledgeable, devoted to amateur radio, and active on more frequency bands than most of us know exist. Jim was a founding father of *Ham Radio* magazine twelve years ago, and he was known for his ability to convince reluctant basement experimenters to publish their findings in the amateur press. Jim's last goal was DXCC Honor Roll, and he had worked four new countries in the last week of his life. People like this are hard to find, and W1HR's void will be difficult to fill.

We ran a photo last month of Nao Akiyama JH1VRQ, one of Japan's most active and avid hams. Nao's home was destroyed by fire early in April, and he lost most of his valued radio records. Nao was overseas liaison officer for the Japan DX Radio Club, and he corresponded with most of us who are into DXing. Please. You may remember working JH1VRQ in the past few years, in contests especially. Look him up in your log and get some QSLs off to him c/o the JARL bureau in Tokyo. Think where you would be if your collection of DX cards was wiped out by a personal disaster. Thanks.

There was plenty of good news on the DX front in April, 1980. Herewith a rundown.

You read our report on the Heard Island VK0RM operation last month. The good news is that Jim Smith P29JS and Dave Gardner K6LPL are both interested in planning a full-blown operation from this remote island late this year or early next. The accompanying box has the letter from P29JS regarding this. P29JS has thus far expended considerable effort on behalf of DXers and he seems likely to be in a position where he could pull off a full-bore expedition. How badly you want to work Heard depends on how close you are to the Honor Roll and how much you might want to be on the Honor Roll a couple of years from now.

Speaking of K6LPL, Dave operated from Johnston Island /KH3 in April and did an exemplary job. We listened to Dave for a long period of time, and no matter who he worked, chit-chat was at an absolute minimum. It was always rush, rush, rush. Dave started his expedition by firing up 26 hours after he departed the infamous Fresno DX Convention and operated SSB despite a cold of what sounded to be monumental proportions. Dave was all business, which is what counts in an operation of this kind. It is great to know that Dave's injuries while on Palmyra as K6LPL/KH5 last January have apparently healed enough to enable his Johnston operation. QSLs for this one to Joe Merdler N6AHU, who is, by the way, associated with the Personal Communications Foundation. Those of you not familiar with the PCF

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Heard Island DX Association
c/o PO Box 2053
Konedobu
Papua, New Guinea

73 DX Column

Dear OM,

Anybody who has followed the recent activation of Heard Island will be disappointed in the misfortune suffered by the people involved. Even if all had gone well, the size and duration of the operation (interspersed as it was with the requirements of a scientific expedition) meant that the total of anticipated contacts would not exceed around 1000 QSOs.

Prior to VK0RM, Heard Island had not been activated for 8-10 years and has never been the subject of a full-blown DXpedition. It is intended to try to change this situation within the next 10 months.

The Heard Island DX Association has been formed for the purpose of activating Heard Island.

A considerable amount of research has already been done in conjunction with the scientific expedition which took place in March this year. During the coming months, further work involving the necessary logistics to support a serious amateur DXpedition to Heard Island will continue.

The Australian authorities concerned have indicated that there would be no serious objection to a well-planned, well-founded, and good-intentioned amateur DXpedition. It is intended that the association will offer a place in the team to a professional scientist to carry out research on Heard Island over the duration of the DXpedition.

It is anticipated that the team will consist of a number of experienced "contest-type" operators who, while capable of dealing with the tremendous demand that exists for Heard Island, will have the capability of offering other skills which will contribute to a successful operation.

The financing of any major operation invariably creates problems; the costs of mounting this DXpedition will be considerable. Many people and DX groups have indicated a tremendous interest in the activation of Heard Island and offers of assistance have been numerous.

Funding of the 1980-81 DXpedition will be based on the following criteria:

(a) Each member of the amateur team will be required to contribute to the expedition fund.

(b) Individual donations will be accepted.

(c) Offers of financial assistance from the various amateur radio societies, radio clubs, and DX groups will be accepted.

(d) Residue of funds accrued after completion of QSL commitments.

A trust account has been established by the founder members of the Heard Island DX Association to account for the funds received, and receipts will be issued for all contributions.

In the unlikely event of the DXpedition not taking place as scheduled, all donations will be either refunded or allocated to another DXpedition or worthy charity. In either event, all donors will be notified personally.

Firm offers of radio equipment have already been received, but no offers of ancillary equipment, antennas or power supplies, etc., have as yet been solicited.

Owing to weather conditions, the time slot available is mid-December to mid-February. As you can see, the time factor to allow an operation to take place in 1980 is very limited.

We thank you for your cooperation and assistance in helping us to activate one of the most difficult and rare DX countries in the world today.

73,
Jim Smith P29JS
President
Heard Island DX Association

Leaky Lines

Dave Mann K2AGZ
3 Daniel Lane
Kinnelon NJ 07405

RTTY, to me an arcane, mysterious mode that I deliberately avoided for years, has finally gotten to me. I had sidestepped it on the theory that since inanimate objects are unpredictably perverse, I would rather not have any truck with it. People are bad enough, but at least they can be dealt with to some extent, however slight. But when you're dealing with machines and gadgets, the only way to overcome their occasional idiosyncrasies is to take a sledge to them.

How does one capture the attention of a dumb machine? You can slug a recalcitrant jackass over the head with a two by four. But you cannot do anything with a malfunctioning machine. You might just as well bay at the moon!

As I say, I avoided teletype™ like the plague. But in recent months, several of my buddies, the more affluent ones, had bought themselves Pets, Apples, TRS-80s, and the like, and a few even went for those dandy little DS3100 ASR jobs. All at once, I found that I was left with two or three guys to talk with; the rest were all pounding on the "green keys." It frustrated me no end. When I did run into them once in a while, they were patronizing, uppity, and positively revolting!

So, notwithstanding my natural aversion to the mode, I was forced to get in on the action. It was strictly a case of peer pressure and keeping up with the Joneses.

I latched onto an old clunker . . . a Model 15. It had its problems. As I've already implied, what I know about teletype you could put into an eyedropper, with room to spare. So every bug that gave me trouble became a major crisis. I had to seek help on practically every one of them, and I suppose I exposed myself for what I really am: a rather nontechnical person. One of my friends, while on the phone with me, said that he had monitored one of my QSOs in which I was attempting to make head or tail out of someone's explanation about loop circuits and scathingly asked me, "Hey, Dave, where did you get your license . . . at Sears & Roebuck?" I know that he was just trying to be funny, but it cut me to the quick. I mean, I can look at a diagram of a Hartley or Colpitts oscillator and identify it . . . I can recite Ohm's Law and the Square of Turns Ratio . . . I know the formulae for inductive and capacitive reactance and know the difference between a Lissajous figure and a lecher line. But RTTY is something else again.

It's the frightening intricacy of the thing. It has more wheels, cogs, cams, ratchets, levers, escapements, springs, sprockets, pawls, pivots, bearings, shafts, bushings, idlers, and other gadgets and widgets than anything I've ever tackled since I surreptitiously dismantled our old Seth Thomas when I was about eleven (and got the worst trouncing of my life from my righteously indignant father). RTTY is a formidable and diabolical challenge indeed, especially to one who, like me, is all thumbs.

Then, too, this machine had not been in service for quite a spell, and a great deal of the old grease had dried out pretty badly and was of the hardness and consistency of well-aged Portland cement. Have you ever tried to remove a blob of old dried-up bubble gum from the seat of your blue serge pants? Well, that's what it's like to clean up that ancient, dessicated grease in a Model 15.

Moreover, at least ten families of spiders, moths, and other wildlife had made their domiciles in that machine, and I found some artifacts within that indicated that at least one small boy must have used it as a repository for some of his prized possessions. A few marbles, a small pocketknife with a broken blade, a size 8 snelled Eagle Claw fishhook, two baseball cards (Johnny Mize and "Lucky" Jack Lohrke, which suggest that this particular kid must have been a Giants fan fast approaching middle age by this time), and a red cardboard cylindrical Daisy BB container holding a few old-fashioned kitchen matches. I believe that I've gotten all of his stuff out of the machine, but you never can tell. It's possible that I've missed some items which will turn up later.

I needed a terminal unit, of course. I hung around the house for days on end, hoping to intercept the UPS man so that the XYL wouldn't find out that I'd ordered one COD. I figured that I could tell her I'd traded some old stuff in the basement for it, just as I'd done when I got my linear amplifier and the 2-meter FM rig. But, of course, the damned thing had to arrive during a brief ten-minute hiatus when I was out of the house. She made out the check for $238.95, and on the stub, in very neat handwriting, she wrote, "What nerve!!!"

As close as I can figure it, that TU has cost me about 400 bucks to date, counting the new handbag, the gloves, the two tickets to "Evita," and the restaurant after the show. I'll never order a piece of gear COD again . . . that I promise you.

RTTY operators generally prepare what is known as a "brag tape." It is simply a rundown of the station equipment and is pretty much standardized; most of them are fairly similar. I was delighted to learn, however, that there are a couple of guys who rebel at the conventional and show their disdain by running tapes which are much different. This represents the sort of iconoclasm dear to my heart . . . to me, there's nothing worse than a stuffed shirt who never whistled in a library. Sacred cows often get booted in the tail, and this brightens my day. After hearing many squares denouncing these non-conformists in rather harsh terms, I couldn't possibly avoid making up an unconventional brag tape. This is the way mine will go.

The transmitter here is a Multi-Elmac 67, driving 6 UV201's. The tubes are installed in small tomato paste cans which are placed in large tomato cans, and the outer jacket holds sufficient water to act as a cooling chamber. (If desired, Chianti may be substituted.)

The receiver is a Sky Buddy, and the antenna (Beverage type) is composed of 144 beer cans (Coors), soldered end to end, mounted on the outhouse roof. The metallic slats from a venetian blind, grounded to the radiator grille of a 1926 Essex Super-Six, act as a counterpoise.

The terminal unit consists of a pair of close-mounted salad forks activated by a series-tuned Mixmaster paddle which can be simultaneously utilized to whip up custards or cake batter, thus saving electrical energy.

The reperf utilizes the services of a Mexican alien fruit picker. He punches the tape by doing the Mexican hat dance on it while wearing a pair of Lee Trevino's old golf shoes.

We have no pix to transmit at the moment, but the puncher has volunteered to talk to his brother, a distributor who exports Tijuana bibles into the US, among other Mexican products, mainly agricultural in nature. Before long, we hope to have on hand a good selection of RTTY pix such as Tillie and Mac, Maggie and Jiggs, Ella Cinders, Popeye, Lil Abner and Daisy Mae, etc.

I'd like to see anybody top that. That's the sort of brag tape that'll make people sit up and take notice. But as far as those pix are concerned . . . forget it; it's just a gag. But, incidentally, if you know anyone who owns any of those old 8-pagers, see if you can get him to Xerox a few and send them to this QTH. I haven't seen any of those since way back in high school . . . har, har!

Ham Help

I am interested in—in fact, "desperate" for—information from anyone who has solved TVI in conjunction with cable HBO units. QSOing with other hams, I find this seems to be a nationwide problem for amateurs.

The unit used locally is made by Magnavox and tuned to channel 4.

I have tried all the usual methods, such as shielding, grounding, and filtering, with little success. All and any solutions will be greatly appreciated.

Harry Umphenour WD9IVY
1127 W. Nebraska Ave.
Peoria IL 61604

LETTERS

PRC

The accompanying article may give *73* readers an idea of where ham radio stands, or stood, in China when I was there. There are so many background cultural and political problems to be overcome. Decision-making is always done as a committee. I think the quickest way to a license would be a quid pro quo. If an American businessman who was a ham had something they really wanted, the subject could be broached.

While I was there, they asked me to extend my stay and go to some other plants to work on the instrumentation. I told them I would *if* they would give me the temporary license. They didn't and I didn't . . . sort of! They would not give me my travel papers, visa, or passport when it was time for me to go. I ended up putting in an extra two months I had not counted on! I probably could have refused to go to work and they would have either locked me up or expelled me from the country. My company finally sent another guy, so they let me go. Needless to say, I'm not with that company any more! We had a few loud discussions over that deal when I finally got back! The Chinese are difficult, frustrating people to deal with. They are very clever and it is foolish to underestimate them. They respect strength, ability, cleverness, and patience. I don't think there is any one man or woman, outside of the Chairman himself, who can give permission to operate.

You may not hear me on with a JY8 call . . . I'm in Arabia! There is a MARS station in Dhahran, but I'm about 130 miles from it out in the desert. I'm trying to arrange a time to find it and the guy in charge of it, and a time I can get in there. We work a minimum of 60 hours a week. Our only day off is Friday, the Moslem holy day. We work a lot of the Fridays anyway. I never did get it arranged last year, but perhaps this year I'll get lucky. I did read the article about Jordan in the January, '80, issue of *73*. Perhaps I can route myself through there on one of my turnaround leaves.

I have read *73* over the past 15 years and have always enjoyed it. I wrote an article, "The Protector," that was published in *73* some 10 or 12 years ago.

Don McCoy WA0HKC
Dhahran, Saudi Arabia

Don McCoy WA0HKC at the Great Wall of China near Peking.

BY1HKC! . . . ALMOST

Assignment to China! The call from the home office reached me while I was on a job in Fresno. This was early fall in 1976. At that time, few Americans had penetrated the Bamboo Curtain. I was in field service for an instrumentation company and had already been a portable 7, 6, 5, 3, and 2 that year. Perhaps a little smooth talking and there I would be, BY1HKC. I sent off a quick note to Wayne Green; he answered and said my chances were a million to one, but if I succeeded, he would lend me a portable station. First step completed!

Three days after leaving Denver, I got off a train in the city of Tsang Chou, in Hopei Province. Tsang Chou is southeast of Peking and north of Tsingtao, where they make the beer! My destination was an anhydrous ammonia plant where I would start up and take care of the plant instrumentation until the Chinese took over. They billeted me in a "guest house" with nine other Americans and ten Europeans. These men had various other start-up duties.

An interpreter was assigned to me and I went to work. The job kept me very busy out in the field. I'm interested in languages, so I learned some Mandarin Chinese from my interpreter and the people I worked with. Before I left, they gave me a small "Chairman Mao" medal for taking the time to learn.

After a month or so, when I was pretty well known, I started making inquiries about amateur radio. I asked middle-aged people and especially the technical men I dealt with on a daily basis. I had some QSL cards with me and showed them also. No one professed to knowing what I was talking about. After a week or two of casual questions, the guest-house manager sent for my interpreter and me. He said he had heard of my questions and interest in amateur radio. What specifically did I want to know? I told him I would like to be issued a temporary license to operate a station from the guest house. I went on to explain that it was not political in nature, only a hobby. I told him I could arrange to have equipment flown in, and also that I would like to be issued the call BY1HKC to coincide with my own call, WA0HKC. I mentioned the calls so there would be no mistake in my request.

Mr. Yang, the manager, said perhaps he could arrange a meeting with the man in charge of radio for the Tsang Chou district. My hopes soared!! Mr. Yang and I had spent Christmas Day on a six-hour trip in a freezing mini-bus. We exchanged many ideas and thoughts. By the end of the trip, we had a mutual respect for each other. I had found a man's job did not indicate his position in party hierarchy, so perhaps Mr. Yang was in a position to help my cause.

About a week later, we were again summoned to a guest-house meeting room. Mr. Yang introduced us to a Mr. Wo, a man about 65 or so. After the ceremonial tea and small talk, we got down to business. Mr. Wo was the man in charge of the radio district. I gave him one of my QSL cards. Yes, he did know about amateur radio, but it had been many years since he had thought of it. Mr. Wo said he had received my request through Mr. Yang. He had contacted his superiors in Peking and "due to the differences in our social systems," Peking had refused my request. Mr. Wo seemed genuinely sorry he couldn't help me. Naturally, I asked Mr. Wo if he had ever been a ham himself, and he said something like "working for the social system has taken most of his time." I did not want to make an issue of the question in front of Mr. Yang, so we both smiled, like two conspirators. Perhaps Mr. Wo was making the answer fit the circumstance. Mr. Wo mentioned they had a radio training system for school children to communicate between schools. He said that may lead to amateur radio again. I never saw any evidence of that in Tsang Chou, but perhaps in the larger cities it was true, or maybe something got twisted in the translation.

The China National Technical Import Co. (CNTIC) was the sponsoring agency for us. All non-Chinese foreigners (they consider Chinese-Americans, Chinese-South Americans, etc.,

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OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR JULY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
25737	1	0150:28	99.0
25749	2	0049:47	83.8
25762	3	0144:02	97.4
25774	4	0043:21	82.3
25787	5	0137:36	95.9
25799	6	0036:55	80.7
25812	7	0131:10	94.3
25824	8	0030:29	79.1
25837	9	0124:44	92.7
25849	10	0024:03	77.6
25862	11	0118:18	91.2
25874	12	0017:37	76.0
25887	13	0111:52	89.6
25899	14	0011:11	74.5
25912	15	0105:27	88.0
25924	16	0004:45	72.9
25937	17	0059:01	86.5
25950	18	0153:16	100.1
25962	19	0052:35	84.9
25975	20	0146:50	98.5
25987	21	0046:09	83.4
26000	22	0140:24	96.9
26012	23	0039:43	81.8
26025	24	0133:58	95.4
26037	25	0033:17	80.2
26050	26	0127:32	93.8
26062	27	0026:51	78.7
26075	28	0121:06	92.2
26087	29	0020:25	77.1
26100	30	0114:40	90.7
26112	31	0013:59	75.5

OSCAR 8 ORBITAL INFORMATION FOR JULY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
11835	1	0139:56	77.4
11848	2	0001:33	52.9
11862	3	0006:22	54.1
11876	4	0011:11	55.3
11890	5	0016:00	56.5
11904	6	0020:48	57.8
11918	7	0025:37	59.0
11932	8	0030:26	60.2
11946	9	0035:15	61.4
11960	10	0040:03	62.7
11974	11	0044:52	63.9
11988	12	0049:41	65.1
12002	13	0054:29	66.3
12016	14	0059:18	67.6
12030	15	0104:06	68.8
12044	16	0108:54	70.0
12058	17	0113:43	71.2
12072	18	0118:31	72.5
12086	19	0123:19	73.7
12100	20	0128:07	74.9
12114	21	0132:55	76.1
12128	22	0137:43	77.4
12142	23	0142:31	78.6
12155	24	0004:07	54.0
12169	25	0008:55	55.2
12183	26	0013:43	56.5
12197	27	0018:31	57.7
12211	28	0023:19	58.9
12225	29	0028:06	60.1
12239	30	0032:54	61.3
12253	31	0037:42	62.6

OSCAR 7 ORBITAL INFORMATION FOR AUGUST

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
26125	1	0108:14	89.1
26137	2	0007:33	74.0
26150	3	0101:48	87.6
26162	4	0001:07	72.4
26175	5	0055:22	86.0
26188	6	0149:37	99.6
26200	7	0048:56	84.4
26213	8	0143:11	98.0
26225	9	0042:30	82.9
26238	10	0136:45	96.5
26250	11	0036:04	81.3
26263	12	0130:19	94.9
26275	13	0029:37	79.7
26288	14	0123:53	93.3
26300	15	0023:11	78.2
26313	16	0117:27	91.8
26325	17	0016:45	76.6
26338	18	0111:01	90.2
26350	19	0010:19	75.0
26363	20	0104:34	88.6
26375	21	0003:53	73.5
26388	22	0058:08	87.1
26401	23	0152:24	100.7
26413	24	0051:42	85.5
26426	25	0145:57	99.1
26438	26	0045:16	83.9
26451	27	0139:31	97.5
26463	28	0038:50	82.4
26476	29	0133:05	96.0
26488	30	0032:24	80.8
26501	31	0126:39	94.4

OSCAR 8 ORBITAL INFORMATION FOR AUGUST

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
12267	1	0042:29	63.8
12281	2	0047:17	65.0
12295	3	0052:04	66.2
12309	4	0056:52	67.5
12323	5	0101:39	68.7
12337	6	0106:26	69.9
12351	7	0111:13	71.1
12365	8	0116:01	72.3
12379	9	0120:48	73.6
12393	10	0125:35	74.8
12407	11	0130:22	76.0
12421	12	0135:09	77.2
12435	13	0139:56	78.4
12448	14	0001:31	53.9
12462	15	0006:18	55.1
12476	16	0011:04	56.3
12490	17	0015:51	57.5
12504	18	0020:38	58.7
12518	19	0025:24	59.9
12532	20	0030:11	61.2
12546	21	0034:58	62.4
12560	22	0039:44	63.6
12574	23	0044:30	64.8
12588	24	0049:17	66.0
12602	25	0054:03	67.2
12616	26	0058:49	68.5
12630	27	0103:36	69.7
12644	28	0108:22	70.9
12658	29	0113:08	72.1
12672	30	0117:54	73.3
12686	31	0122:40	74.5

Contests

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

GHOST TOWN DXPEDITION

A group of amateurs from the Gallatin Ham Radio Club will be on the air from 1800 GMT Saturday, July 5th, until 1800 GMT Sunday, July 6th, from Bannack, Montana. Presently a ghost town, Bannack was the first capital of the territory of Montana. The DXpedition will use the callsign W7ED and operate on 7235 kHz SSB, 14060 kHz CW, 14285 kHz SSB, and 21360 kHz SSB (plus or minus 5 kHz). Specially printed certificates loaded with historical information will be sent to those sending QSL cards, an SASE, and $1 to help defray printing costs. Requests should be sent to: Bannack DXpedition, 417 Staudaher Street, Bozeman MT 59715.

IARU RADIOSPORT CHAMPIONSHIP

Starts: 0000 GMT July 12
Ends: 2400 GMT July 13

All amateurs worldwide, in single-operator and multi-operator/single-transmitter categories, are eligible. No multi-transmitters are allowed. Separate categories of competition for single-operator stations will include the following: CW only, phone only, and mixed phone/CW. In the single-operator category, one person performs all operating and logging functions. Use of spotting nets is not permitted. Multi-operator single-transmitter stations must observe a 10-minute-per-band rule: If a contact is made on a band, the transmitter must remain on that band for at least the next 10 minutes.

A maximum of 36 hours may be used for single-operator entries. Off times must be at least 30 minutes in length. There is no time limit for multi/single stations. Use all amateur bands, 160 through 2 meters. Each station may be worked once per frequency band, regardless of mode. Crossband contacts are not allowed. Contacts made by retransmitting either or both stations do not count for contest purposes.

EXCHANGE:

Signal report (RST) and ITU zone. Please note that ITU zones are not the same as the ARRL zones. See page 74 of the May issue of *QST* for a list of ITU zones by callsign prefixes.

SCORING:

Contacts within one's own ITU zone count 1 point, outside one's own ITU zone but within one's own continent count 3 points, and outside of one's own continent count 5 points. The multiplier is the sum of the number of different ITU zones worked on each band. Final score equals the number of QSO points times the zone multiplier.

AWARDS:

A certificate will be awarded to the highest-scoring CW-only, phone-only, and mixed-mode entrant in each ARRL section, each ITU zone, and each DXCC country. In addition, achievement-level awards are available for making 250 QSOs, 1000 QSOs, and/or making a total of 50 or more multipliers. In the case of multiple award levels achieved, only the highest award will be issued. Additional awards may be made at the discretion of each country's IARU member society.

ENTRIES:

All entries worldwide are to be sent to IARU Headquarters, Box AAA, Newington CT 06111, USA. All US and Canadian entrants must use official log sheets and summary sheets or a reasonable facsimile. Entries must be accompanied by dupe sheets if 200 or more QSOs were made. Entries must be postmarked no later than August 25th. An entry received after mid-October may not be in time to be included in the printed results. All entries become the property of the IARU and none can be returned. In cases of dispute, the decisions of the IARU/ARRL Awards Committee are final. Each entrant agrees to be bound by the provisions as well as the intent of the contest announcement, the regulations of his licensing authority, and the decisions of the IARU/ARRL Awards Committee. Incomplete or illegible entries will be classified as check logs. Usual disqualification rules apply!

MAINE QSO PARTY

Starts: 1600 GMT July 19
Ends: 2000 GMT July 20

Sponsored by the Portland Amateur Wireless Association, the contest is open to all. Stations may be worked once on each band and mode. CW and phone count as the same contest and Maine stations may work other Maine stations.

EXCHANGE:

QSO number, RS(T), and QTH. Maine stations send county; others send state, province, or country.

FREQUENCIES:

SSB—1815, 3930, 7280, 14280, 21380, 28580.

CW—1805, 3560, 7060, 14060, 21060, 28060.

Novice—3725, 7125, 21125, 28125.

SCORING:

Complete QSOs count 3 points. Out-of-state stations multiply the total number of QSO points by the number of Maine counties contacted (maximum of 16). Maine stations multiply the total number of QSO points by the sum of Maine counties, states, provinces, and countries.

ENTRIES & AWARDS:

Certificates will be awarded to the top scorer in each area. A Worked All Maine Award is available to any station that contacts all 16 Maine counties.

Logs should show date and time in GMT, band, and emission. Logs, summary sheet, and requests for info on the WAM award should be sent by September 1st to: Joe Blinick K1JB, Portland Amateur Wireless Assoc., PO Box 1605, Portland ME 04104.

WORKED ALL BRITAIN CONTEST—LF CW

Starts: 0900 GMT July 20
Ends: 2200 GMT July 20

This is the 4th of the five Worked All Britain contests for this year. The remaining contest is shown in the calendar.

All contacts must be made on CW using the 160- through 40-meter amateur bands. There must be a one-hour break shown in the logs. The maximum op-

Continued on page 170

Calendar

Jul 1	Canada Day Contest
Jul 5-6	Ghost Town DXpedition
Jul 12-13	IARU Radiosport Championship
Jul 19-20	Maine QSO Party
Jul 19-20	SEANET DX Contest—CW
Jul 19-20	QRP Summer Contest
Jul 20	Worked All Britain Contest—LF CW
Jul 26-28	County Hunters Contest—CW
Aug 1-7	SWOT QSO Party
Aug 2-3	ARRL UHF Contest
Aug 2-3	Illinois QSO Party
Aug 9-10	European DX Contest—CW
Aug 16-18	New Jersey QSO Party
Aug 16-18	Rhode Island QSO Party
Aug 23-24	All Asian DX Contest—CW
Aug 31	Worked All Britain Contest—VHF
Sep 13-14	European DX Contest—Phone
Sep 13-14	ARRL VHF Contest
Sep 13-14	Pennsylvania QSO Party
Sep 13-15	Washington State QSO Party
Sep 14	North American Sprint
Sep 27	DARC Corona 10-Meter RTTY Contest
Sep 27-28	Delta QSO Party
Oct 4-5	California QSO Party
Oct 4-5	ARRL Simulated Emergency Test
Oct 11-12	ARRL CD Party
Nov 1-2	ARRL Sweepstakes—CW
Nov 8-9	European DX Contest—RTTY
Nov 8-9	IPA Contest
Nov 9	International OK DX Contest
Nov 15	DARC Corona 10-Meter RTTY Contest
Nov 15-16	ARRL Sweepstakes—Phone
Dec 6-7	ARRL 160-Meter Contest
Dec 13-14	ARRL 10-Meter Contest
Jan 18	FRACAP Worldwide Contest

Awards

Bill Gosney WB7BFK
2665 North 1250 East
Whidbey Island
Oak Harbor WA 98277

DX AWARDS FROM SWEDEN

A few months ago, we outlined some very popular awards made available to amateurs by the SSA, the national society of radio amateurs in Sweden. Since that time, I've become familiar with several other award sponsors in that country and wish to share them with you now.

The Bull Award

In order to make the province of Dalsland, Sweden, better known and to increase the activity of the amateurs in that region, the Melleruds Radio Club (SK6CM) decided to issue the "Bull Award."

To qualify for this diploma, stations in Norway, Sweden, Finland, and Denmark must achieve 10 points, other European stations must achieve 5 points, and stations outside Europe must obtain 2 points credit. Every QSO with a radio amateur residing in Dalsland will give the applicant 1 point toward his or her goal. Should you have a QSO with SK6CM, 2 points will be credited to your total. All bands and modes will be allowed, but only one QSO with each station will count. All QSOs must be on or after January 1, 1979. Contacts via a repeater or satellite will not count.

Applications must list each callsign worked, date, time GMT, band, mode, and the applicant's own name, call, and full mailing address. QSLs are not required. General certification rules apply. The award fee is 5 US dollars or 20 Sw. cr. Send your application and award fee to Melleruds Radio Club, 464-00 Mellerud, Sweden.

As of April 25, 1979, the following list of amateurs would qualify for contacts to obtain this award: SK6CM, SM6s: AGW, ALJ, AMU, ASJ, AWZ, BER, BGG, BLE, BOT, BPX, CGI, CJK, CLX, CMK, CNC, COY, COZ, CQK, CUA, CWK, CYU, DKU, DXY, EOi, EPA, ESW, EUC, EUT, FCM, FFK, FLR, FNE, GAS, GDP, GMR, GQJ, HQZ, HRL, IHF, JJZ, JKB, JMA, JOD, JOG, JOM, JOO, JQA, JRB, JRY, JUJ, KFA, KFB, KFF, ST.

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The SWL Activity Club of Sweden and their award manager were very kind to send me complete award program information about the two major DX awards being offered by their organization.

Worked All Zone 14 Countries Award

This award is available to amateurs in three levels of achievement:

Class A—work 27 countries in *CQ* Zone 14.

Class B—work 22 countries in *CQ* Zone 14.

Class C—work 15 countries in *CQ* Zone 14.

There are no band or mode limitations, nor are there any date restrictions known at this time. Applications for WAZ14CA are sent with US $2.00 or 10 IRCs to SWL Club Activity, Fack 55, S-780, 40 Mockfjard, Sweden. GCR apply.

Countries in *CQ* Zone 14 are: CT1, CT2, C31, DA/DF/DJ/DK/DL, DM, EA, EA6, EI, F, G, GD, GI, GJ, GM, GU, GW, HB9, HB0, LA, LX, ON, OY, OZ, PA/PI, SL/SK/SM, ZB2, 3A, 4U (Geneva).

Worked ITU Zones 17/18 Award

As with the Zone 14 Award, the W-ITU-Z17/18 Award is available in three levels of operation:

Class A—work all countries in ITU Zone 17/18.

Class B—work 7 countries in ITU Zone 17/18 including TF (Iceland).

Class C—work 5 countries in ITU Zone 17/18.

Endorsement will be made available for single band or mode achievements. Applications must be sent to the SWL Club Activity with 10 IRCs or US $2.00. Mailing address is Fack 55, S-780, 40 Mockfjard, Sweden.

Countries located in ITU Zones 17/18 are: ITU Zone 17—TF; ITU Zone 18—JW, JX, LA, OH, OH0, OJ0/OH0M, OY, OZ, ZM.

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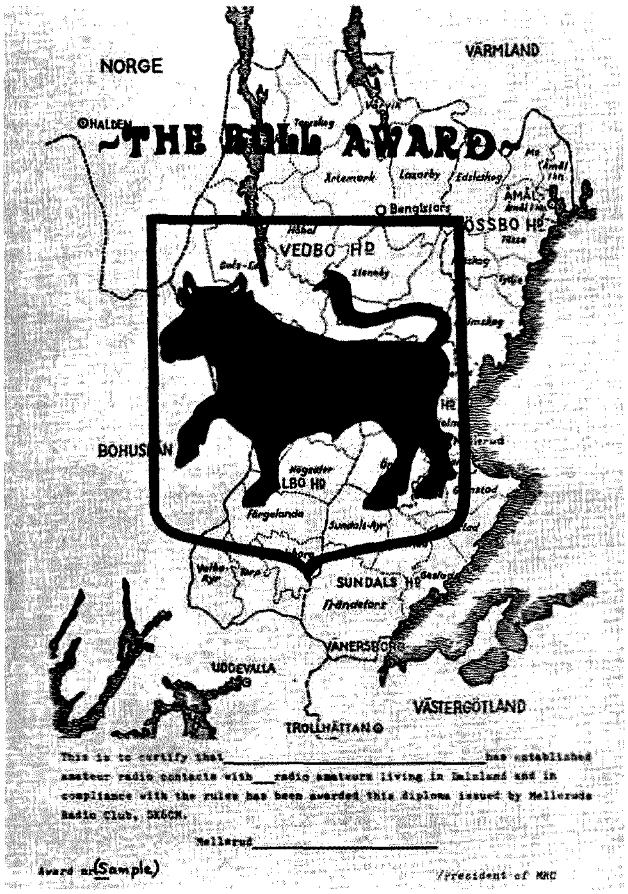
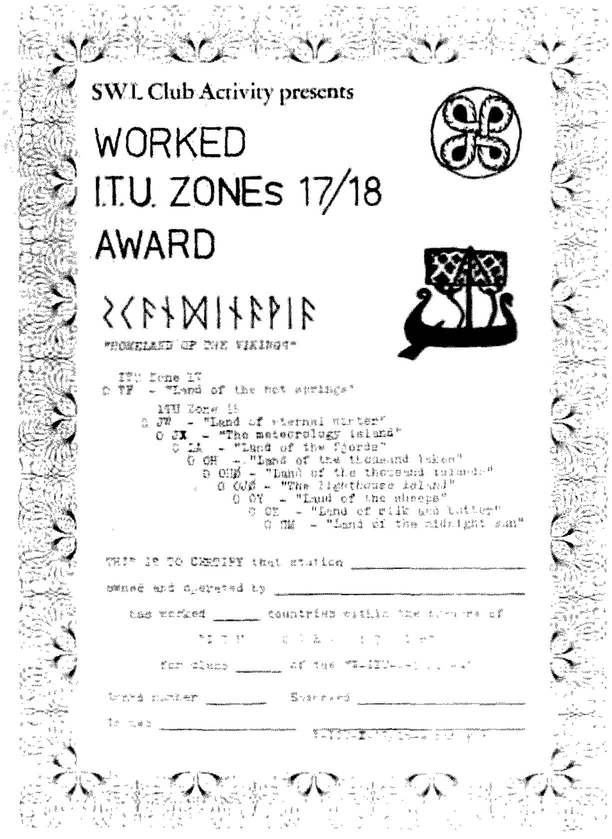
Our good DX friend, Erland Belrup SM7COS, enlightened us

Continued on page 162





New Products

ROBOT RESEARCH INTRODUCES LOW-COST IMAGE-PROCESSING SCAN CONVERTER

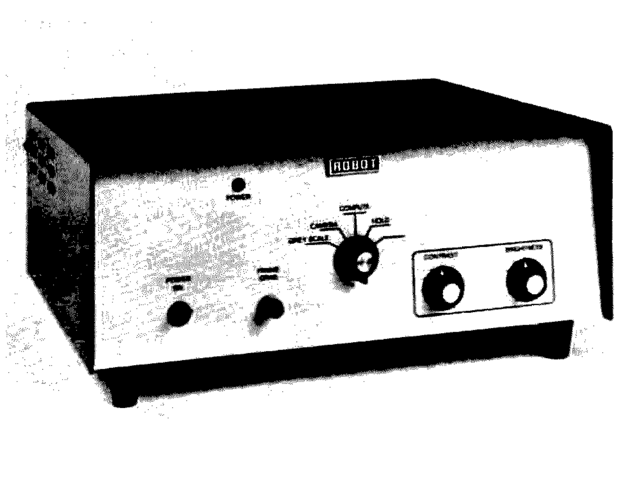
A new low-cost image-processing scan converter for iterfacing between computers or microcomputers and TV cameras and monitors has been introduced by Robot Research, Inc.

Designated the Robot Model 650, the unit has a 256 × 256 × 6 MOS frame-store memory which permits a picture to be frame-grabbed from a television camera and supplied to the computer on a random access basis. One picture element (pixel) can be moved every 63.5 microseconds. Frame-grab memory contents are viewed on a television monitor at all times. Frame-grab memory contents may be replaced from the computer on a random access basis.

Image data may be quantified or enhanced since the computer can also write new data into the frame-grab memory. This data may be derived from the data previously taken from the memory or may be entirely new data. As frame-grab memory data is altered by the computer, the displayed image on the monitor also changes.

The unit may be programmed with assembler or high-level languages, and by using multiple Model 650s may be daisy-chained to a single computer. Interface with either 16 bit minicomputers or microcomputers is available by means of different interface boards.

For further information, contact: *Robot Research, Inc., 7591 Convoy Court, San Diego CA 92111.* Reader Service number 479.


Robot Research's Model 650 scan converter.

MICROPROCESSOR-CONTROLLED REPEATER

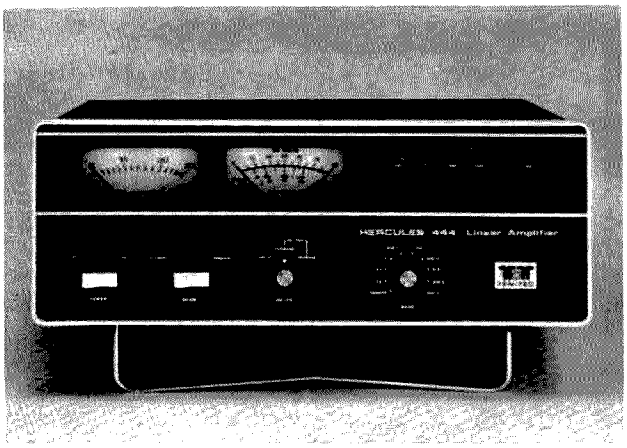
A line of repeaters covering the 144, 220, and 450 MHz bands has just been introduced by Micro Control Specialties. The new Mark 3CR repeaters combine all the features of the popular Mark 3C repeater controller plus transmitter, receiver, and power supply in a rack-mount cabinet ready for immediate service. The microprocessor-based repeater provides 39 tone-accessible functions including autopatch, autodial, redial, reverse patch, external outputs, and secure control operator commands. Crystal-controlled digital tone decoding ensures stable and reliable function access. To keep users informed of its status, the repeater generates 13 different Morse messages, several of which are custom programmed to user specifications. Basic repeater operations such as time-out, tail, and ID timing are also directed by the microprocessor so that the repeater can discriminate intelligently against noise and kerchunkers. Several of these operations can be modified remotely by command functions.

The repeater receiver uses dual-gate MOSFETs in both rf amplifier and mixer stages for high sensitivity (20-dB quieting with only 0.25 uV of input signal) and freedom from overload in the presence of ½-volt signals. Crystal filtering and double conversion are both used to obtain 65-dB rejection of off-frequency signals, so the repeater is well suited for use in hostile rf environments.

Transmitter output is 2 Watts, but optional amplifiers are available to increase the power output to any desired level. Transmitter and receiver oscillators are temperature-compensated to meet commercial frequency stability requirements. The audio circuits combine generous amounts of feedback with symmetrical clipping for virtually transparent audio quality.

For further information, write *Micro Control Specialties, 23 Elm Park, Groveland MA 08134.* Reader Service number 482.


Micro Control Specialties' Mark 3CR repeater.


TEN-TEC's Hercules 444 linear amplifier.

TEN-TEC INTRODUCES NEW LINEAR AMPLIFIER

TEN-TEC has offered the amateur radio world another "first" in its new Model 444 "Hercules" kW linear amplifier—it's the first solid-state unit with instant break-in.

Absolutely no tuning is required—in fact, there are no tuning knobs! The sleek front panel of the amplifier has just four switches (power, mode, meter, and band). Behind the 444 black-out upper panel are two large meters which light up when ac power is turned on. One meter measures collector current, while the other measures collector voltage or power (forward or reverse). Also on the black upper panel are six status indicators with LEDs that light up to show a condition (overdrive, improper control switch setting, heat sink temperature, swr, overvoltage/overcurrent, and rf output balance). Any condition will shut down the amplifier when set limits are exceeded.

The design of the Hercules 444 uses two 500-Watt push-pull transistor amplifier modules,

B & W's Model BC-1 balun.

operating at 45 V dc at 22.2 A, typically providing 600 Watts rf output from the hybrid output combiner. Driving power required is 50 Watts, typical. Frequency coverage is 1.8 MHz through 21.5 MHz, with provision for four auxiliary bands. Duty cycle is continuous for SSB voice modulation, 50% for CW or RTTY (keydown time is 5 minutes max.). Continuous carrier operation is possible at reduced output. ALC voltage is negative, starting at zero, and is adjustable. Both input and output impedances are 50 Ohms, unbalanced.

The separate power supply, housed in a utility-type enclosure, provides approximately 45 V dc at 24 Amperes. The supply uses a tape-wound transformer and choke to reduce size and weight (50 lbs.). A unique automatic line voltage correcting circuit (patent applied for) eliminates the possibility of applying too high a voltage to the final transistors. This new regulating innovation is highly efficient since it only becomes operative under low voltage conditions.

For further information, write or call *TEN-TEC, Inc., Highway 411 East, Sevierville TN 37862.*

B & W's BC-1 BALUN

Barker & Williamson, Inc., has announced a new product for the radio amateur, the Model BC-1 balun. Its features include impedance of 50 Ohms unbalanced to 50 Ohms balanced, frequency of 1.8-30 MHz, and 2.5 kW to 5 kW PEP. For further information, contact: *Barker & Williamson, Inc., 10 Canal Street, Bristol PA 19007; (215)-788-5581.* Reader Service number 478.

TRAC'S MODEL TE-292 MEMORY KEYER

Containing all CMOS ICs, including three CMOS RAM chips, this unit offers twenty-seven possible combinations of messages. The Master Memory switch selects a RAM. With that RAM, you can have two 50-character messages, four 25-character messages, or one 50- and two 25-character messages. A second and third position for the Master Memory switch allows the above choices twice more.

In all, there are six possible 50-character messages and twelve 25-character messages available, for a total of 27 choices. Blank spaces may be recorded while the message is playing. An LED tells when the message is operating. This keyer contains deluxe quarter-inch jacks for both keying and output, and operates on a single 9-volt battery.

For further information, contact *TRAC Electronics, Inc., 1106 Rand Bldg., Buffalo NY 14203.* Reader Service number 481.

TRAC's Model TE-292 memory keyer.

KANTRONICS' SIGNAL ENFORCER™ DUAL AUDIO FILTER FOR CW, SSB, RTTY, ASCII AND AM

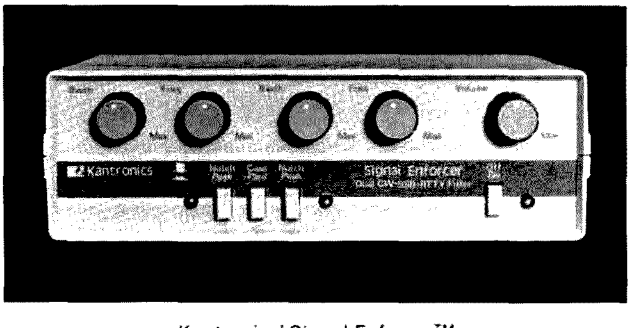
A frequency-agile, dual audio filter that will reduce or eliminate signal interference to any one of five common modes has just been introduced by Kantronics. To provide ultimate versatility in a single accessory, the Signal Enforcer™ uses two independently tunable filters to team up on signal interference to CW (continuous-wave), single-sideband, AM, radioteletype and ASCII computer transmissions.

The Signal Enforcer's two state-of-the-art filters have both notch and peak capabilities. That means they can be used either to reduce signals on all but a selected frequency (peaking) or to eliminate signals on a selected frequency where interference is present (notching). Because they are independently tunable, one filter can notch out an interfering signal or noise source while the other filter peaks up the signal being copied.

The filters can be operated in series on separate frequencies to notch and peak, or they can be teamed to make a super peak or super notch filter. In series, the filters can even be used to notch two frequencies at once. Series operation of the Signal Enforcer is called cascading. The filters can also be used in parallel to peak two frequencies at once.

In the cascade mode, for example, one filter can be used to peak a weak CW signal while the other is used to notch out a nearby foreign AM broadcast station. Also in the cascade mode, the Signal Enforcer can act as a doubly potent single filter to peak or notch individual frequencies. Operated in the

Continued on page 156

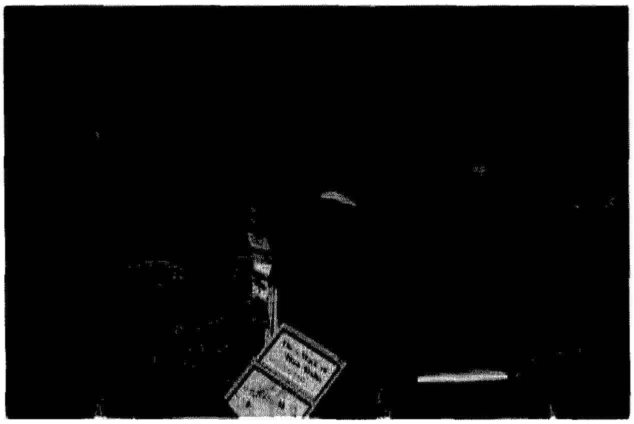


Kantronics' Signal Enforcer™.

The Rites of Spring

—Dayton does it again

Chris Brown N1AUI
Jeff DeTray WB8BTH
Bryan Hastings KA1HY
73 Magazine Staff



Jerry Swank W8HXR autographs the first copies of his new book, The Magic of Ham Radio, *a 73 publication. Chris Brown N1AUI, one of the book's editors, looks on.*

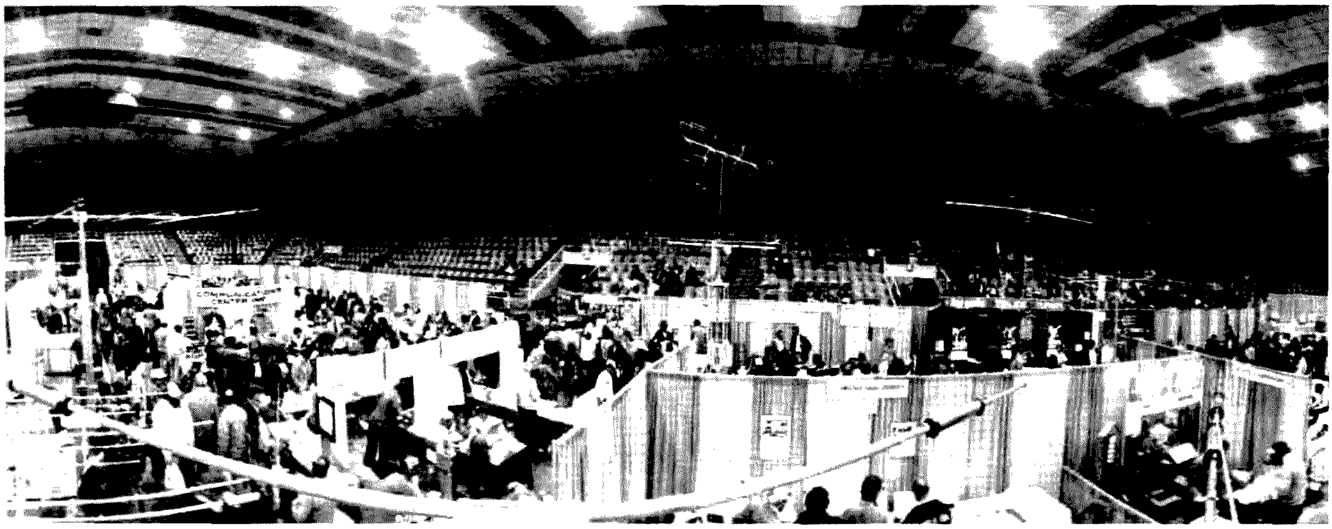
"Dayton, huh? Boy, I sure wish I were going along with you. I've always wanted to see that one. They say there is nothing like it."

As the van rolls west through the long Pennsylvania night, the chatter on most two-meter repeaters within range is of Dayton. Not the city, but the institution that has become a rite of spring for thousands of hams—the Dayton Hamvention.

"Say, you're about on the edge of this machine. If you drop down to the nine/one machine, you can take it clear into Ohio. Have a good trip and I hope you enjoy Dayton. Maybe I'll see you there during the weekend. Seventy-threes."

The Dayton Hamvention has become the granddaddy of all ham gatherings. In sheer size, it is larger than many of the towns its participants come from. And they come from all call areas of the US and Canada, and from many European and South American countries. They come to be part of the Dayton magic. When you go to Dayton, you don't just see it, you live it. From the crowded exhibition halls to the spacious 10-acre flea market, from the businesslike technical forums to the freewheeling evening bar scene, Dayton is ham radio at its most intense. It allows the ham total immersion in his hobby. For these three late April days, a ham can eat, sleep, and drink ham radio as he can at no other

Photo by Dan Tkach WB8OBD



time or place. He's at Dayton, and it's another world.

But why Dayton? Why this out-of-the-way rather bland mid-western city? It seems a long drive from anywhere, especially the population centers of either coast. Except for its proximity to the R. L. Drake Company in nearby Miamisburg, it has no distinguishing features a ham would find significant. Why then did over twenty-five thousand hams make the annual pilgrimage to Dayton this year in spite of a lousy economy, an energy shortage, and a viciously enforced fifty-five-mile-an-hour speed limit on the nation's interstate highway system? To answer that question, you have to know what Dayton is.

There are actually four Daytons. Each is distinct and offers its own unique flavor. When added together, the whole is much greater than the sum of the individual parts.

The Hall

One Dayton is manufacturers and dealers. The huge Hara Arena is wall to wall equipment—the newest releases, the latest gadgets. Magazines, badgemakers, and booksellers, too, jammed shoulder to shoulder in a delightful potpourri of electronic madness, and it's all for sale.

When the gates open at 8:00 am, the people who have been waiting in line for an hour or more flow into the arena with a vengeance. Once inside, the river of humanity fragments like so much white water as each person, with his own velocity and direction, heads for the booth of his dreams. For many, Collins/Rockwell is the stuff of dreams.

Booth is not the right word for what Collins/Rockwell has attempted to construct. Environment is more accurate. Their potted plants and lush carpets provide an air of artificial luxury amidst the chaos of the main exhibition hall. Collins knows their clientele.

Engineers in three-piece suits wait to courteously answer questions and provide specifications. They carefully rationalize to the curious why their new three-thousand-dollar transceiver, steeped in tradition, costs twice as much as its imported counterparts. Traffic ebbs and flows throughout the day in the Collins environment. The engineers grow tired of the same questions, the incessant CW coming from a nearby booth, and the heat.

In another part of the arena, the Kenwood booth, staffed by eight Japanese engineers and countless factory reps and salesmen, does a brisk business. Every conceivable Kenwood unit made is on display. Plans for new models are secretly divulged as service gripes are efficiently attended to. There are no potted plants at Kenwood—just customers, radios, and all those Japanese engineers who don't seem to mind incessant CW or redundant questions and who always look cool.

Collins and Kenwood. America and Japan. The parallels extend beyond the hobby.

The Flea Market

Dayton is also the most legendary electronic flea market in the country, maybe the world. Acres of used PC boards, vintage Motorolas, surplus scrap, and nearly-new Kenwoods. Peopled by carney hucksters, off-duty engineers, forty-year veterans, and kids in search of their first rig, the flea market is the people's Dayton.

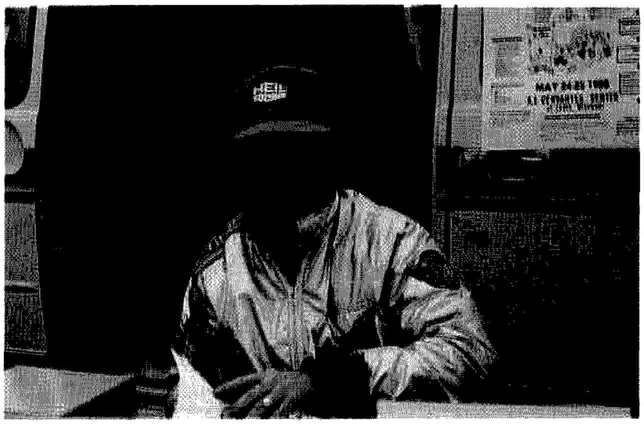
"What can you do with a 48-pole relay?"

"Who cares? The price was right!"

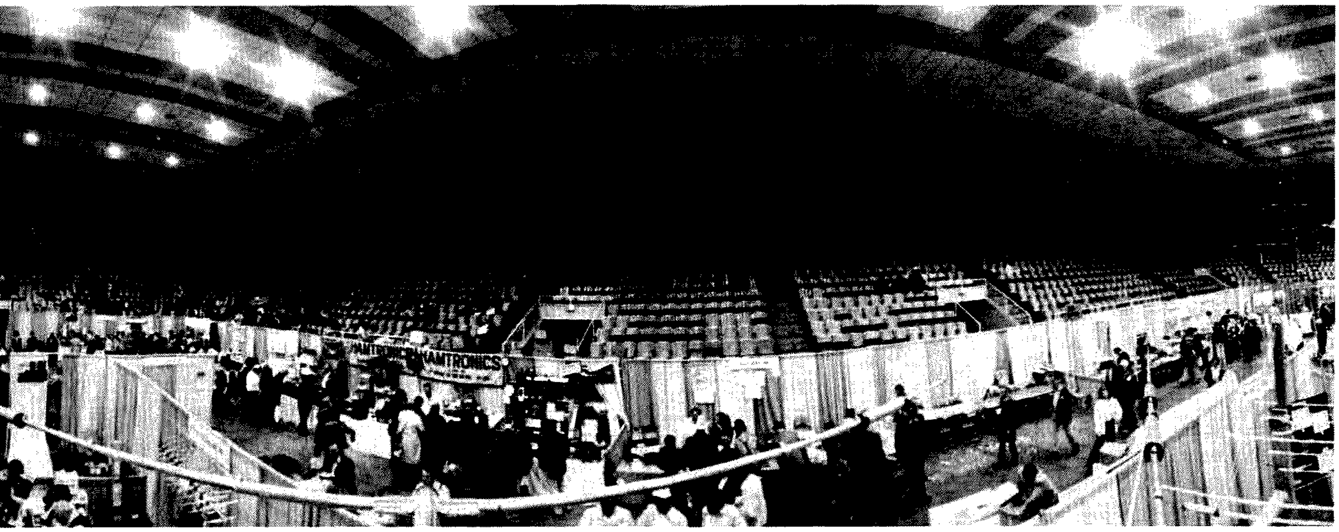
"It runs off 28 volts, ya know."

"So . . . I'll figure out something."

For the bargain-hunter, the Hamvention's flea market is heaven on Earth. There is at least one of



Why is this man smiling? This is Bob Heil K9EID, who has just discovered that his CB-to-10-meter FM conversions are selling like hot cakes. Bob has authored several articles for 73.



Lunch at the flea market is a spartan affair.

The medium is the message.

Getting there is half the fun—and expense.

everything in that ten-acre communications cornucopia. Perhaps the only item not for sale was one huckster's personal supply of Coors, cases of which were stacked a dozen high atop his van and guyed like a Rohn tower.

Don't plan to see the flea market in an afternoon—a day and a half is more like it. If you're conducting a serious search for something, you'd do well to carry along a notebook so you can remember just where you saw that mint Gonset Communicator or Viking Thunderbolt.

Comparing prices is fun, too. You'll see an amazing value on a one-of-a-kind item only to walk ten paces and find the same gizmo $5 cheaper. That is the flea market.

There was a guy who had five SB-101s. Five. How he ever accumulated that many he would not say. A good-looking pair of Drake twins went for $900. Some nut dressed as an Arabian oil sheik, scimitar in hand, drove a hard bargain as he dickered over price through his Budweiser-equipped interpreter. One made as much sense as the other.

The master of understatement was the guy who was trying to unload a rusted-out military-surplus transceiver that had been air-dropped without a chute. His attached cardboard tag read "$5—Needs some work."

The flea market is an electronic junkyard and a living history of ham radio: For some, memory lane; for others, the sideshow at Dayton's three-ring circus.

A Sunday Forum

Another Dayton is forums—this year, thirty in all. Everything from QRP operation to OSCAR, extraterrestrial radio signals to Earth-based malicious interference. Contests, ATV, the FCC, VHF, DX, Westlink, and WARC. At Dayton, there is a forum for everyone, a quiet respite in a hectic day. A classroom experience for those long out of school or a chance to ask questions and get answers from someone you've only read about.

John Johnston is in the hot seat today. As Chief of the Personal Radio Branch of the Federal Communications Commission, he has come to the Dayton Hamvention to conduct a forum. The subject of his forum is, simply, "The FCC." Meeting room number one is filled with the curious and the angry when he arrives. The government's adversary relationship with the ham is obvious as he fields questions like a middleweight fending off jabs to the head.

"Why don't you guys give tests at hamfests anymore like you used to? What are we paying our taxes for, anyhow?"

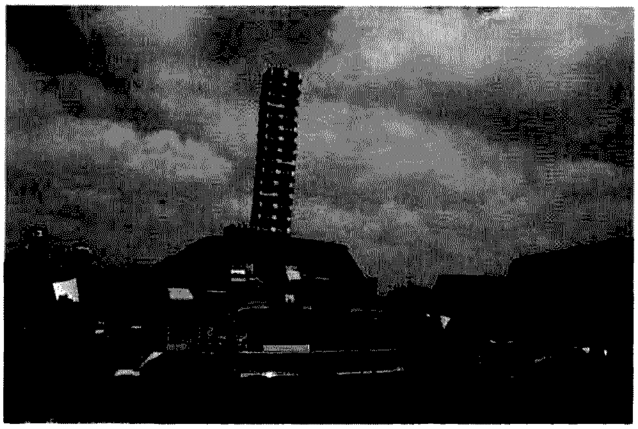
"Who the hell thought up the new callsign assignment system? And why?"

The questions keep coming as John Johnston bobs and weaves his way through the forum offering hope here, rationalizing Commission actions there. Always on the defensive, he does his best to pacify the crowd. He has come to Dayton as a representative of the federal government. This is a particularly bad weekend to be placed in that role. Three days earlier, other representatives of the federal government had failed in their attempt to rescue the American hostages in Iran and had given an international display of technical incompetence.

The hams at John Johnston's forum are tired of the stalemate in Iran, of bureaucratic incompetence, of the federal government. This weekend John Johnston is a victim of bad timing.

People abruptly rise and leave throughout John Johnston's forum once they have their say. Having the bureaucracy's ear, one on one, for a few moments, seems to satisfy them. As they leave, others hurry to take their places, hoping there is still time to air their pet peeves. A microphone circulates through the crowd and verbose hams have no trouble verbalizing their feelings.

"What is the FCC going to do about these damn repeater-jammers? There is a guy in my town we'll deliver to you in a basket if you'll put him away for awhile. Why haven't you people



The Coors tower: slightly askew, but operational on all bands.

One of several exhibition areas within the huge Hara Arena.

done anything about this mess?"

"Why are the questions on your exams so confusing? Some sound as if they are written by PhDs."

After two hours, John Johnston has had enough. He says there is only time for a few more questions. There are many more hands up in the air and many more questions wanting answers. Good-naturedly, he carries on through the long afternoon . . . bobbing and weaving . . . bringing the bureaucracy to the people.

Kansas City DXers

Finally, Dayton is people. When the arena doors close for the evening, the bars and restaurants come alive. Manufacturer and club hospitality suites are busy every evening. On Friday night, an FM Bash; on Saturday, a banquet with two thousand guests. People are a major part of the Dayton experience.

The Kansas City DXers are hard-core. Their hospitality suite on the fifth floor of the Downtown Stouffers has been buzzing with activity since the door opened at 6:00 pm. Now, well past 11:00, it is still crowded with people three deep at the cash bar.

"Hey, who wants to take the CW QRM test? It's a real bear. C'mon, you guys; it'll separate the men from the boys. Twelve different DX calls in fifteen seconds in heavy QRM. Let's do it!"

Other guests in the suite stir self-consciously as three teenagers cautiously approach the corner of the large table where a cassette recorder waits.

"We'd like to take it."

"Well, well. Alright, boys. Sit right down. Here are the rules. You get one shot and one shot only. Write your calls on top of your paper and get ready."

The suite grows silent as the young ops try to get comfortable, try to calm down. The tape begins and fills the room with a deafening hash of CW. Bent over their copy pads, the boys try to look serious, though their furtive glances at one another telegraph the hopelessness of their situation throughout the room. The tape ends. The test is over.

"Let's see how you did. No, no, there's one, no, no. Well, one out of twelve. Not bad."

The others did not get any.

"Not exactly a championship score. But come back and try next year. We'll be here. We're always here."

The young op who managed to pull one DX call out of the mess on the tape watches as his name and score are duly recorded on the score sheet tacked to the wall. Proud of his achievement, he lingers for

Oil for technology! The sheik and his interpreter drive a hard bargain in the flea market.

a moment before shuffling out the door and back to his parents' room.

"Okay, okay. Who wants to see the slides of the VP1 expedition? Or how about the Monster Quad slides? We haven't seen them lately. Come on, you people, it's early. Hey, get those VP1 slides loaded. Boy, what a trip that was! Even got an OSCAR QSO from there."

The bar is busy again and the crowd jostles for position as the slide projector is readied for the Nth time. The first slide hits the screen in the beautiful turquoise and blue hues of the Caribbean.

"Now this sandy spit of earth is one of the rare ones. VP1-land. You can see our 20-meter beam behind that palm on the left of the grass hut. Quite a shack, huh? We were lucky it didn't rain. Getting that antenna up was something else. Had to use bamboo mast for the thing, but it worked like a charm. Amazing what you can do with some spit and coax. Next slide!"

The slides click on; in the darkened hospitality suite, the tinkle of ice-filled glasses is a soothing counterpoint to the host's staccato monologue. The Kansas City DXers like what they do. They are hard-core.

All of this is Dayton. And more. Eight free bus lines operated by the Hamvention running throughout the city for those needing transportation. For three days, the busiest repeater in the country, the largest one-day CPR course ever given. Awards for "Ham Of The

Year" and "Special Achievement" won by Californians; hot dogs, beer, too few hotel rooms, too many exhibitors on the waiting list.

Why the Dayton Hamvention has become popular is a bit of a mystery to current Hamvention organizers. They do concede that being the first major ham convention each spring is a factor in their success.

The Dayton Amateur Radio Association is not mystified by the running of the Hamvention, though. This totally volunteer group, with minimal support from their city, manages to stage a most professional convention, the scale of which would give pause to many larger organizations.

The 1980 Hamvention staff was headed by General Chairman Noel McKeown WB8QQC. McKeown is a fortyish practicing attorney from Xenia, Ohio, with a flair for organization and a sense of humor. The squeaky toy duck he has attached to his HT antenna makes him easy to spot in a crowd. He was the first ham back on the local two-meter repeater after the disastrous tornado which leveled much of his home town, and now he maintains his cool despite being in his first year as Chairman. Reluctant to delegate authority, he places himself at the center of the organizational maelstrom. While accessible to all of his people, he is firm in his resolve to maintain decision-making control and responsibility. His HT is never quiet as he strolls through the arena like a general on the battlefield—more tables are needed here; there is a power failure there. All problems find rapid solutions in Noel McKeown's Hamvention.

Self-effacing, he characterizes his role as merely that of a shoulder to cry on. In a sense, he is right, for he does not work alone. Thirty-two people are listed in the official program as staff and hundreds more have contributed time and effort.

Hamvention planning begins in May each year. Consequently, twelve months are taken up with organizational work. Endless rounds of meetings, critiques, and strategy sessions run throughout fall and winter. For the Dayton Amateur Radio Association, the effort pays off.

This year the Hamvention had close to twenty thousand gate customers at six dollars a head and more than six thousand pre-registered ones. Almost two hundred exhibitors in the main arena paid $180 for each booth space. In addition, hundreds of flea-marketers bought space for the weekend at thirteen dollars a spot. The Saturday evening banquet, a tradition for many conventioneers, was a sellout with two thousand in attendance.

If the Association's communication van is any indication of the profitability of running the Hamvention, the return is worth the trouble. Their Drake-equipped 30-foot motor home is an impressive sight.

The Dayton Hamvention is profitable for the exhibitors, too. One large dealer has reported six-figure business over the Dayton weekend, and smaller operations making badges, selling books, and hawking electronic kits show up year after year along with the ever-efficient State of Ohio tax agents.

What the future holds in store for the Dayton Hamvention is on the minds of the organizers. The declining economy and tight money situation does not bode well for expensive equipment-oriented hobbies like ham radio. Whether the Dayton Hamvention will continue to grow in size, as it has for the past five years, is difficult to say. There were indications that business had slowed this year in comparison to last. As the economy goes from bad to worse, tough times may be ahead for the Dayton Hamvention.

For the present, the Dayton Hamvention rolls on as the biggest and most successful ham gathering in the country. One can only hope that as inflation chips away at the non-essentials that make life worth living, people will be reluctant to let go of what they hold dear: opening day at the ballpark, fishing season, the Dayton Hamvention. After all, rites of spring should die hard. ■

Flotsam and jetsam: electronic and otherwise.

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One Step at a Time: Designing Your Own Ham Gear

—part II

In Part I of this article, I covered the first three parts of a seven-part step-by-step process, taking us from design to building and testing. Here are the other four parts.

Parts Acquisition

Acquiring parts for the project may be the most frustrating stage in the entire design process. Part of the problem stems from the variety of components now available. Not too long ago, say about twenty years, we could build what we wanted from coils, capacitors, resistors, tubes, sockets, transformers, wire, and jacks. Plus a cabinet, necessitated by the advent of television. Thousands of transistor types and a growing number of IC types now make it impossible for one dealer to carry everything. Handling costs have risen so that locally-available parts in blister packaging are expensive. Fewer mail-order houses wish to fool with open bins of resistors or with a small order. Fortunately, the situation seems to be improving for many kinds of parts, and a few individuals have begun to specialize in parts for rf. If only hams had not decided to build more than just transmitters and receivers; now they insist on keyers, frequency counters and readouts, synthesized vfos, and even computers. Little wonder parts dealers cannot keep up.

Parts ordering will involve several orders to different houses. It is useful to try to be as complete as possible in the initial order, since many houses have a minimum order. Of course, it is inevitable that you will forget to order one small, but crucial, part available only from a company with a $20 minimum, but then what better time to stock up on everything for the next project?

It is possible to divide parts into three types: crucial, needed, and desirable. Crucial parts are those without which an entire circuit may need to be replaced with another. The inability to obtain a special power transistor may require rethinking the entire set of amplifier stages. The unavailability of a specified power transformer may require you to redesign the whole power supply, e.g., to shift from a bridge rectifier circuit to a full-wave center-tap circuit.

Needed parts are those whose absence may require some circuit or construction modifications. Changing from toroids to slug-tuned coils may require giving thought to shielding and the consequences of lower Q.

Desirable parts are those which, in your design and with respect to your objectives, may have adequate, easily-available substitutes which will do the job just about as well. A vfo with silver-mica capacitors rather than polystyrene ones will work satisfactorily in some units (not subject to great temperature changes).

The point in making these distinctions is to determine the order in which you acquire parts. To receive all the desirable parts for a circuit and to fail to obtain the crucial one amounts to filling the parts bins of your shack for use in another circuit.

Besides acquiring parts in the priority of crucial first and desirable last, you should buy in two steps. First, purchase all the major components. Then think about matters such as chassis and cabinet. To discover that your transformer and circuit board require a 4″x 5″x 6¼″ cabinet when you have just bought a 4″x 5″x 6″ cabinet only adds a spare aluminum case to all those extra parts you just put in the junk box. If possible, put off buying chassis and case until after the next stage (planning the layout). Then you will be sure that everything will fit. (But do not feel bad about violating this advice; nearly everyone does. I have three or four small boxes and cabinets awaiting projects designed just to fill them up.)

Layout Planning

Many builders follow the rule of breadboarding all circuits before building a final version of a piece of equipment. If you are one of these persons, then you will want to jump ahead to the stages of building and testing before working through this one, even though some of the general points here can ease potential problems in breadboarding. Modern construction techniques permit many types of equipment to be breadboarded and built simultaneously. Using a perfboard or circuit board as a sub-chassis means that the builder can perfect parts of a total unit one at a time and then—if the breadboarding method is also a sound building method—simply install the working subunits into the overall case. Whatever your particular building

technique, giving plenty of thought as well as pencil and paper to planning the physical layout of your equipment will ease the construction process.

There is no one best way to build equipment for oneself. Our skills vary. Some enjoy metal work, others want to minimize it; some enjoy the finishing process of paint and decals, others use blank panels; some love to make up circuit boards, others prefer perfboard techniques or the use of terminal strips. And, in fact, there is no set way for the actual construction process to proceed. Therefore, with attention to some cautions given below in the section on building, choose the type of construction which you can do best. Just as building a piece of equipment increases our knowledge of electronics, however, building also can increase our building skills; do not hesitate to try a new technique. As a hedge against messing up your project, you might first experiment with the technique on a small project in order to learn the basic skills and discover the main pitfalls. But if you have never etched a circuit board or bent your own chassis or wound your own coils, acquiring skills such as these can add to your building and designing skills by opening up new possibilities. Construction of a piece of equipment should not be outside your abilities just because the mechanical work is difficult. Besides, there may be hams in your area who can help you learn or who may do the work expertly for you. Trading skills is an old and honored ham custom.

Before you perform the first mechanical task, work through the placement of the parts. There are two levels to this planning task: circuitry and cabinetry.

Circuitry and the interconnection of circuitry requires attention to the placement of parts and leads on each subassembly, whether that be a tube socket, terminal strip, circuit or perfboard, or a chassis. The use of subassemblies on boards is recommended wherever possible because it will permit independent testing of the circuits involved, replacement of a small part of the project in case of a major snafu, and easier maintenance after the unit is complete. In laying out parts of the circuits, pay special attention to the following items:

1. Signal paths: Are they as short and direct as possible? Are input and output leads isolated as much as possible? Are there minimal crossovers?
2. Components: Are they going to be securely fastened? Will they interact (e.g., are coils—except for toroids—at 90-degree angles to each other or shielded)? Will they all fit?
3. Dc paths: Are they neatly routed? If wire, are they bundled into cables? If PC board or perfboard, do the runs avoid capacitive coupling to signal paths?
4. Switches and controls: Are leads short unless they carry only dc? Is necessary shielding planned for?
5. Crossovers: Do circuit paths cross over (either on one side of a board or on alternate sides) in ways to create undesired coupling? Are connecting cables between boards isolated with respect to dc and signal? Are subunits isolated either by position or shielding?

Cabinetry includes not just the overall case of the unit, but chassis and other substructure considerations which go into making up a total unit as well. Among the things you should think about are the following:

1. Power supplies: Are they positioned for adequate mechanical support of transformers and chokes? Is ac isolated from lines into which hum might be coupled?
2. Major parts placement: Is the size and weight distribution well balanced for mechanical support and operating ease? Is there sufficient room around these major parts for associated circuitry, shielding (where needed), and mechanical supports?
3. Mechanical supports: Are dials, vfos, and other units with movable electronics or mechanics adequately supported for stable, unbreakable operation? Will shafts or mounting brackets of controls or subunits interfere with other subunits of the equipment?
4. Maintenance: Are subunits mounted so that they are easily removed for maintenance? Are test points accessible for metering? Are parts mounted to the main frame or chassis accessible for replacement?
5. Controls and jacks: Are controls placed for ease of operation without confusion? Are jacks for input and output conveniently placed? Are fuses and line cords accessible without interference to operation?

The last set of questions, concerning the use of panel-mounted controls and jacks, should open the builder to new ideas. Most builders try to emulate commercial construction, even to the point of putting the same items on the front and rear panels. Remember, however, that this piece of equipment is being custom-built by you for you. That means that you have freedom to choose just where each control, jack, fuse, or cord will go. If you are building a CW transmitter, there is no general good reason for putting the key jack on the rear panel, even though almost every commercial transceiver and transmitter has it there. Where you place it should depend upon what you need from the equipment by way of operating ease, convenience, and design necessity. In principle, there is no reason not to use the top and sides of the unit, as well as the front and rear, for controls and jacks. The decision whether or not to use a surface is determined by your objectives, circuit constraints (e.g., high-impedance rf leads), and mechanical constraints (e.g., a box having only independent front and rear panels).

Consideration of the unit's panels brings up another matter. Earlier, we mentioned that you might want to review your objectives throughout the design process. Now, before getting to the stage of actually building the equipment, is a good time to perform the review. In your design of circuit blocks and in your research and selection of circuits, you may well have unconsciously changed some of the objectives through your decisions. In laying out the parts, you are made aware of most of the elements of operational ease of the equipment. If these thoughts are not among your objectives, you should add them now, after thinking through carefully what you want in this department. After all, you expect to operate with the equipment for a far longer period than it will have taken to design and build it.

Circuit Interaction: Shielding and Isolation

Although many of the points to be made about shielding and circuit isolation have been mentioned in the course of these design hints, it may pay to look at the subject as a whole. Planning the layout

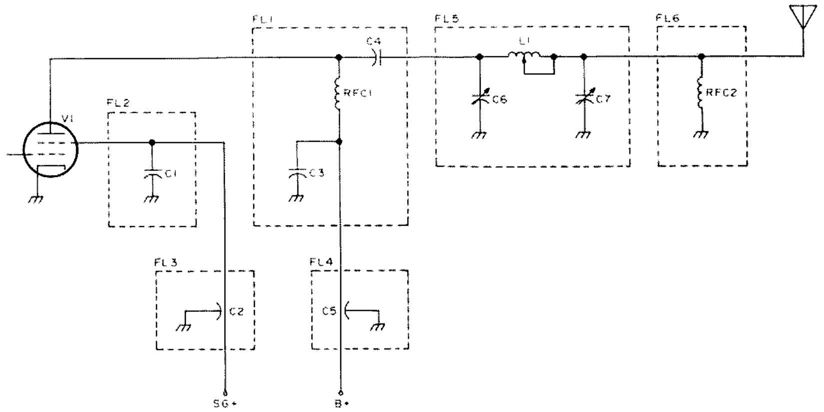


Fig. 6. This figure illustrates thinking about the output circuit of a typical power amplifier circuit as a collection of filters. FL1 consists of C3, C4, and RFC1, which separate the dc and rf. FL2 and FL3 also separate dc and rf, sending the latter to the chassis ground. C2 is a feedthrough capacitor, used where dc enters the amplifier enclosure. FL4, consisting of C5, has a similar function for the plate voltage. FL5, consisting of C6, L1, and C7, is a pi-network which passes rf energy at the frequency to which it is tuned and attenuates energy at all other frequencies, including harmonics and spurious frequencies. FL6, RFC2, is a back-up filter: Should C4 break down and permit dc to the output, RFC2 will route it to ground and blow a fuse rather than let it appear at the antenna where it might pose a danger to the operator or bystanders. It is not only possible, but also useful, to think of most circuits and circuit elements as filters which separate energy into two or more paths. Such analysis makes us aware of the fact that each type of energy (dc, ac, af, rf, etc.) must have a complete path, and that good design has a proper route for each type of energy at every point in a circuit. For example, bypassing energy to ground is a proper route for af and rf energy which we do not want at some point in a circuit.

of parts provides an excellent opportunity to forecast all the possible difficulties you might encounter from circuit interaction.

The most common type of equipment to suffer from unwanted circuit interaction is rf gear, either transmitters or receivers. Station accessories also come into play since they might have to work in an environment of stray rf fields or rf energy carried to the unit by power or interconnecting lines. However, almost any type of equipment—audio, digital, test, etc.—can suffer from improper energy transfer. Therefore, the following list of places to think about may help you predict and take preventive action against trouble spots.

1. Power entry: Look out for possible line surges, rf on the power lines, voltage spikes, etc. Any of these items can kill solid-state devices or interrupt proper operation. Bypassing, voltage limitation, and other usual handbook-type preventatives should be employed.

2. Dc lines: Check for possible signal coupling, whether rf, af, or digital. Separating lines is effective for some troubles. Extensive bypassing can avoid other problems. In digital gear, there may be simultaneous pulsing on several devices which pulls a heavy current load, thereby reducing the supply voltage to individual devices for an instant. This may cause a device to operate erratically.

3. Parts placement: Look for parts interaction due to placement and positioning. Capacitive coupling should be suspected everywhere until you are satisfied that it is minimal. Inter-coil coupling possibilities should arouse your suspicions. Additional coupling in switches is another suspect.

4. Shield placement: Be sure that your shielding efforts are adequate to the needs. Using additional screws, adding tops to enclosures, being sure shields extend beyond the edges of components they shield, making sure cables have good chassis grounds for their shields—these points should all be remembered, as well as others which handbooks can provide in detail.

5. Electronic isolation: Check all filter chokes and bypass capacitors to see that they are where they should be and that they are of the proper value. Coupling capacitors associated with rf chokes and bypass capacitors, as in Fig. 6, form a type of filter. A filter may be defined as any device which separates energy into two or more paths. If the coupling capacitor, say in a power amplifier, is too small, rf will be forced into the dc lines. If the choke or bypass capacitors are of the wrong values, they will aid rf in reaching the power supply. From there, rf can travel to everywhere else that you do not want it. Use feedthrough capacitors for running power into any enclosed subunit. Add further filtering if you think rf might be a problem. Check each circuit for each stage to be sure that all filtering (and this includes things as simple as tuned circuits) is adequate. The list of electronic isolation techniques is far longer than this note can give a hint of. The key thought is this: Be thorough! Every problem you anticipate in advance is one less problem you will face later and one less circuit to be needlessly torn apart after you build it.

Building and Testing—One Stage At A Time, Cumulatively

Building your well-designed piece of equipment is not just a matter of good construction practice. Certainly, you should always adhere to the practices which the handbooks and various articles show. Practicing the skills of mounting components, soldering, cabling dc leads, and the like should be part of every project. They will vary in part with the type of construction that you choose. The reason these practices will not be reviewed here is that you should have thought through them in the preceding stage of selecting circuits, acquiring parts, and planning your layout.

The actual process of building is one of putting these practices to use in a way that will best ensure that your unit will function as desired. This happens for the home builder only if he combines building and testing and takes one stage at a time. Remember that your project is not a kit, engineered to be repeated in the home. Kit manufacturers can have you work on widely separate subunits of the kit at the same time because they have made the unit work a number of times already. For you, the

home builder, this is the first time. Therefore, to be sure that every subunit will contribute to the whole in a way to meet your design specifications, you must build and test them as you go along.

Besides, it is much easier this way. One reason for suggesting earlier that you build in terms of subunits was to permit you easily to accomplish this step-by-step procedure. A good way to think of the building and testing procedure is to call it "circuit adjustment." You will be combining your circuit parts in order to make a circuit work. Notice that you will not be building and then seeing if the unit works. Instead, you are going to do what you must to *make* it work. Often we think of adjustment as changing the setting of a potentiometer, a variable capacitor, or a slug-tuned coil. But, every change made in the value of a bias resistor—even if it means taking out a fixed-value part and putting in another—is also a circuit adjustment.

Among the other replacement adjustments you may have to make are these: replacing an active device with one having higher/lower gain, adding chokes and bypasses, rerouting leads, rewinding coils, replacing capacitance-division networks, changing resistor and/or capacitor values in timing circuits, altering supply voltages, revising ground paths. And these are only a few of the possibilities. Luckily, you will have to consider only a few of these possibilities for any one stage that you build and test. If you have thought through the earlier stages of design, the number of possible adjustments will be minimal. (But remember that Murphy lurks in the background to make a liar out of me.)

Before getting to the building process itself, let's spend a moment thinking about test equipment. Most hams would love to have a completely-equipped laboratory but do not have the cash or the space to put one together. Short of that ideal, what equipment is the most necessary? The answer to this question will vary with the kind of project you are building. The two most basic instruments for every project, however, are the VTVM and the VOM. The VTVM is for voltage and resistance measurements. The VOM is for current measurements. If your project deals with rf, then you should have an rf probe for the VTVM. In addition, a grid-dip oscillator permits pre-adjustment of tuned circuits and a basket full of other handy tests. A good gdo also will function as a sensitive wavemeter to sniff out spurious emissions. Oscilloscopes and frequency counters are useful, but if you are just beginning to put your workshop together, save them for later and begin with the essentials.

For digital work, the VTVM and the VOM are still basic. A digital probe to indicate device logic state is handy, but a scope is probably the best item to determine the pulse trains and shapes. Thus, if your projects are going to be mostly digital, then a scope takes much higher priority on the test equipment list.

Finally, you should have a variety of signal sources and signal decoders. That is, a variety of oscillators and receivers. If you are building a transmitter, an allband receiver—however inexpensive—can be extremely useful: It can tell you *where* your oscillator signals are (as well as if they exist), and the S-meter can help you peak up a circuit. For receivers, you need signals for rf, i-f, and af testing. Often these can be made up from junk-box parts as you go along. Lab-grade generators may be more accurate, but they are also many times more expensive. The cheap and easy way is usually more than good enough to get a unit fully and satisfactorily functioning. If you then want to perfect adjustment to the last gnat's hair, there is usually a well-equipped ham in the area, or perhaps a friendly technical school, a serviceman, or even a setup at a hamfest.

With these thoughts in mind, let's begin the process of building and testing. Begin always with the power supply. Beginning here has several advantages. First, power becomes available to all the stages. Second, you can run your dc cabling around the chassis or case before adding other parts. Third, you can assure yourself that all requirements for regulation, ripple, and load capability are going to be met.

The next stage depends upon the unit you build. In general, there are only receivers and transmitters, that is, signal generators and signal decoders. Test equipment, such as frequency counters and oscilloscopes, are simply special types of decoders. Function generators and audio oscillators are in a family with transmitters. Therefore, there are only two building progressions you have to think about.

For decoders or receivers, begin with the output stage. In a receiver, this will usually be the audio stages; in a counter, it will be the visual readout. Whatever the device, it is usually easy to provide inputs to check the proper output of the stage. All other stages will work progressively into this one. If you are not sure this stage works, then when you build another, you will not know which of the two stages needs adjustment. If it does work, then your potential problems are cut in half. The trick is to work backwards toward the input to the unit, testing each circuit and each subunit as you go. This does not mean you may not want to alter something in a later stage after adding the earlier ones. It does mean that you will have the best chance of making the entire unit function as you planned.

For transmitters and other signal generators, begin at the opposite end. A CW transmitter might begin with the vfo. Once this works, move to the heterodyne ocsillators and mixer. Finally, tackle the amplifier trains. For an SSB transmitter, you might begin with the audio stages. Then work on the carrier generator. Next comes the balanced modulator, the sideband filters, the vfo, the mixer, the heterodyne oscillators and mixer, and finally the amplifier stages.

In all of your work, add accessories last. VOX, electronic T-R switches, sidetone monitors, and the like are all additions to the basic unit and should be deferred until you are sure the basic unit functions correctly. On the other hand, be sure you distinguish between accessories and essentials. Although a blocked-grid keying network is not part of the signal generation train, it is essential to a CW transmitter and should be developed with the main part of the rig. Likewise, avc, if essential to a receiver design, should be begun as soon as you reach the stage from which it is derived.

Figs. 7 and 8 illustrate the progressive building process for two small projects. The order of building and testing can be altered somewhat. You might begin on a receiver with the highband converters, using an available receiver to check them out, but the general principles given here are a

sound way to begin your thinking. If you vary them, you should be clear in your own mind just why you are departing from them and what advantages you will gain.

Circuit Interaction: Spurious Oscillations and Emissions

While building and testing each stage of the unit, you should be aware of circuit problems which might occur and what corrective actions you can take at this stage of the design process. Most of them have to do with oscillation and the mixing of oscillations. In transmitters, we refer to harmonics, parasitics, and spurious emissions. In receivers, we tend to think of "birdies." Whatever we call the effects, there are only a few basic causes and cures. Here is a starter list.

1. Amplifiers on a high: The wire leads and the components associated with an amplifier can produce oscillations at some unpredictable very high frequency. This is true of both tube and solid-state amplifiers. When building an amplifier, check it in operation with a sensitive wavemeter tuned through the range from 50 to 200 MHz. If you detect any oscillations, the usual methods of adding parasitic suppressors to the plate leads of power tubes or adding a ferrite bead to the collector lead of a transistor will usually take care of the problem.

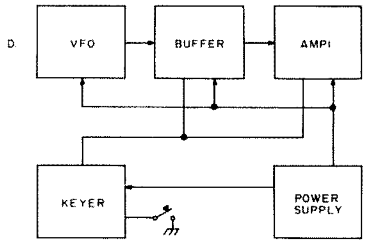
2. Amplifiers on a low: Transistor amplifiers are subject to low-frequency oscillations (which are not a problem with tubes). Additional bypassing with values from .1 to 1 uF in the collector supply lead will usually eliminate this problem.

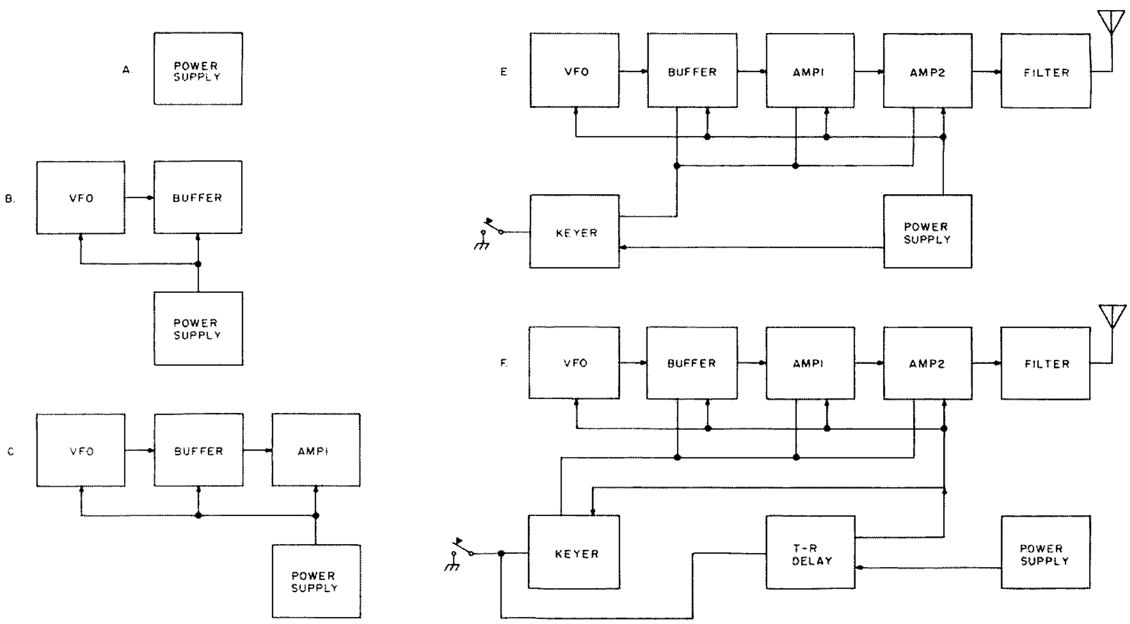
3. Spurious mixing: Modern equipment, especially for rf, usually contains several oscillators. There is no telling where, in all the circuitry, that signals from them may mix and produce new frequencies either in or out of the ham bands. Careful shielding of circuitry and rf leads will often cure this problem by ensuring that signals go only to the stages in which they are supposed to be mixed. Spurious mixing of signals can result from rf getting into dc lines from improper lead dress, as well as from direct radiation. Thus, there may be several things to check.

4. Harmonics: Oscillators have harmonics which may cause problems. The harmonics may produce direct output or they may mix with other signals to produce new signals. In receivers, these new products can show up as "birdies," i.e., steady or warbling tones that show up at a certain point on the dial. In transmitters, the products, if in the ham band to which the amplifier is tuned, can show up as a well-amplified signal, but not in the place you think you are operating. If you encounter any of these problems, check the harmonic frequencies of all oscillators and see if any mixed combination might produce the problem. The cure may involve shielding and lead dress, but a trap, placed in the output of the offending oscillator and tuned to the troublesome harmonic, can often eliminate the difficulty.

The list of possible problems could be extended. In transmitters, standard precautions against harmonics should be used. In one form or another, these precautions apply to all signal generators. In receivers or decoders, precautions should be taken at the input or early in the equipment to pre-

Fig. 7. Stages in the construction of a low-power solid-state CW transmitter for 40 meters. a) Building and testing the power supply. b) Building and testing the 7-MHz vfo and buffer stage. c) Adding a tuned amplifier and testing for feedback to the vfo. d) Adding a keying transistor to key the buffer and amplifier. e) Adding a second power amplifier and half-wave filter; testing power levels and signal purity. f) Adding a CWX circuit to provide power with the first dit and delay removal of power for 1 second after transmission is complete; acts as a T-R switch.





vent all but the desired signal from appearing in the output, either as a false signal or as a mixing or distortion product.

The essence of this list, however, is to make you aware of some typical problems that show up in the building process, problems which have simple cures which may be added to the circuit without affecting its main function. If you clean up each stage as you proceed, then you cut down the possible causes of such problems. In transmitters, they ordinarily will be caused by the new stage itself or by the new stage in combination with the preceding stage. In receivers, the problems are usually traceable to oscillators mixing somewhere. The simple cures will take care of better than ninety percent of the cases. And the procedure of building a stage at a time will usually make locating and curing the problem an easy matter.

The effect of building and testing as you go, one stage at a time, is that you accumulate a functioning unit. If you attend not only to the fact of a circuit's functioning but also to its sensitivity, output level, and all the other factors you noted down while designing the unit, the final adjustment will yield a piece of equipment ready for use. Close the lid, label the switches and controls, clean the handling smudges from the case, and begin using your equipment. The only question left will be your satisfaction: Will it be greater the first time it works or when you suddenly realize a year later that it still works and as well as many commercial pieces of equipment?

There is one other question: What will you want to build as your next project?

Before closing, we should take one more look at the notebook you have been accumulating as the design process proceeded. By now, it not only has a collection of objective lists, block diagrams, circuits, and notes, but also has layout drawings and other notes you entered while adjusting the circuits you built. At this point, it will pay to add the following:

1. A clean schematic of the final unit, just as you finished it. This drawing can be broken up into sections according to the subunits you built, or it can be a single large drawing. The subunit system of drawing does tell you where every part is, and this may help you later when your clear memory has dimmed because you have been building other pieces of equipment.

2. Clear drawings of the front panel, rear panel, and chassis or subunit layouts, just as you finally built them. These can replace some of your earlier sketches (but save those earlier sketches if they contain ideas that may be useful to other projects).

3. Notes on the typical operation of the unit. For transmitters, this may include tune-up procedures, neutralization procedures, and the like. For receivers, this list might contain the effects of controls and their interaction, the most useful ways to null out unwanted signals, and other operating procedures.

4. Notes on signal and dc voltages and device currents. These notes, which can also be entered onto the schematic diagram, provide a record of what conditions are normal for the unit. If you ever have to troubleshoot the unit, they can help you locate a trouble source fast.

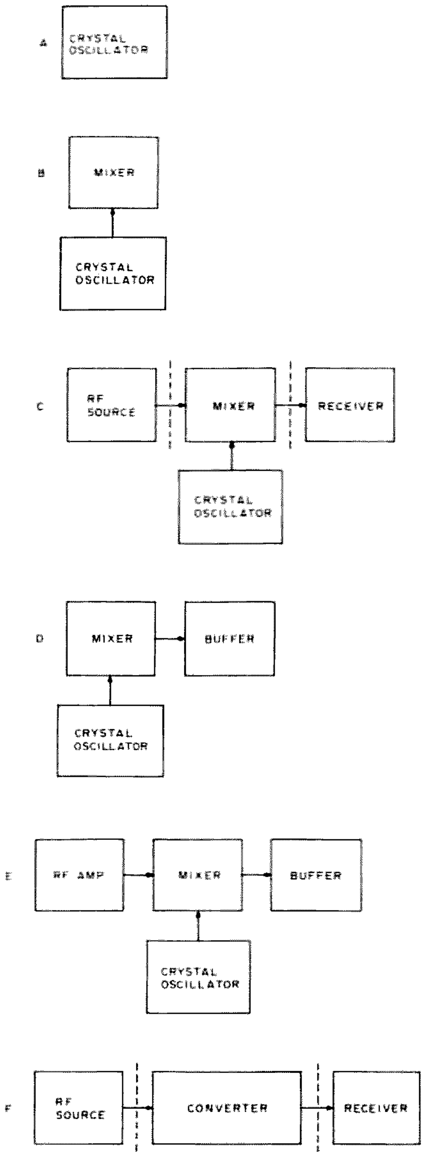


Fig. 8. Stages in the construction of a 10-meter converter. a) Building and testing of the crystal oscillator; without the oscillator, no conversion will be possible. b) Adding the mixer. c) Testing the basic converter for mixer alignment. d) Adding a buffer/i-f amplifier with low gain and low-impedance output. e) Adding an rf amplifier for additional gain. f) Testing the complete converter, noting operating voltages and performance figures for future reference. Although this procedure looks elaborate for a small project, it is, or should be, the natural procedure for a project such as this. Unlike building a kit, there is no point at which I could say that the unit worked right the first time. In fact, even at stage f, when the unit was working well, I decided to see if I could make it work better by controlling the rf stage with avc derived from the receiver.

The purpose of these notes is twofold. First, they aid you in any later servicing and maintenance work. Second, they provide operating notes should you ever sell or give away the unit. There is a third possible use: If you ever have the urge to write up the project for a ham magazine, you will have all the information at your fingertips.

The main purpose of this article has been to develop a step-by-step thinking process so that a new General class ham can move from soldering circuits to designing his own equipment. It is based on the premise that

clear thinking is nine-tenths of the battle to successful design and building. The steps given here are aids to clear thinking. As such, they have no magic. As you progress in the art of design, you will begin to alter them to suit your own individual way of going about things. More and more of the work will become natural and require fewer checklists and notes. But having a workable system to begin with can make the process of growth more rapid and more successful. I hope that this article will aid the process and encourage you to design and build.

The thought process described here is also useful to those who do not plan to build, however. The stages of thinking can help you to evaluate commercial equipment. By thinking through your objectives in having a piece of equipment, it becomes clear as to what features are important to you and which are extras you can do without. By looking at a manufacturer's literature, you can learn how he has designed the equipment to fulfill those functions, and what circuits he has chosen to satisfy each block subfunction. Examining the parts layout and the construction techniques, with an eye on what advantages he wanted to gain and what potential problems he wanted to overcome, can teach you much about the interaction of the electronic and physical dimensions of radio equipment. All of this will not only make you a more intelligent buyer, but it will also aid your understanding of the equipment as you operate it and perform maintenance upon it. And this can add a new satisfaction to your experience in amateur radio. ■

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Top-Banding the DX-60B

—put a classic rig on a classic band

After having my interest in 160 meters kindled by reports of increased activity and by reading a number of articles in recent magazines concerning the "top band," I decided that I, too, wanted to share in some of the excitement.

Because my present HF transceiver does not include that long-forgotten range of frequencies, I considered either buying a new transceiver or building a transmitter and using my Hammarlund HQ-145A receiver. After investigating the purchase of a new transceiver, I decided that that would best be put off until financially better times. Regarding the building of a transmitter, there appeared to be many schematics available, but the parts for the higher power units seemed to be difficult to obtain. I thought I would like to learn a little more about the band by operating with higher power before going QRP.

One day while I was operating RTTY with my Heathkit™ DX-60B on 20 meters, it suddenly occurred to me that the DX-60B might not be too difficult to convert to 160 meters. After looking at the assembly manual and schematic, I realized that I was right. And, not only would the transmitter give me 90 Watts on CW, but it also would give me AM phone ability. This mode is still pretty popular on 160.

The DX-60B cost about $90 new and was designed for Novice and General use. The inclusion of AM phone made the transmitter obsolete before its time, and many still can be purchased through classified ads and flea market sales for around $30-$40.

Since the circuit of the DX-60B uses a crystal oscillator, driver, and amplifier in the rf stages, only two tuned circuits must be changed to use the unit on 160 meters. With the 160-meter conversion added, the transmitter can be used on all bands, 40-10 meters, but the case will have to be opened and jumpers added to use the transmitter on 80 meters. Since the only other use I have for the transmitter is on RTTY and I very seldom leave 20 meters on that mode, this was not much of an inconvenience for me.

The modification involves the removal of coils L2 and L3. These coils have to be taken completely out of the unit to make their

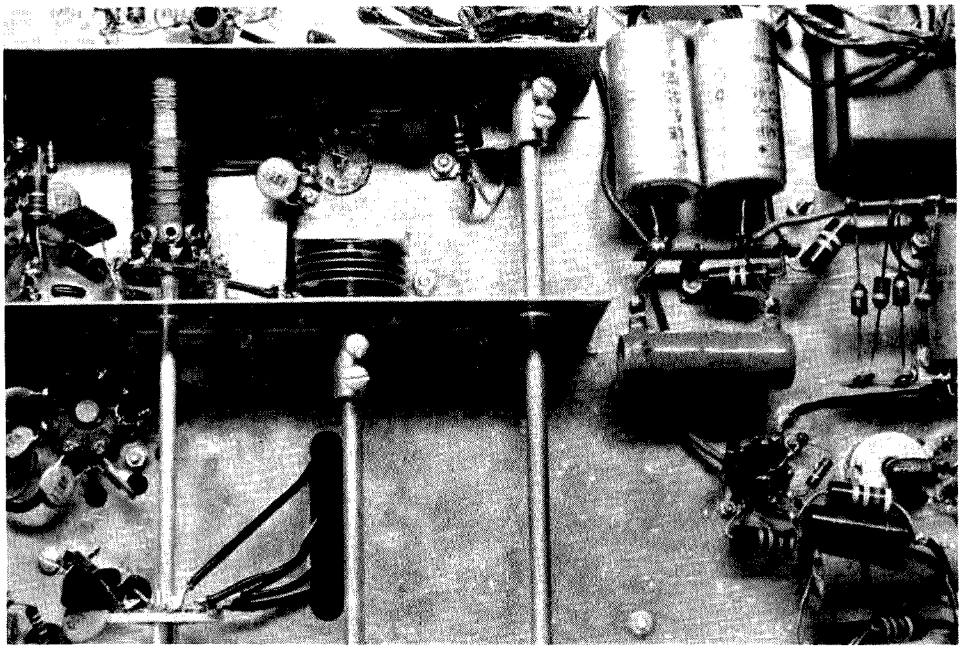

Photo A. Bottom view of the DX-60B. Coil L2 with the additional coil winding is at the upper left. The additional capacitor across C21 can be seen at the lower left.

modification possible.

After the removal of coil L2, drill another hole in the coil form as close as possible to the end of the form away from the mounting terminals. This hole should be in line with the hole farthest from the solder terminals.

Unsolder the wire from the terminal connected to the 80-meter switch contact. This is the wire which comes from the hole farthest from the terminals. Pull the wire back through the hole. Then insert a short piece of bare large-diameter wire into the hole. Bend the wire inside the coil form so that it cannot be withdrawn. Attach the wire which was unsoldered from the terminal to this large-diameter wire on the coil, taking up all of the slack. Also attach one end of an enamel-covered #26 AWG wire to the large-diameter wire. Continue winding this piece of #26 wire around the coil form in the same direction as the original coil. This additional coil should consist of 40 turns and must be scramble-wound to fit in the space between the large-diameter wire and the new hole. After winding the 40 turns, feed the wire through the new hole and down through the coil form to where the original wire was unsoldered from the 80-meter switch terminal. Solder this new wire to the terminal. The large-diameter wire will be used as a shorting terminal to restore the transmitter to 80-meter operation. L2 can now be reinstalled into the unit as it was originally.

Remove coil L3 by unsoldering the wires on the bandswitch under the chassis. Then unsolder the wire from variable capacitors C22, C23, and C24 and the wire from the low-pass filter at the coil.

Drill a new hole in the coil form at the end closest to the mounting lugs and in line with the coil terminals. Make sure that this hole is not closer to the end of the coil form than the end of the mounting lugs. This is to ensure that the new coil which is to be wound will not short on the mounting lugs. Again insert a bare, large-diameter wire through the hole and bend it inside the coil form. This wire can be bent in a loop on the outside of the form. It will act as a terminal for the 160-meter coil.

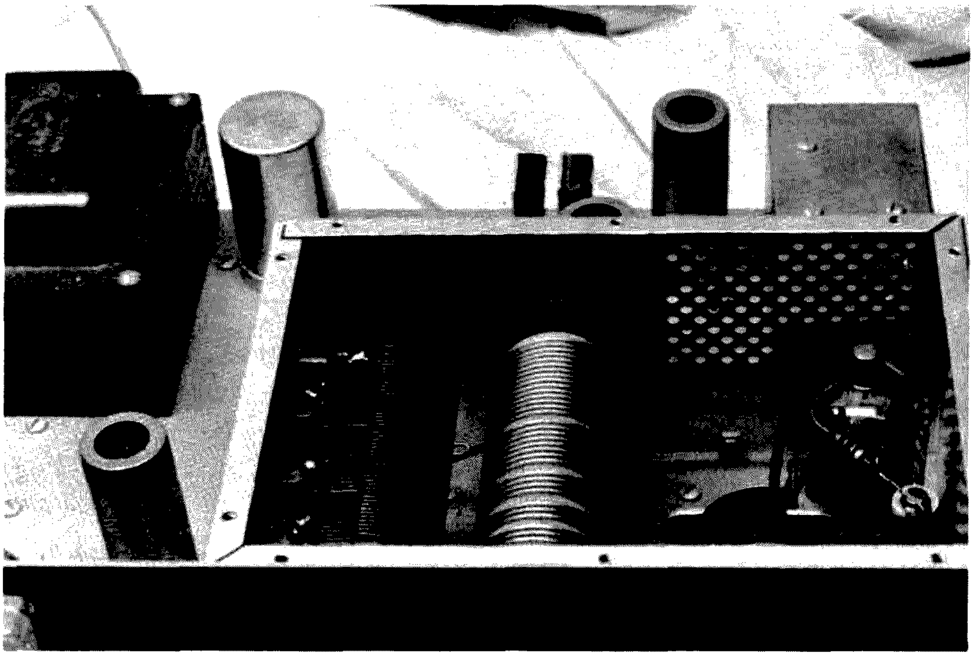

Photo B. The new winding on L3 shows in this top view of the DX-60B. The additional capacitor across C22, C23, and C24 is not shown, but the solder point is shown on the frame at the rear of the capacitor.

Bend the wire coming from the 80-meter terminal of the coil out at a right angle to the coil so that when the coil is remounted it will point toward capacitors C22, C23, and C24. Also, solder a length of #18 AWG enamel-covered wire to the 80-meter coil terminal. Wind 35 turns of this #18 wire on the form between the 80-meter coil terminal and the new terminal at the end of the coil, in the same direction as the original coil. Again, this section will have to be scramble-wound to fit in the space. Make sure that this wire does not touch either mounting lug at the end of the coil. Solder both terminals.

Attach a length of insulated #12 AWG wire to the new terminal and bend it so that it will fit through the opening in the chassis to the switch when the coil is remounted. Then reinstall the coil.

An extension may have to be soldered onto the wire from capacitors C22, C23, and C24 so that it can be soldered to the new terminal. Also, solder the wire from the low-pass filter to the new terminal. Under the chassis, solder all the wires back to the switch in the same order in which they were unsoldered. The new wire from the new coil terminal is soldered to the 80-meter switch terminal.

Make sure the wire from the 80-meter terminal on the coil is not touching the

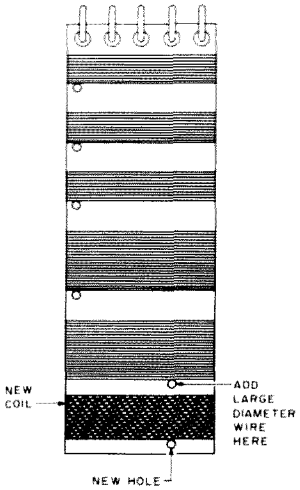

Fig. 1. Modification of L2.

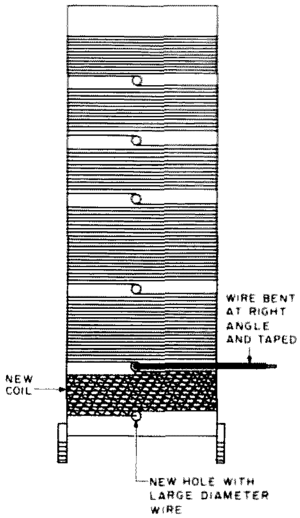

Fig. 2. Modification of L3.

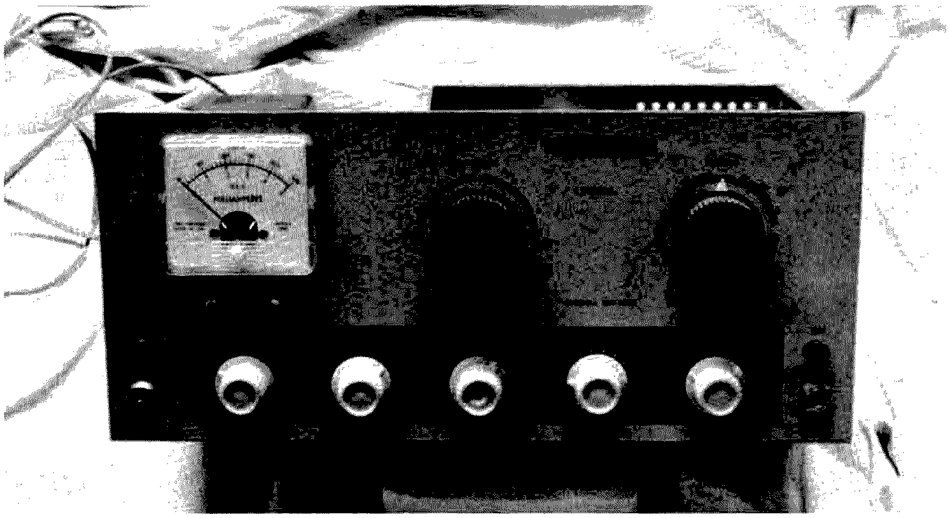

Photo C. A front view of the DX-60B with its top cover removed.

capacitors or ground. A small piece of plastic electrical tape can be placed over the exposed end of the wire, and then the wire can be bent under the coil.

Locate the 68-pF capacitor (C21) under the chassis. This capacitor is connected from the bandswitch. Place a 50-pF capacitor in parallel with this capacitor.

This completes the conversion. If the transmitter does not load correctly on 160 meters, an additional capacitance may be needed across capacitors C22, C23, and C24. This capacitor can be soldered from the terminal of one of the capacitors directly to the frame of the capacitor. Try about 500 pF at 1000 working volts to start.

The transmitter will now work on all bands indicated on the front panel bandswitch, except that the 80-meter position will now be the 160-meter position. (Of course, if the capacitor was added across C22, C23. and C24, it will have to be removed to restore correct loading on the other bands.)

To resurrect 80-meter operation, three steps must be taken. A shorting wire must be connected from the junction of the new coil and the original coil of L2 to the 80-meter terminal on the bandswitch. The wire from the 80-meter terminal of coil L3, which was bent and taped, must be connected to the wire from capacitors C22, C23, and C24 to the coil. And the 50-pF capacitor must be removed from across the 68-pF capacitor near the bandswitch.

Let's get back to 160-meter operation. Install a 160-meter crystal in any one of the four crystal positions. Connect a dummy load of 50-Ohm impedance to the antenna jack at the back of the transmitter. After the set warms up in the standby position, check to make sure you have the crystal selector switch in the correct position. Set the drive level to about 2½ on the front panel. The final tuning capacitor should be set in the 80-meter region, and the final loading capacitor should be turned fully counterclockwise. Set the meter switch to the grid position and turn the function switch to tune. Quickly rotate the drive tuning control for maximum grid reading, then set this reading to 2.5 mA on the meter using the drive level control. At this point, use a good receiver to check the output of the oscillator. Listen on the 160-meter band for the purity of the oscillation and then check 80 meters for the harmonic, which should be down in signal strength from the primary frequency on 160 meters. If for some reason there was a wiring error in the conversion of the driver tuned circuit (L2), it is possible that the driver could be acting as a doubler and putting out most of its signal in the 80-meter region. Therefore, if the 80-meter signal is stronger than the 160-meter signal, go back and check the wiring of L2. (As a point of fact, Heathkit suggests the use of 160-meter crystals in this transmitter for use on the 80-meter band—before modification, of course.)

If all seems to check out all right up to this point, you can proceed with the tune-up.

Set the meter switch to the plate position and turn the function switch to the AM position. Quickly rotate the final tuning control to obtain a dip or minimum plate-current reading on the meter. Next, set the function switch to the CW position and, while maintaining minimum plate current with the final tuning control, start increasing the loading with the final loading control. With an indication of 100 mA, the transmitter will be running at 75 Watts input, and with a reading of 150 mA, the input power will be 90 Watts. At this point, if you cannot get sufficient loading to achieve the desired input power, that capacitor which we discussed before will have to be added across capacitors C22, C23, and C24. Begin with either 500 pF or 1000 pF at about 1000 working volts. This should allow you to load the transmitter to its maximum power.

After you have the loading straightened out, again switch the meter switch to grid position and set the drive level to 2.5 mA on the meter. Again, check the plate current and reset your dip with the final tuning control. Then set the function switch to standby.

To transmit on CW, merely insert a key in the key jack, and when you are ready to transmit, switch the function control to the CW position.

To transmit on AM phone, remove the key and connect a high-impedance microphone to the microphone jack. When ready to transmit, turn the function switch to the AM position.

I've had many happy hours operating the DX-60B on 160 meters and I am sure you will, too. With the use of the proper antenna, it will perform beautifully and give you a signal you can be proud to radiate.

The one drawback to the rig as described in this article is that it is crystal controlled. I have added a home-brew vfo which can be plugged right into the DX-60B, and with this accessory, operation was made much more pleasant and contacts became easier to initiate. In a future article, I will describe this vfo, which cost only a few dollars to construct, but added so much to the rig.

But, even when you are rockbound, the DX-60B can give you many enjoyable hours exploring the "top band."■

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Forward into the Past!

—a solid-state restoration project for a vintage BC receiver

What do you do when you have an old broadcast receiver mounted in a beautiful console cabinet and you can't buy tubes for it? Why, you convert it to solid state!

A friend approached me with just such a project. He had a Philco broadcast and shortwave receiver, one that his grandfather had used when living on a farm. It was battery-operated, using 1.4-volt series tubes, but powered from a six-volt storage battery and deriving its plate voltage by means of a vibrator. He wanted its appearance unchanged. That meant leaving the tubes (all shot) in their sockets. It also meant using the original coils and tuning capacitors, as he wanted the dial calibration to remain meaningful.

After some hesitation, I undertook the job. The actual man-hours were not recorded, but they would not truly be indicative of the task, because I pursued many false trails before arriving at the circuit ultimately used.

The original circuit is shown in Fig. 1. You'll note that it shows a somewhat conventional superheterodyne configuration, remarkable only in several oddball quirks. One of these, introduced for reasons known only to God and the Philco engineers, is the application of a direct-current bias to two 0.05-uF capacitors. Another, is a third winding on the second intermediate-frequency transformer which carries bias to the screen-grid of the tube in that stage. A semi-educated guess would be that this provided neutralization for the stage.

In common with the usual design of battery-powered receivers of its day, this one derived grid bias voltage from the IR drop across tube filaments. This feature necessitated a complete redesign of biasing circuits, including that of the agc bus.

The job was tackled in three stages. Really, four, if you count the power supply. I took the coward's way out, and bought one from Radio Shack! (It was their catalog no. 22-124.)

The first element is illustrated in Fig. 2, which shows the frequency-conversion stage only. This stage required more work than all others combined. It was a hellcat, pure and simple! The difficulty lay in getting the oscillator to perform properly over the desired frequency spectrum.

As shown, the original converter tube was replaced by two transistors, one as the "first detector" (as we used to call them) and the other as the local oscillator. The original

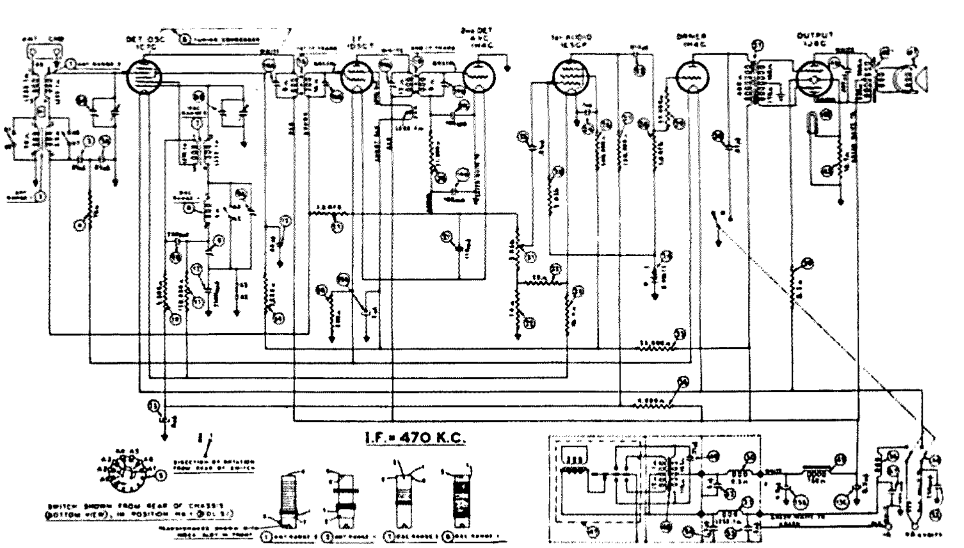

Fig. 1.

coils, padders, trimmers, and variable capacitors were used without modification. And that created a problem!

You might think, as I did, that modern active devices, with their much-superior mutual conductance, would oscillate with the greatest of alacrity. Hah! After trying the hottest bipolars, the hottest junction field-effect, and a variety of insulated-gate field-effect transistors, I ended up with one of the latter. Both gates were paralleled. This one, suitably cajoled, oscillated with vigor at mid-frequencies and with enervation at either extreme. But it did oscillate! That is, it performed satisfactorily on the BC MF band, but poorly on the HF band. It had too much feedback on that frequency range. A 40k-Ohm resistor across the gate coil brought the oscillations under control.

Note that the drain voltage of the oscillator is regulated at nine volts by means of a zener diode. Also note the use of two rf chokes in series, one of 2.5 mH and one of 30 mH. Two are needed for the frequency range, which is from 0.55 MHz to 18 MHz. The associated capacitor (9B in the original circuit) is a part of the frequency-determining circuit, and a very high impedance is required at the "top end" of the cascaded rf chokes.

Two bypass capacitors are used across the source bias resistor to ensure a low reactance to either HF or MF current.

You may question the use of a loading resistor across the secondary of the first i-f transformer. It does tame the wildness of the stage, and introduces only a moderate deterioration of selectivity. There's a certain amount of regeneration in the stage, which tends to provide enhanced selectivity.

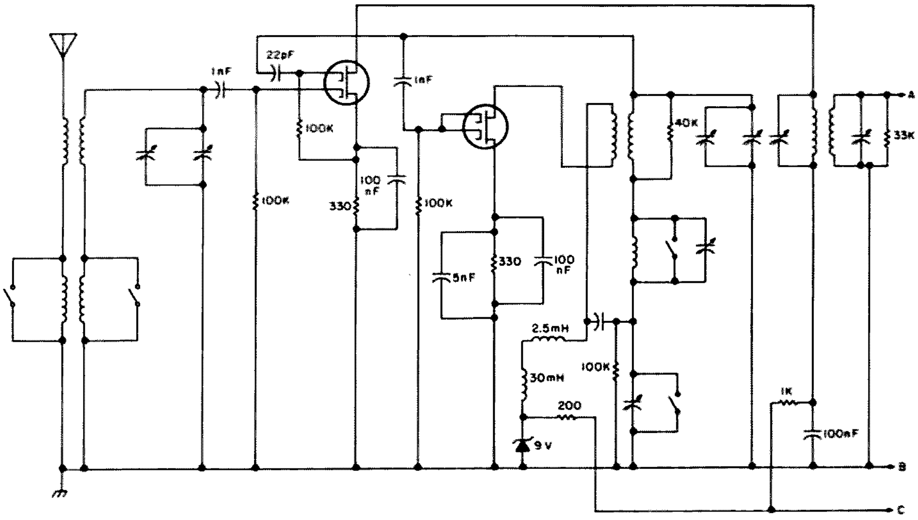

Fig. 2. The dual-band antenna and local oscillator section, plus the first i-f transformer. The FETs may be RCA 40673, ECG 222, or Motorola F2004. The zener diode is a Motorola Z0412. Parts not identified are original components. The 6-pole single-throw switch is the bandswitch.

Fig. 3 shows the i-f stage, the "second detector," and the first af stage. Note the use of 100-Ohm series resistors for the drain and #1 gate of the active device. These, plus the 10k-Ohm resistor in parallel with the primary of the second i-f transformer, are needed to curb a tendency to oscillate. One can understand the use of that third winding on the transformer!

A signal diode is used for the second detector. The two 100-pF capacitors and their associated 51k-Ohm resistor are contained within the can of the original i-f transformer. Both af and agc voltages are taken off the hot side of a 0.5-megohm resistor.

For the first af stage, a dual set of coupling (isolation) capacitors is employed. The smaller one couples from the high impedance of the agc resistor; the larger one couples from the low impedance of the volume control to the input of the bipolar transistor. The value of the 15k-Ohm resistor forming a part of the biasing network was determined by an empirical method. A sine wave audio signal was introduced into the input circuit at a low level. The waveform at the stage's output was observed on an

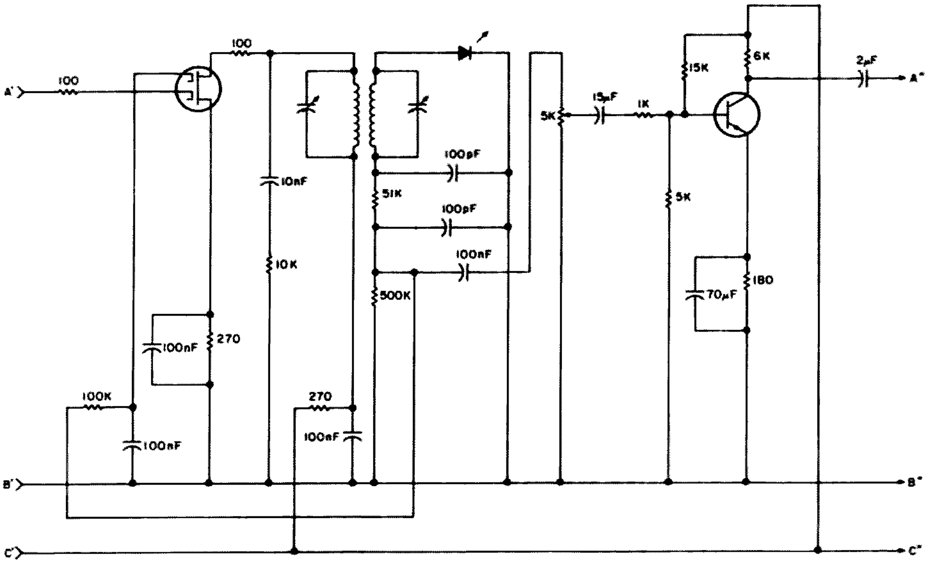

Fig. 3. Intermediate-frequency amplifier, demodulator, and first audio amplifier stages. The FETs may be 40673, ECG 222, or Motorola F2004. Any signal diode will suffice for the demodulator. Try various NPN bipolar transistors to select one for best gain and lowest noise, then adjust bias for best fidelity.

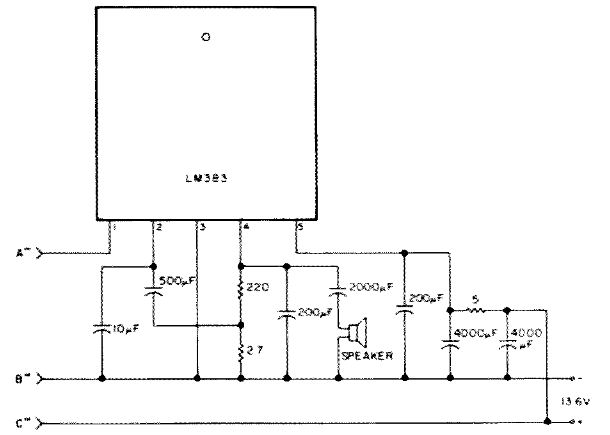

Fig. 4. Audio power amplifier uses Radio Shack LM383.

oscilloscope. Then the level of the input signal was advanced until distortion was observed on an audio voltage crest. The value of the resistor was adjusted until, when overloaded with audio input, the stage went into limiting simultaneously on both positive-going and negative-going peaks.

It was noticed that this stage developed an excessive hum when the gain control was set at zero signal input. The addition of a 1k-Ohm resistor in series with the gate cured the hum.

An audio power amplifier IC seemed the logical way to go for the final stage. The LM383, Radio Shack no. 276-703, looked like a reasonable choice; one was purchased and installed. It required a certain amount of fiddling before operation was satisfactory. It appeared that a very low output impedance was essential for its power supply; also, filtering requirements were rigorous. I added a pi-section low-pass filter of two 4000-uF capacitors, and a 5-Ohm resistor. This helped, but did not entirely eliminate, a residual hum. What remained had to be tolerated.

As mentioned previously, a 13.6-V power supply was procured from Radio Shack. Other than being slightly lacking in filtering, it seems to be quite adequate.

With all its frustrations, the job was interesting and very challenging. Some of the problems were solved by means surely not elegant—more by brute force than nicety.

A number of lessons were learned, some the hard way! For instance, it pays to experiment with a number of bipolar transistors even in an audio stage. The differences in behavior were marked. There seems to be little difference among RCA 40673, Sylvania ECG 222, and Motorola HEP F2004 dual-gate insulated-gate FETs.

Don't be tempted to use any 40-year-old capacitors! Be suspicious of old resistors, too. Be lavish with contact cleaning spray. Don't attempt to use a bipolar transistor with a coil-plus-capacitor combination designed for use with a vacuum tube.

And, above all, don't hesitate tackling a conversion job. It can be done! (The owner agrees!)■

ADDSCAN

—now you can be two places at once

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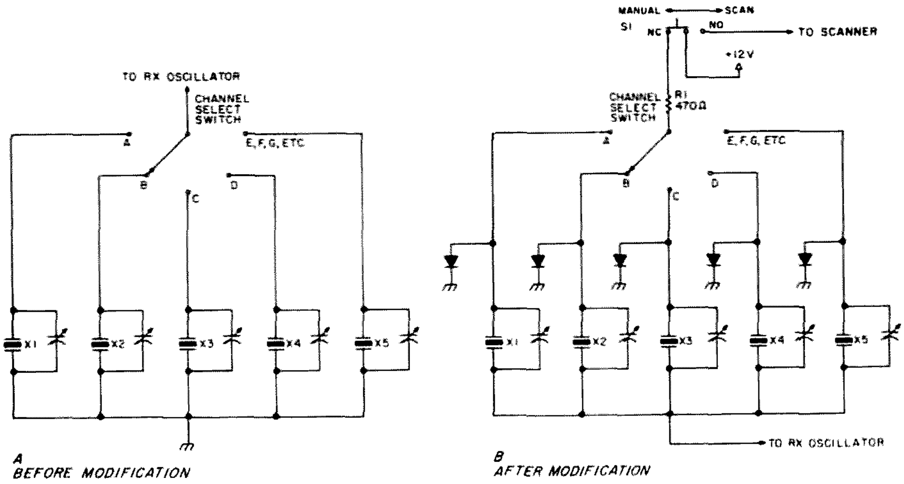

Fig. 1. (a) Crystal deck before modification. (b) After modification.

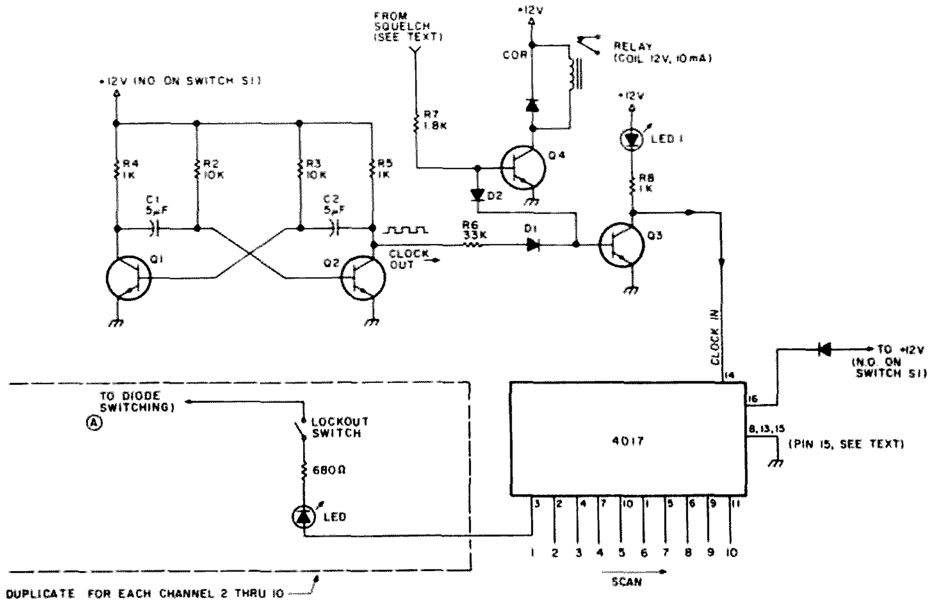

Fig. 2. Scanner schematic.

One major drawback in owning an older crystal-controlled 2-meter rig is having to listen only to whatever you have your channel selector turned to. The end result is missed contacts and a very tired hand from switching the channel selector switch back and forth. After staring at the front of my rig and scratching my head in frustration, a thought occurred to me: "Hmm, a scanner would be nice . . ."

The features of this scanner include LED indication of the active channel, channel-lockout switches, and an LED busy-channel indicator/COR. Junk-box-variety components can be used, although not everyone has a 4017 counter chip lying around his junk box. All transistors are 2N2222s, diodes are 1N914s, and LEDs are whatever looks nice. I built my prototype on perfboard; construction is fairly straightforward. The scanner consists of 4 main sections: clock, inverter/COR, counter, and diode crystal switching.

Converting the crystal deck in the receiver to im-

plement diode switching is the first thing on the agenda. This not only will make it possible to connect up the scanner, but also will make it possible for remote switching of channels if desired, as switching is accomplished by switching a voltage rather than the oscillator leads themselves.

This conversion will work on almost any rig in which RX oscillator crystals have one side grounded, as do my Wilson WE-224 and most other makes. On most rigs, this ground is one long common-to-all-crystals bus —see Fig. 1(a).

First, lift the ground connection from this bus. If the ground is made via the screwheads from the screws that hold the deck in, you may have to file some foil away around them. Next, disconnect the RX oscillator input lead from the channel-selector-switch wiper and connect this lead to the common bus for the crystals that you just finished isolating from ground. Now, connect a 470-Ohm resistor between the wiper on the channel-select switch and the NC connection on S1.

Installation of the switching diodes is next—see Fig. 1(b). Connect the cathode end of each diode to the side of each crystal that connects to the channel-selector switch and bus all of the anodes to ground. Keep all leads short. Find a +12-volt source in your radio and connect the wiper of S1 to it. If everything checks out so far, connect the radio to power and fire it up —it should work normally. Disconnect power.

The inverter/COR consists of Q3 and Q4. Transistor Q3 supplies pulses to the counter from the clock and keeps the clock pulses from advancing the counter when a squelch voltage appears. Since a squelch voltage from the radio is necessary to stop the scanning when a signal is present, now's a good time to pull out your schematic, if you haven't already. Find the squelch section. Most FM transceivers have a "noise" squelch, in which "noise" present at the discriminator is amplified and rectified into a dc bias voltage to turn a transistor "on," squelching the receiver. When a signal is present, the noise at the discriminator "quiets," removing the bias and unsquelching the receiver. Locate this switching transistor and find its collector. This is where the squelch voltage for the scanner is taken. Transistor Q4 is the optional COR and can be omitted if not needed. Or, leave it in to sound a buzzer, key a transmitter, or whatever.

The clock consists of Q1-Q2, which is an astable multivibrator whose frequency is determined by the time constant of the 10k resistor and 5-uF capacitor. With these values, the clock runs at about 15 Hz, which is about one and a half scans a second if 10 channels of scan are implemented. A 555 timer could have been substituted for the clock to lower the parts count, but I didn't have one lying around the shack at the time and I'm a cheapskate, anyway.

The 4017 CMOS counter/divider does the counting. For each positive-going pulse from Q3, it advances 1 count. When it reaches count 10, it resets and starts over. The 4017 is a nifty chip in that it has a special "reset" pin. Using this feature, it is possible to use it not only as a count-to-ten counter, but also as a ÷9, ÷8, ÷7, etc. For example: If your rig has only 6 channels, take count 7 (pin 5) and connect it to the reset terminal (pin 15). In this way, it will scan to 6, then reset on the seventh count. If you want your rig to scan 10 channels, simply ground the reset pin.

Theory of Operation

The output of clock Q1-Q2 is fed into the base of inverter Q3. The output of Q3 goes high with every low count of the clock. The output of Q3 is fed into the 4017 counter, and for each count of the clock in which the output of Q3 goes from low (about 1 V) to high (12 V), the counter advances its count by 1, making it "scan." Each output of the counter is connected through an LED, lockout switch, limit resistor, and switching diode to ground. As each output goes high, each respective switching diode is forward biased, effectively grounding one side of the crystal, connecting the crystal momentarily to the RX oscillator circuit. If there is a signal on that channel, there will be a voltage available at the squelch circuit. This squelch voltage will make Q3 conduct, forcing Q3's output to stay low, which stops the 4017 from advancing with the clock to the next count and locking it on the active channel. Diodes D1-D2 isolate the clock voltage from the squelch and vice versa. LED 1 is just a visual indication that the clock is counting during scanner operation and works as a carrier indicator when the scanner is disabled.

Conclusion

Why listen to one channel at a time when you can listen to ten at a time? This setup is especially nice on business and vacation trips when you don't know which channels are used locally. Monitor them all and find out! ■

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Flat Cells are No Fun!

—build a battery status monitor

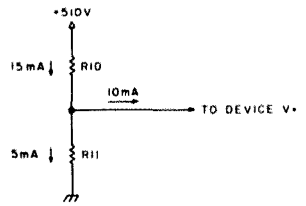

Fig. 1. 510 V/15 mA = R10 + R11 = 34k. R10 = (510 volts − 10 volts)/15 mA ≈ 33k; R11 = 34k −33k = 1k. Therefore, R10 = 33k and R11 = 1k.

With the sales of two-meter rigs on the rise (most powered by 12 V dc), many hams are finding themselves with a great deal of battery-operated equipment around the shack. Sure, many of us have 12-volt power supplies that can almost be used for arc welding, but quite a few people have battery back-up for emergency service. Add calculators, radios, digital voltmeters, clocks, toys, tape recorders, and photographic equipment and you have a scene that makes Eveready grin from ear to ear.

The pilot light/voltage monitor will not extend the life of or eliminate the need for any batteries. What it *will* do is give you plenty of warning that the old power source just ain't what she used to be. As an added bonus, it will tell you that the device is on, and it will do it at very little cost.

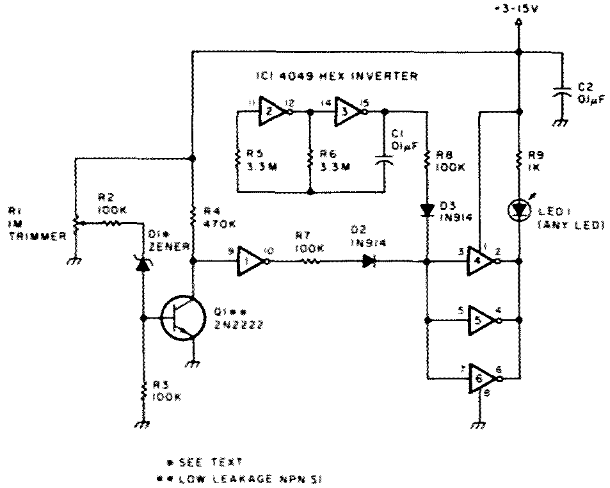

Fig. 2. Pilot light/voltage monitor.

Circuit Operation

Trimmer resistor R1 sets the voltage threshold of the device. As long as the voltage applied to the circuit is greater than this threshold, zener diode D1 will conduct, causing transistor Q1 to saturate. This keeps pin 10 of inverter 1 in a logic 1 or high-voltage state.

Inverters 2 and 3 form a low-frequency oscillator (2 Hz or so) which would normally cause the LED to blink at a slow rate. The LED will not blink, however, as long as pin 10 remains high. The reason for this is that diodes D2 and D3 form an OR gate and inverter 1 continuously applies a 1 to D2, which passes (ORs) the continuous 1 to light the LED regardless of D3's input.

When the voltage falls below the voltage threshold, pin 10 falls to logic 0 (about zero volts). With the constant 1 removed from D2, the pulses from inverters 2 and 3 are ORed through D3 and the LED will flash. The flash rate can be adjusted by changing C1, R5, or R6.

Construction and Component Substitution

Almost any type of construction can be used including printed circuit or perfboard. The only restriction is that the LED must be placed in a position that is clearly visible.

The value of the zener is not critical. Its voltage

rating must be less than the voltage threshold that you wish to have, however. You can't fire a 5-volt zener with 3 volts. Ideally, the zener should have a sharp knee, but the prototype worked with any one that was tried.

By itself, the pilot light/voltage monitor will operate from about 3 volts to 15 volts. Much higher voltages can be monitored by using a voltage divider. Do not try to regulate the voltage divider!

For example, assume that you wished to monitor a 510-volt flash battery. Calculate R10 and R11 as shown in Fig. 1.

Works nicely on paper, doesn't it? Well, it would work if you can afford 15 mA. Stop and calculate the power drawn from the battery. 510 V × 0.015 A = 7.65 Watts!

Which brings me to my final point. The device needs about 10 mA to operate. A voltage divider needs a few mA. Make sure you can spare the current! A nine-volt transistor radio battery cannot spare 10 mA. AA, C, or D cells can. Nicads or a car battery certainly can. As a wise man once said, "Look before you solder," or something to that effect.

Adjustment

Adjustment is quite simple. Using a variable power supply or a voltage divider, adjust the voltage to your desired threshold. Turn the trimmer pot, R1, until the LED is constantly on. Slowly back the pot off until the LED begins to blink. Try raising and lowering the supply voltage to make sure the device operates at the desired threshold.

As an added precaution against battery failure, buy some stock in a good battery company. ■

When Plus Goes Minus

—a 555-based negative power supply

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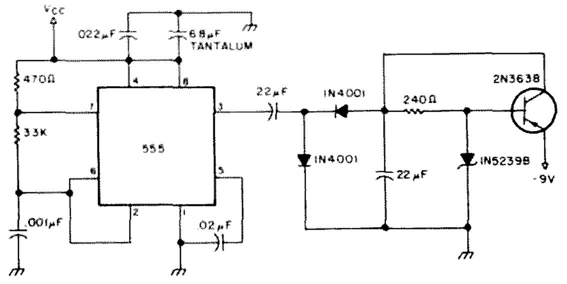

Fig. 1. Original −9-volt power supply.

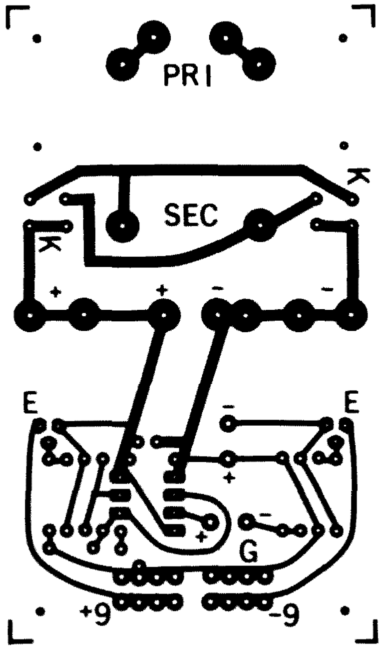

Fig. 2. PC board layout.

Recently, I had to make an extensive modification to a number of identical pieces of equipment. As a result of the modification, the power supply in these sets, which had originally been designed to furnish only regulated 5 volts, had to be revised to also deliver +9 volts and −9 volts. The ±9-volt supplies did not require as stiff regulation as the 5-volt line, and the current demand for the two supplies was less than 20 mils.

Since rebuilding the power supply by replacing the power transformer with one which had windings of the correct voltages for the three supplies and adding the components for complete power supplies would be costly in time, material, and space, I looked for a more economical way to obtain the plus and minus

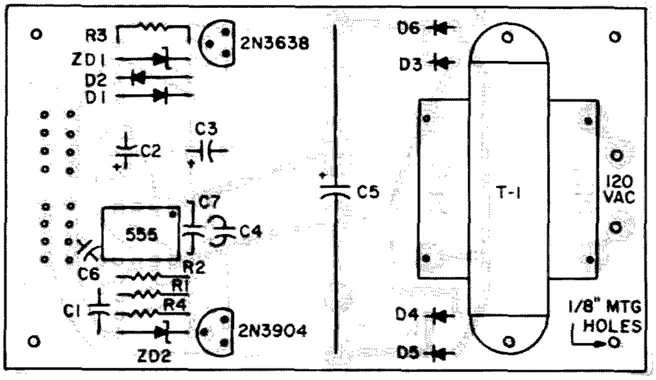

Fig. 3. Component layout.

supplies.

As the input voltage to the 5-volt regulator (at the filter capacitor) was about 12 volts, the positive 9 volts could be obtained by connecting a series resistor and a zener diode to the filter capacitor. This became the +9-volt power supply for the cost of two small components.

Now to the remaining problem, a −9-volt supply. There have been a number of dc-to-dc power supplies made where a low dc voltage is transformed into a higher dc voltage. Usually this is done by using the low dc voltage to power an audio oscillator and then raising the output voltage of the oscillator to the desired level with an audio transformer. This voltage is then rectified and filtered and becomes the dc output voltage.

Although the circuit is usually used to manufacture a voltage of the same polarity as the original supply voltage, there isn't any reason why one couldn't recover a voltage of the opposite polarity.

The entire problem was even simpler than it first appeared. Since the 12 volts at the filter capacitor could be used to power the audio oscillator and give an output voltage close to 12 volts from the circuit, there would be no need to use an audio transformer to boost the voltage. This kept the required number of components to a minimum and saved some space. Once again, a series resistor and a zener diode would be used to establish the −9-volt level.

A circuit was designed for the −9-volt supply using the well-known 555 IC timer as the audio oscillator. See Fig. 1. The 555 is able to supply currents of up to 150 mA, so it is operating well within its ratings at 20 mA. The output voltage is 1½ to 2 volts less than the supply voltage at pin 8 (and inverted), but still high enough that a stable −9 volts can be obtained with a Vcc of 12 volts. To ensure that a varying load would not upset the regulation of the zener diode, a 2N3638 transistor was added to the circuit to carry the load current. As the load current flows through the transistor rather than the series resistor, the voltage across the zener diode remains very constant. The regulation of the −9-volt supply is very good.

The 555 audio oscillator was designed to operate at over 20 kHz in this circuit, so filtering requirements would be minimized. The purpose of the parallel combination of a 0.022-uF disc capacitor and a 6.8-uF tantalum capacitor at pin 8 of the 555 is to suppress the extraneous pulses usually emitted by a 555. These, or a similar combination of capacitors, really control the unwanted pulses. The two capacitors have to be connected close to pin 8 to be effective.

The positive and negative 9-volt supplies were built on a small printed circuit board and placed in the equipment cabinets with a minimum of problems. The negative power supply proved so effective and trouble-free that I later constructed a positive and negative 9-volt power supply to replace those ±9-volt battery combinations frequently called for with many op amp circuits.

I used a 12-volt power transformer sold by Radio Shack, along with a number of other Radio Shack parts, and built the supply on a 2" × 3.5" single-sided printed circuit board. Fig. 2 is the foil pattern for this power supply and Fig. 3 is the component layout. Fig. 4 is the schematic of the positive and negative power supply.

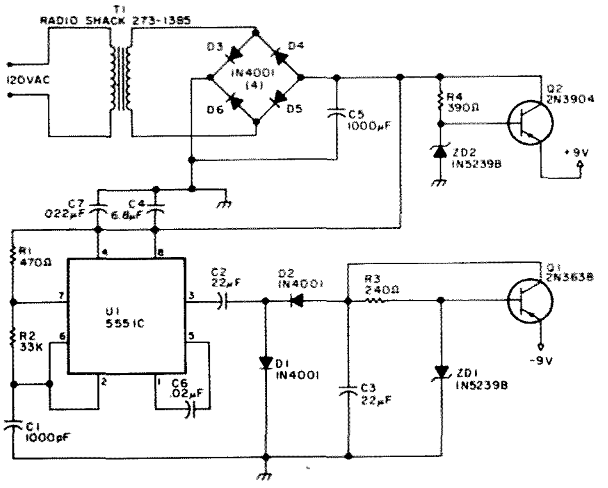

Fig. 4. Complete plus and minus 9-volt power supply.

The transistors shown in the plus and minus regulators can be replaced by others with a higher current rating if one wants to draw more current from either supply. The 555 will furnish about 60-70 mA with the components shown in Fig. 4. About the same amount of current can be taken simultaneously from the positive regulator without overloading the transformer.■

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Depolarize that Power Supply!

—positive or negative grounds won't bother you any more

Being in the 2-way radio service business, I see many of the same failures over and over again. One of the more common is the case of reversed power polarity, particularly in mobile installations. Avoidable? Sometimes, yes, certainly, when due to lack of attention during the installation. Sometimes there is confusion about which is the "hot" lead—the red or the black. Sometimes, the problem just isn't avoidable, e.g., when the radio is to be swapped among vehicles. For some reason, the problem seems most often to afflict hams who take their radios along on business trips and get power from the cigarette lighters in rented cars.

The problem prompted design of a simple modification which steers the proper polarity to the radio while at the same time avoids shorting the battery—which blows the fuse if present or the wiring if a fuse is not present.

Radios come in two flavors, as far as power polarity is concerned: dedicated ground (usually described as "12-V negative ground only" or equivalent) and floating ground (usually described as "12-V positive or negative ground" or equivalent). The only technical difference is whether or not one of the power leads—usually the negative—is connected to the radio chassis. Some radios have only a single power terminal (usually the positive) with the return made through the case and mounting hardware to the vehicle frame. These can be used only in negative-ground systems unless modified as described below. The Midland 13-513 synthesized 220-MHz rig is one popular radio which is designed for negative ground only.

The other, so-called "non-polarized" types of radios have floating power inputs in which both the positive and the negative power leads are dc-isolated from the chassis. As long as the positive lead goes to B+ and the negative lead goes to B−, all is well. One of these connections is most conveniently made via the vehicle frame; *which* connection may be so-made depends on whether the vehicle has a positive or negative ground electrical system, and which connection *actually is* made may not be clear when using a cigarette lighter plug—especially if the power cord coming from it is all one color.

The polarity-protection modification is slightly different for a dedicated-ground radio than for a floating-ground radio. To determine what kind of radio you have, measure the resistance between each of the power leads and the chassis. This test

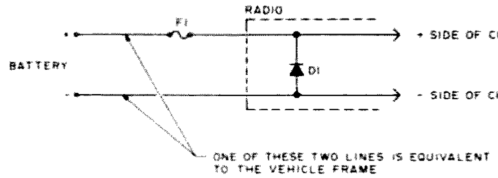
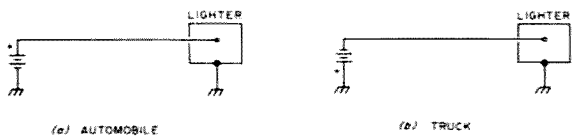


Fig. 1. Typical primary power circuit.



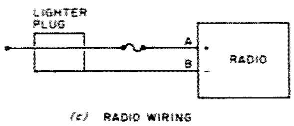


Fig. 2. Classic cause of reversed polarity. (a) Automobile. (b) Truck. (c) Radio wiring.

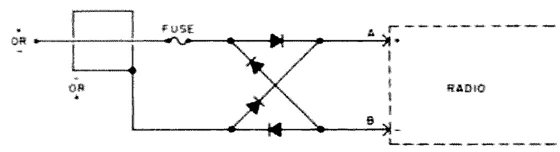


Fig. 3. Depolarizing circuit. Diodes should have a current rating greater than the fuse value.

should be made with the radio out of the vehicle, and the power switch ON. If either terminal shows direct continuity, you have a dedicated-ground radio.

The basic primary power supply for a typical mobile radio looks something like Fig. 1. If battery polarity is correct, the diode is back-biased and looks like an open circuit. If the polarity is reversed, the diode is forward-biased and looks like a short circuit. This presumably blows the fuse and protects the radio. (If the forward current rating of the diode is greater than the fuse value, the fuse may blow before the diode itself is damaged. This is not always the case, however, and even a brief period of reversed polarity may cause the diode to open, leaving the radio with no protection.) The diode in Fig. 1 is often called the "protective diode."

What we'd like to do comes down to the situation shown in Fig. 2. We'd like to take the radio with its power cord shown in Fig. 2(c), plug it into either of the cigarette lighter sockets in Fig. 2(a) or Fig. 2(b), and have it work properly. The cigarette lighter is shown for example only; the same principles apply if a slide mount or hard wiring is used. The ground symbol is used to denote the vehicle frame because this is, in fact, the way vehicles are wired.

What we need to do is to come up with a way such that no matter what the polarity is at the lighter socket, the radio will see B+ on lead A in Fig. 2(c), and B− on lead B in Fig. 2(c). This is done quite simply by arranging four steering diodes in a bridge, as shown in Fig. 3.

The diodes are not critical, but they must be able to carry the current drawn by the radio in the worst case. Any of the 1N4000-series diodes will work well for radios up to 10 Watts or so. It is best if the diodes have a forward-current capacity of perhaps twice the fuse value, just in case of a catastrophic short in the radio. This will help ensure that the fuse blows before any diodes fail, and that there will be that many fewer parts to replace. Since the protective diode isn't needed any more, it can be cannibalized for use in the bridge.

The bridge may be built anywhere in the power line, inside the radio, or even inside the cigarette lighter plug. I favor building it inside the radio because it makes for neater external wiring and also assures that the bridge is between the fuse and the radio. This allows the fuse also to protect against breakdown in the bridge itself, which is not the case if the bridge is built into the lighter plug.

The battery voltage seen by the radio is reduced by about 1.5 volts (two diode drops), but performance has not been degraded on any of the radios I have so modified. The voltage reduction is only about 10%.

For floating-ground radios, that's all there is to it. For dedicated-ground radios, however, one additional modification is required to prevent a dc-return path through the antenna wiring, i.e., the coax shield. If you are using a magnetic mount (such that the shield doesn't touch the vehicle frame), this final step is not necessary. It is advised in any case, however, just for the additional protection. Dc-isolation in the coax can be achieved very simply by the use of a small capacitor as shown in Fig. 4. The capacitor will block dc power, but is transparent to rf. The value of the capacitor is not critical, but it should be a ceramic type for low rf loss.

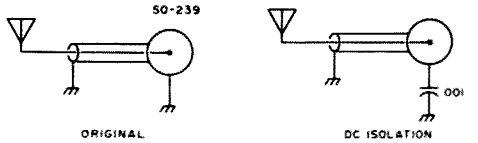


Fig. 4.

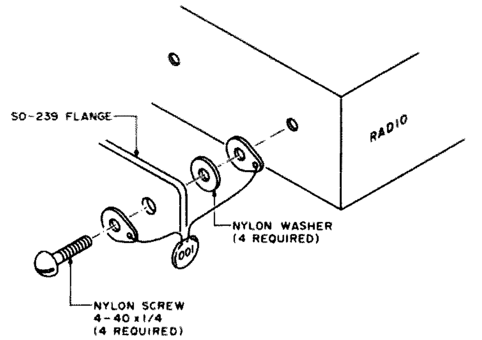


Fig. 5. Dc-isolation of standard SO-239 antenna jack.

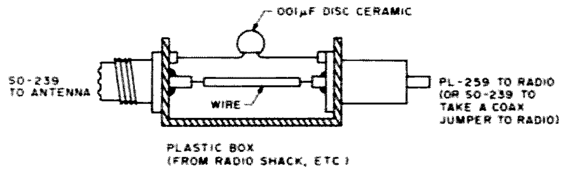


Fig. 6. Dc-isolation in antenna line.

The easiest way I have found to obtain this isolation with a standard SO-239 connector is as follows:

1. Remove the four metal screws holding the SO-239 flange to the radio chassis.

2. Install four nylon screws through the SO-239 flange, through nylon washers, to the case. Connect the capacitor across one of the nylon washers as shown in Fig. 5.

I have found that size 4-40 nylon machine screws fit the original sheet-metal screw holes very well, so nuts and lockwashers are not needed.

Some radios do not use the flanged SO-239 connector, and have a single-hole mount version of the SO-239. In this case, I suggest making a coupling as shown in Fig. 6. The plastic box can be very small and can be mounted right on the radio.

Keeping in mind that the objective is to keep the radio case isolated from power ground, it follows that the case must not be allowed to touch the vehicle frame. This can be done in a variety of ways, of which the simplest is just to lay the radio on the seat beside you. This is probably what you do anyway, when you often move it from one vehicle to another. For other mounting arrangements, appropriate substitution of nylon for metal hardware will do the job. In many newer vehicles, the dashboard is plastic so that you needn't worry about mounting the radio even if you use the standard metal hardware.

Finally, many radios have a power connector on the rear apron—not just wires coming out. If you build the diode bridge inside the radio, as recommended, you'll also be pro-

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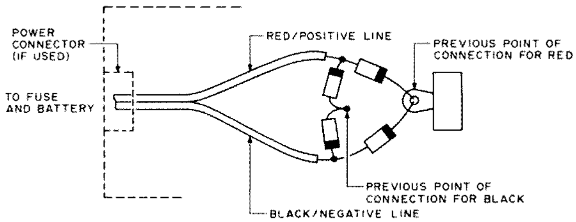

Fig. 7. How to add the bridge inside the radio.

tected even if the mating power connector is somehow reversed at the radio. A pictorial diagram of how to make the modification inside the radio is shown in Fig. 7. Here is a step-by-step procedure:

1. Remove the red and black leads from their termination points inside the radio.

2. Connect two diodes (banded end) to the point from which you removed the red (positive) lead.

3. Connect the free end of one diode to the red lead, the free end of the other diode to the black lead.

4. Connect two diodes (unbanded end) to the point from which you removed the black lead (this may be the chassis itself).

5. Connect the free end of one diode to the red lead, the free end of the other diode to the black lead.

And there you have a very simple modification which is impossible to defeat and will positively protect your equipment. The only remaining question, it seems to me, is why this isn't the way radios are built at the factory in the first place. ■

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Transform Noisy Fluorescents

—"temporary" solution

I had a very bad case of QRN recently, from an old fluorescent fixture in the operating room. I did not have time to replace the tubes in the fixture. It was in the middle of a DX contest, and the stores were closed for most of the contest weekend.

I noticed that most of the noise originated when the ac line dropped slightly below the rated 117 volts. So why not boost the ac input to the tired fluorescent lamp and for the time being eliminate the noise from the fixture?

For the moment, an old Variac™ was pressed into service and the noise disappeared.

It would be unwise to keep such an expensive setup in operation indefinitely for such a purpose, however, so this modification seems to represent a compromise between expediency and sound engineering practice. See Fig. 1.

This is recommended solely as a temporary cure, of course, but who is to say how long "temporary" is? ■

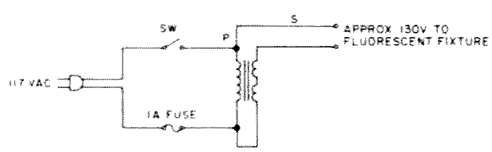

Fig. 1. The transformer can be any spare transformer that will supply approximately 10 to 12 volts ac. This can be accomplished by using a single winding, or by using two windings in series, such as 6.3 and 6.3 volts. In order to "add up," the windings must be properly polarized. Otherwise, a lowered voltage will result.

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Early Radio Detectors—A Backward Glance

—pulling rf from the ether was (and is) no easy trick

If you wondered why the more modern nomenclature, demodulators, is not used in the title, there's a reason. The very first detectors were simply that: means of detecting the presence of radio-frequency energy. Also, the use of the term indicates that this article will not be concerned with demodulators for frequency-modulated signals.

Heinrich Rudolf Hertz made the first and the simplest detector. He just bent a dipole antenna around into a circle, leaving a tiny air gap between the two ends. When radio-frequency energy of the frequency at which the (circular) dipole resonated was present, he could (in a dark room) see a minute spark.

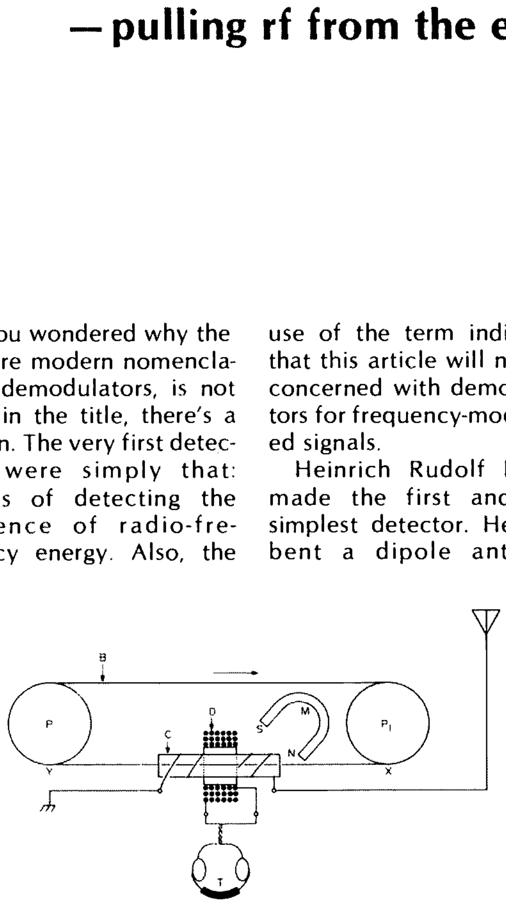

Fig. 1. The magnetic detector. An endless band (B) consisting of a number of fine strands of iron wire is passed over two pulleys, P and P1, one of which is turned slowly by clockwork. This causes the band to move in the direction indicated by the arrow. The band is made to pass through a small glass tube, C, around which is wound a single layer of insulated wire. This wire carries the incoming rf signal. The second coil, D, is wound over the solenoid. It conducts the recovered audio to the headphones, T. The magnet, M, is placed near the band, which moves from point X to point Y. Note that the north pole of the magnet is close to the band.

Edouard Branly gets the credit for the next step in the art of detecting the presence of radio waves. In 1890, he received a patent on a device which permitted the operation of a local relay by means of wireless waves. It was crude but good. The principle was elementary. A glass tube was filled with loose iron filings (later iron plus nickel), and wires were stuck into each end. The loose filings were a poor conductor of the direct-current voltage applied in a series circuit made up of the voltaic battery, a relay, and the iron filings, but when radio-frequency energy was routed through the glass tube, the filings stuck together (cohered). In that state, they conducted the direct current quite well, causing the relay to actuate. But if the radio-frequency energy was turned off, the filings remained cohered. If you wanted to detect the dots and dashes of radiotelegraphy, it was necessary to keep the filings agitated so that they would de-cohere as soon as the rf signal ceased. This problem was solved easily by using a buzzer with a clapper that tapped the coherer tube.

Crude as it was, Branly's coherer was used widely for many years. One reason for its continued use was the fact that the relay could be used to produce "hard copy." It was quite easy to have the relay actuate a pen poised over a strip of paper being pulled slowly underneath. Another reason for its continued use was the fierce competition between rival "wireless" communication companies. They shared no inventions. Each protected its

own. Not a one had a really good system, yet each had some devices that were superior to similar ones being used by other communication companies.

Curiously, the next four types of detectors were introduced rather closely together—approximately in the period between 1904 and 1906. The least known of these was the Marconi magnetic detector. It was a somewhat complex device. A loop of multi-strand iron wire was pulled by clockwork through a circular path that involved passing through a glass tube. (More on that glass tube later.) Just before the moving wire went into the glass tube, it passed through the magnetic field of the north pole of a permanent magnet. That magnetic field induced a weak south-pole type of magnetism into the small segment of wire immediately under it. The segment continued its way into the tube, to be followed, of course, with more magnetized segments.

The glass tube merits additional description. A single-layer coil was wound directly upon the tube. The two ends of this solenoid were attached to the radio-frequency tuner (or directly to the antenna and ground in the basic systems). Over the solenoid, another coil, one with many turns and many layers, was wound. A pair of headphones was attached to the multi-layer coil. As the magnetized wire was pulled through the tube, any "wireless" signal applied to the solenoid (which acted as a primary of a transformer having a single-turn secondary, the moving wire) induced a magnetic field into the wire. This field caused an abrupt reversal of the weak polarization of that segment of wire. The field created by this reversal cut the many turns of the multi-layer coil, creating a current that actuated the headphones.

This form of detector seems to have performed acceptably well on Marconi's system of wireless communication. It must be remembered that Marconi used only spark transmitters. These emitted discontinuous waves, Type B emission. There is no record of how it might have performed on voice-modulated, tone-modulated, or key-modulated continuous waves (Type A emission).

Another type of detector, this one a true demodulator, was the thermionic diode. It was discovered by Thomas A. Edison, who never pursued any possible application for his discovery. An English scientist, John Ambrose Fleming, was more imaginative. He recognized that the diode made an excellent rectifier for radio-frequency signals. It is not known just who first became aware of the fact that rectification enabled the demodulation of most types of radio signals. For some reason, the thermionic diode did not come into common use until the 1930s. It was, and is, an excellent detector. Perhaps it is the requirement of filament power that caused it to be ignored in favor of much less reliable types of signal rectifiers.

In this same time period, the electrolytic detector was introduced by some long-forgotten inventor. It used a tiny platinum wire, only 0.0002" in diameter, which was carefully lowered so as to just touch the surface of the liquid in a small cup. The liquid was either nitric or dilute sulphuric acid. Rectification took place at the junction between wire and acid. It was an effective detector, but it had one great drawback: It required a stable platform. That one fault ruled it out of the shipboard market, which was one of the best markets for wireless gear.

The last of the four, the crystal detector, seems to have been developed simultaneously by several persons, although Greenleaf Whittier Pickard often is given credit for its invention. There were many types of rectifying crystals used. Some detectors used two crystals in contact with each other. (One wonders if these were PN junctions?) Most used some variety of a point contact. Often this was the renowned "catwhisker," a small and springy wire, usually brass, that made tenuous contact with a spot on the surface of the crystal. The proper spot had to be found by careful search. Once found (and retained, an even more difficult undertaking!), it provided maximum audible signal from the incoming radio waves. A few varieties of crystals needed direct current through their junctions for best operation. It is quite possible that some of these actually oscillated, conceivably on the tunnel-diode principle. Such claims were made, although the principle of operation was only guessed at.

All of the multitude of crystal detectors shared one common characteristic: Their sensitivity varied inversely with their stability!

Coming several years after the introduction of the previously-mentioned detectors, the triode vacuum tube, Lee DeForest's famous audion, did not immediately displace the older types. There were several explanations. Audions were very hard to obtain. They were not sold outright, but came with DeForest equipment and were replaced (at a high price) only if the defective audion was returned! They also were expensive and had a life span that was unpredictable but all too often distressingly brief!

Audions were used in two differing types of detection techniques. One, the bias detector, required biasing the grid into a non-linear portion of the $E_c I_p$ curve. This form of demodulation did not provide maximum sensitivity, but did constitute a detector capable of coping with strong signals without causing excessive distortion. The most favored method of using a triode as a demodulator was as a "grid-leak detector." The actual principle of this type of operation was dual in nature. That is, the grid and cathode, in conjunction with the grid-blocking capacitor and the grid resistor, constituted a diode rectifier ("detector"). As these elements also were parts of the triode tube, they, plus the plate, also constituted an audio amplifier. The combination of detection and amplification in one vacuum tube resulted in sensitivity that far outstripped all competitors.

All rectifier-type demodulators worked satifactorily for receiving discontinuous-wave (spark) and modulated continuous-wave signals, but were useless for extracting intelligence from key-modulated (make-and-break modulation) continuous-wave radiotelegraph signals.

Continuous-wave signals were generated by several means. Probably the first was the Fessenden arc. Carefully-controlled arcs could produce an excellent continuous wave. So could the Alexanderson high-frequency alternator. The vacuum tube, after it became commonly available in the early 1920s, was the choice of both experimenters and commercial users for low-power and even medium-power continuous-wave generation, although arcs and alternators continued to be used in high-

powered stations for many years.

Perhaps the first attempt to "demodulate" continuous-wave radiotelegraphy was by use of a "tikker" (yes, that is the correct spelling!). Before describing just what a tikker is, let's consider why one was needed. When a continuous-wave signal is rectified, the result is a direct-current pulse the length of the dot or dash of CW radiotelegraphy. This is not suitable for actuating headphones or for audio amplification. The steady dc pulse must be transformed into some sort of audible signal. A simple way of doing this is to interrupt or break up that dc pulse several hundred times a second. That is what a tikker does. It's a mechanical interrupter.

Reginald Aubrey Fessenden invented the heterodyne detector. He used a low-power arc as a local oscillator. This continuous wave was combined in a non-linear device such as a crystal detector, with an incoming key-modulated continuous-wave signal. By making the former a few hundred Hz higher (or lower) in frequency than the latter, an audible beat note was produced.

A regenerative vacuum-tube detector can be operated in an oscillating state. Slightly detuned from the frequency of an incoming CW radiotelegraph signal by, say, 750 Hz, it develops its own heterodyne note. (This is called autodyne reception.) A regenerative detector therefore can be used to demodulate spark signals, tone-modulated continuous-wave signals, voice-modulated continuous-wave signals, and key-modulated continuous-wave signals. Truly it's the universal detector! ■

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Sheathe Thyself

—a cheap trick to pull on old rubber duckies

For over two years I have been the proud owner of a Wilson 1402-SM HT, and after an incredible amount of hard use and abuse, I have only two pet-

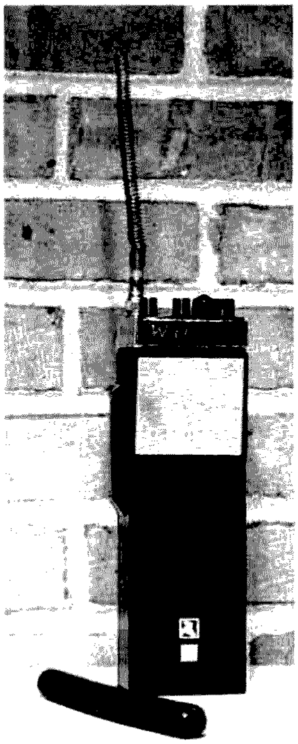

Photo A. Before. The beat-up rubber ducky before installing the replacement covering.

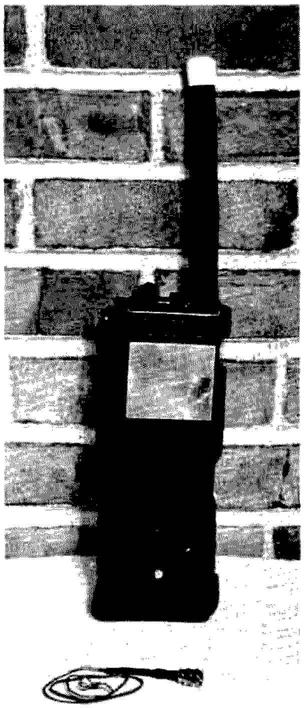

Photo B. After. The automotive hose is now in place, with the 17¢ PVC pipe cap glued over the open end. Note the compact size of the rolled-up "Floppy Duck" (bottom).

ty gripes: (a) the funny little round accessory connector that steadfastly refuses to mate with anything in my junk box, and (b) the early-model rubber flex antenna. More about (a) another time.

Please note that it isn't the pesky "F" connector that I'm complaining about. I know some hams prefer to replace it with a BNC-type, but I've never had any trouble with it. One good feature is that it allows you to match up your HT to all kinds of inexpensive cable-TV hardware. My problem was more basic—the relatively fragile skin of the rubber ducky itself.

After a couple of months of hard use, the antenna started to assume an odd angle when mounted on the rig, and the rubber skin began to look twisted and lumpy. Finally, pieces of the skin began to peel off, exposing the helical copper coils inside. The antenna still worked fine, but it looked terrible and the exposed end began to snag on clothing and poke passers-by in the face (Photo A). Small urchins would point and snicker and attempts to repair the damaged mess with silicone rubber weren't helpful. No matter how it was patched and dipped, it still looked as though it had been stuck in a pencil sharpener by mistake or used to flog armadillos.

The catalogs do list replacements, but at prices running upwards from ten dollars. The solution was a piece of heavy rubber automotive hose with an inside diameter of 3/8" (NAPA #H-176).

An 8" length of this costs fifty cents at a local parts store, but a piece probably could be scrounged for free at a friendly gas station. Of course, lighter neoprene tubing or plastic shrink material could work, but this stuff fits perfectly down over the "F" connector as well and is incredibly tough. Also, a standard ½" PVC pipe cap is a snug friction-fit over the top end (see Fig. 1).

Note that the hose fits flush against the top of the HT, completely covering the connector. To install or remove, simply pinch the tubing against the knurled fitting inside, and the whole thing unscrews as a unit. Rf

losses through the material are slight; I can still stand on a hilltop and work the VE3SSM repeater fifty miles away and performance is about the same as the original antenna or the bare spring.

For far-fringe operating, the "Floppy Duck" (Fig. 2) is just the ticket, especially for HTs like the Wilson 1402 which do not have an internal telescoping whip. All it is is a replacement "F" connector and a quarter wavelength of hookup wire which is the right gauge to make the bare conductor snugly fit the center hole of the female fitting on the HT. The wire is held in place with a dab of silicone rubber, and a piece of 1/8" staple is crimped over the insulation to hold it in place. A couple of scraps of shrink-tubing are slipped over the outer flange of the "F" fitting and shrunk in place with a light bulb. The resulting antenna can be rolled up to about the size of a stick of gum (see Photo B) and tucked away in a corner of the HT case until needed. Performance is dramatically better than with the rubber ducky, and the antenna can easily be taped to a bus or train window for operating while traveling. Cost is negligible; the connectors come in packs of two for 59¢ or so at stores like Radio Shack. ■

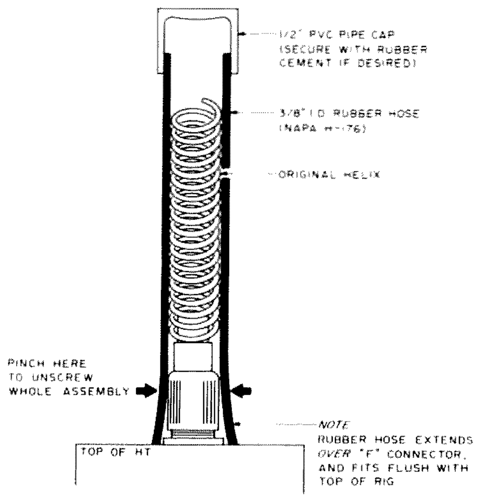

Fig. 1.

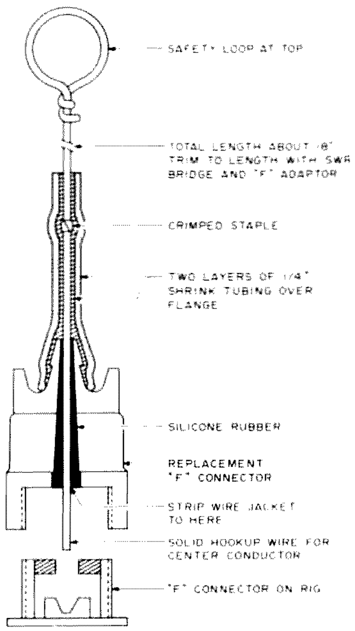

Fig. 2.

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CB to 10

—part XXVI: the Cobra 132

The latest changes in the FCC rules which prohibited the sale of new 23-channel CB sets has made quite a few of these sets available at very low prices. This was because the manufacturers had to unload their surplus and also because CBers wanted to move up to the new 40-channel models.

I have been reading with interest all of the articles in *73 Magazine* on conversion of CB sets to 10 meters. I had a Cobra 132 on the shelf which was built by a Japanese manufacturer for B & K. (The same manufacturer built very similar radios for other companies; they were the Tram Diamond-60 and the Browning LTD.)

With the 10-meter band being so open in recent months, and the number of QRP stations I have heard with great signals, many well over S-9, I decided that I would modify the Cobra and get in on the action from the mobile myself.

Before you attempt this mod, I highly recommend that you get a Sams Photofact.® This will give you all the needed information such as part locations and alignment test points and procedures. The one needed for this conversion is CB-54, June, 1974.

There were several objectives in my conversion. Number one was good 10-meter SSB coverage, and I chose 28.5 to 29.1 MHz. Next was to have continuous coverage with the vco, with enough overlap to cover the spacing caused by the former radio control channels which were located between several of the original 23 channels.

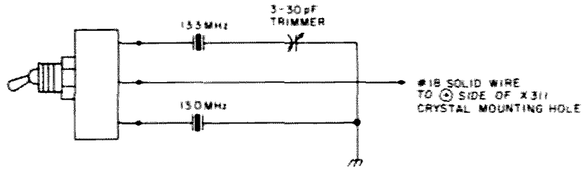

Fig. 1. Switch diagram.

This conversion is set up for the Cobra 132 mobile or the Cobra 135 base station radio, each of which uses the late-version synthesizer, PAC-4231. With the very close similarities of the Tram Diamond-60 and the Browning LTD, I am sure one can use the basics of this conversion to modify these sets up to 10 meters, also.

The parts that have to be changed are listed in Table 1.

To install the new local oscillator crystals that replace the X311, 12.8 MHz crystal, a miniature SPDT toggle switch and a 3-30 pF trimmer capacitor must be added. I will leave it up to you as to where you want to mount the switch. Once that is decided, install as per the switch diagram.

The next step is to enable the blank channel between 22 and 23. With the case off, place the set upside down with the channel selector set on this blank channel. If you look at the back wafer of the channel selector switch, you will see the notched-out portion of the switch. On my set there is a purple wire from the synthesizer board connected to the switch terminal that is supposed to enable this channel. Take a short piece of no. 18 wire and solder one end to the switch terminal. With the other end of this wire, form a contact on the center, bottom portion of the channel selector

Crystals	Remove	Install
X301	15.965 MHz	17.300 MHz
X302	16.015 MHz	17.350 MHz
X303	16.065 MHz	17.400 MHz
X304	16.115 MHz	17.450 MHz
X305	16.165 MHz	17.500 MHz
X306	16.215 MHz	17.550 MHz
X311*	12.8 MHz	13.0 MHz = 28.5-28.8 MHz range
		13.3 MHz = 28.8-29.1 MHz range

Table 1. Parts to be changed. (— See text.)*

Channel	Adjust	Frequency
1	C311	17.300 MHz
5	C309	17.350 MHz
9	C307	17.400 MHz
13	C305	17.450 MHz
17	C303	17.500 MHz
21	C302	17.550 MHz

Table 2.

switch. Glue this in place with a hot glue gun. Be careful not to get any glue on the contact portion of the switch. This may seem a bit crude, but it enabled me to get an extra 10 kHz of coverage that would have been lost unless I changed the whole channel switch.

On the synthesizer board, connect a short between TP302 and TP303, mode switch set to USB. Connect a frequency counter between TP303 and TP304. Adjust per Table 2.

Remove the frequency counter from between TP304 and TP303 and connect to TP309 and TP305. Set the Voice Lock for center frequency. Select the 13.0 MHz oscillator crystal and adjust L301 cw for the proper frequency. Select the 13.3 MHz crystal and adjust the 3-30 pF trimmer for the proper frequency.

Remove the short and the frequency counter. Connect up a dummy load wattmeter. Select channel 23, also select the lower oscillator crystal, AM mode, and adjust T301 through T305 for maximum out on transmit. Next, adjust T14, T15, L3, and C116 for maximum rf out.

Select USB mode, inject 10-mV 2-tone test signal to the audio input; and adjust L2, L5, T1, T2, T3, T4, T5, T6, T16, and L8 for maximum rf output. Adjust R136 for maximum power out, but observe proper linearity to prevent distortion. This is the ALC adjustment; you should have about 8- to 15-Watts PEP out. This completes the transmitter adjustment.

Next, tune in a weak signal source, NB off, and adjust T7, T8, T9, T10, and T11 for maximum sensitivity. The last adjustment is for the Voice Lock range. Adjust R331 and R326 almost maximum clockwise. Adjust R329 almost maximum counterclockwise. Don't go too far or some instability will occur. This wil give you about a 15-to-20-kHz range, which allows total overlap between channels.

Well, that's about it for the conversion. I am sure there are several other ways as far as crystal selection goes, but this one worked for me. The antenna I use is a base-loaded trunk-mount CB antenna that is retuned for 28.6. Good luck with your conversion; hope to work you QRP mobile on 10. 73.■

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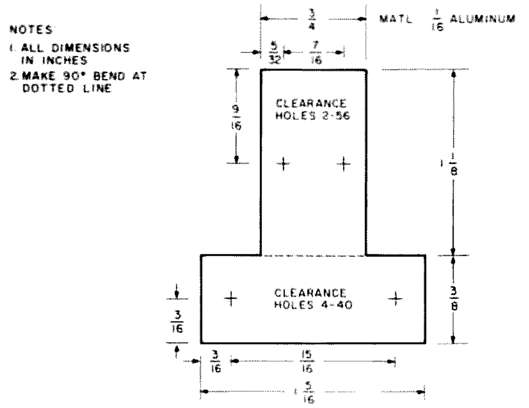

Fig. 6. Battery mounting bracket. Keystone no. 93 battery clip required.

an internal control. To make the front-panel control operative, remove the wire from the rear of S2B and place a jumper between the front and center connections of the switch, Fig. 2.

To test the scanner, set a frequency into memory with the scan switch off. Select a second frequency on the display and depress the scan switch (S2). The display should now alternate between the two frequencies at a 2-Hz rate. Opening the squelch should inhibit the scanning action.

Other Changes

A second modification to the 227R permits the memory to be retained when power is removed. The dashed components shown in Fig. 2 are the only components added. They are mounted (soldered) directly to S4. Fig. 6 is the battery bracket. This mounts internally at the rear of the 227R between the slide switches and the coax connector. The bracket is designed to mount using the holes for the ground lugs from the transmitter printed circuit board. When a frequency is stored in memory and the radio is connected to a 12-volt supply, D1 is reverse-biased and the power to the PLL control board is supplied through D4. This voltage is regulated to 5 volts by R3 and D3. When the input voltage falls below 9 volts, D1 conducts, supplying voltage to the regulator thus retaining the memory. Current drain from the battery under these conditions is about 4 mA. When storing the radio for long periods of time, the battery can be switched off by disabling the memory feature (S4).

One final change permits the 227R to operate above 148 MHz. This is useful when the 227R is being used as a driver for a varactor tripler to the 450-MHz band. Removing diodes D701 and D702 from the PLL control board will expand the frequency coverage to 149.995 MHz.

This completes my list of modifications to the Yaesu FT-227R. They have been in use for some time now and I have not experienced any problems. Comments and inquiries will be answered provided an SASE is enclosed. Acknowledgements go to Bob Wagner W1HWU for his ideas and suggestions, and to my XYL, Deb WB1DRS, for the typing. Good luck, and have fun with your new 227R! ■

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"That's the Way It Was . . ."

Do you recall your first introduction to radio? Do you remember what led you to become an amateur radio operator?

It was in the early 1920s; I was about five years old. I lived in Philadelphia, Pennsylvania, on a street that was narrow and short. There were about fifteen one-family houses on the street. There were two gas-operated lamp posts on either end of the street. The lighting in the homes also was gas.

In a corner of one of the rooms in our house was a workbench strewn with wires, tubes, insulators, batteries, tools, and many other objects that were pertinent to the construction of radios. At the time, it all meant nothing to me, not knowing to what use they were put.

I could always find my father puttering around in that corner. I can recall him using the terms peanut tubes, aerial, and also distant stations. Another term that always stood out in my mind was his referral to KDKA.

One day as he was at the bench, I heard him call excitedly to my mother. I remember him telling her that he had just heard a station from California. He placed the earphones on my head, also, and I heard music.

In time, he constructed many receivers using various circuits to improve the reception, and received many more distant stations.

My next vivid recollection of radio was in 1926 when the Dempsey-Tunney fight was held. People were crowding in front of my house, listening to it. My father had set up a loudspeaker on the window sill.

In 1927, we moved to Brooklyn, New York. I attended the local public school. When I was in junior high school, I became the operator of the movie projector, which used carbon arc light. I still had no interest in following my father's footsteps—in dabbling with radio construction. However, I did become an SWL, and kept a log of the radio stations I heard.

In 1939, I was introduced to amateur radio by a young lad who was my next-door neighbor, Lou W2MGX. He assisted me with the construction of a transmitter for 160 meters. My receiver was a National SW-3. I tried to make a contact, but without success. I became disillusioned and took the transmitter apart. (By the way, I had no license to legally operate a transmitter.)

During World War II, I worked for Bendix. I was the final tester for landmine detectors. There I gained a better knowledge of electronics. I still had no ambition to get interested in ham radio.

In 1955, I worked for a company that was located in the same building with Eico, and met some of the Eico employees. One of them was a ham. Once again, I was fired with enthusiasm to become an amateur radio operator.

Not knowing any hams in my neighborhood, I was at a disadvantage. How could I find a ham who would help me acquire my license? I purchased a *Callbook* and proceeded to thumb through the pages, looking for a ham close to my house. Success! I found one two blocks away.

I jotted down his name, address and call, and went to visit him. I was greeted at the door by his wife. I introduced myself and explained my desire. She called her husband and told him what I wanted. His name was Ray and his call was W2DIU. I was taken aback when I met him. Ray was blind and also wore a hearing aid. His wife, Judy, was also a ham. Her call was K2KBQ.

Ray helped me learn the code and taught me the theory for the Novice license. In a few months, I got my license and was issued the call KN2VGV. That was October, 1956.

Ray would not permit me to get on the air until I built a transmitter. I made the chassis from sheet aluminum and the cabinet of sheet metal. For parts, I cannibalized old radio receivers and television sets. The remainder of the parts I purchased on Cortlandt Street—affectionately known as "Radio Row." I also had to wind the coils. My receiver was a Hallicrafters S-40. I had very little success getting contacts. I was not permitted to erect an antenna on the roof. I tried loading the window screens, the bedsprings, and stringing wires throughout the apartment.

A few years later, I moved to another location. There I was permitted to install an antenna. I had a three-element beam for 10, 15, and 20 meters, a dipole for 40 meters and a 5-element beam for 6 meters. I was now able to enjoy amateur radio to my heart's content, to work DX and to try for WAS. I also had gotten my General.

I have had my trials and tribulations being a ham. TVI complaints, letters from the FCC, feedlines cut, telephone calls in the wee hours of the night, and various other annoyances. But I persevered through it all. I am enjoying ham radio, to my great content.

I am retired and spend a great deal of time teaching those who want to become amateur radio operators. My greatest joy is when my students call and tell me they passed their test and have received their callsigns. ■

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All About Coordinated Universal Time

—GMT has become UTC, but the reasons for using it are as valid as ever

It is popularly called Greenwich Mean Time (GMT) and is now named Coordinated Universal Time (UTC), but is it universal? Universal time is a system that allows a person in one time zone to indicate the timing of an event to a person in another time zone without having to know which time zone that person is in.

For instance, if you received a QSL card from a ham in each of the twenty-four different time zones, and each ham used his local time on the card, it would be necessary for you to know the difference in hours between your time zone and each of the twenty-four. If they all used UTC correctly, it would be necessary for you to know only the difference between your time zone and UTC. If your log was kept in UTC, you could look them up directly—a much simpler process. This is especially pertinent when you have many QSLs to locate in the log.

I speak from experience. In the aftermath of my NT7HEL operation, I was deluged with QSLs. It was very exciting finding a post office box full of cards every day. Exciting, that is, until I started checking the dates and times on the cards with those in my log and found many that didn't match. With over a thousand entries to hunt through, I found myself slipping the hard-to-find contacts on the bottom of the pile.

Time Zone	Abbreviation	Hours To Add
Atlantic Standard Time	AST	4
Eastern Daylight Saving Time	EDST	4
Eastern Standard Time	EST	5
Central Daylight Saving Time	CDST	5
Central Standard Time	CST	6
Mountain Daylight Saving Time	MDST	6
Mountain Standard Time	MST	7
Pacific Daylight Saving Time	PDST	7
Pacific Standard Time	PST	8
Hawaiian Standard Time	HST	10

Table 1. Local-time-to-UTC conversion.

Out of all of the cards received in the first month—they were still coming in eight months later—the following statistics emerged: 24% did not use UTC and 16% used it incorrectly. An interesting sidelight: 278 foreign QSLs were received, and every one used UTC and used it correctly! The two main incorrect uses of UTC were: Failure to advance the date when going past 2400 (UTC midnight), and adding an extra hour unnecessarily to UTC when converting from daylight saving time.

Let's look at these two errors. They both involve a misunderstanding of the mechanism of UTC. In order to convert from local time to UTC it is necessary to know the difference in hours between your time zone and the time zone centered on Greenwich, England. (See Table 1.) Using the Eastern Time zone as an example: We add 5 hours to Eastern Standard Time to arrive at Coordinated Universal Time. Note that 7 pm EST is midnight (2400) in Greenwich. The same is true of 6 pm CST, 5 pm MST, and 4 pm PST. UTC time recorded after that hour should carry the next day's date and not your local date.

An example:
June 15, 1977—6 pm EST is June 15, 1977—2300 UTC.
June 15, 1977—8 pm EST is June 16, 1977—0100 UTC.

The error involving daylight saving time occurs when one uses the same time-zone difference as was used when converting standard time to UTC. Consider the fact that when your time zone changes to daylight saving time, you are in effect moving one time zone to the east (see Table 1 again). Using the Eastern Time zone again: During Eastern Daylight Saving time you add 4 hours to local time to arrive at UTC instead of 5.

One of the easiest ways to keep on top of Coordinated Universal Time is to have a 24-hour clock in the shack and keep it set to

UTC. Digital-readout clocks are now accurate, dependable, and cheap. Use this clock for logging purposes. When it passes 2400, you should change the date in your log to the next day.

One way to remove any doubt is to tune in WWV, WWVH, or CHU regularly, since the time signals on these stations are reported in UTC. When you can't raise any of the above stations, a quick call to 303-499-7111 (Colorado) will get you exactly the same information that is being broadcast on WWV. Interstate telephone calls are very inexpensive after 5 pm local time.

Relative to Daylight Saving Time, an Indian friend of mine compares it to a squaw cutting a foot off of one end of a blanket and sewing it on to the other end to make it longer. The state of Arizona apparently agrees with this philosophy, since we follow standard time all the year around.

What happened to the cards that I slipped to the bottom of the NT7HEL pile earlier? I converted the local times to UTC and found most of those. The rest required a search of the log, entry by entry, until they were found. A few never were.

Need another reason to use UTC? Some DX stations and their QSL managers will not search through a long list of contacts looking for your call. If you are not in the log where your card says to look, you are out of luck! Since the QSLs you send out are an attempt to convince the other guy that you really want one of his cards, why not make it as easy as possible for him to reply? Use Coordinated Universal Time! ■

✓ Reader Service—see page 195

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Don't Be a dB Dummy!

—use a pocket calculator to deal with decibels

For those of us who face the all-important test for that license, take heart! Working with gain and loss with dBs isn't all that hard. Trying to remember a dB table is a pain for some, including me.

Those people endowed with a "smart" calculator have no problem. You can keep your dB table on a program card and can take a break while the calculator does all the work.

If you have an old TI number-cruncher with a square root key, there might be an easier way.

Step 1 is to remember the binary number system. That shouldn't be too hard; everyone can count to two. (See Table 1.)

Bear with me a minute. I don't want to lose you at this point (I lost myself the first time around). Just below the zeros, number from 0 to 10, starting with the LSB at the right as in Table 2.

All that is left is to figure the cube root of the binary number. It sounds hard, but turns out to be fairly easy.

For example, to figure 8 dB (power ratio), take the cube root of 256. Now, take a wild guess of 6 and enter that in the calculator. Now hit the times (×) button once. Enter 256, hit the square root button twice and the times (×) once. Once again enter 256, hit the square root button twice and the times (×) once. By repeating this several times, you end up with 6.3495986, or approximately 6.35. The actual power gain is 6.31. While the figure from the calculator is not exact, it is close enough when you set it down for the test.

The actual dBs for power ratio vs. the calculator's answers are shown in Table 3.

Now, if you want to be really sneaky and figure the voltage or current ratio, all you have to do is take the square root of the power ratio. Figuring any ratio higher than 10 dB is a snap. Take the corresponding number between one and ten. If you want to find the 13 dB power ratio, take the 3 dB power ratio of 2.00 and move the decimal point to the right one place. For 15 dB, use the 5 dB ratio, etc.

Now that dB tables are no longer giving you headaches, go on to bigger and better things. Field gain, transistor parameters, Q of a dipole, etc., etc. ■

1024	512	256	128	64	32	16	8	4	2	1
0	0	0	0	0	0	0	0	0	0	0

Table 1.

1024	512	256	128	64	32	16	8	4	2	1
0	0	0	0	0	0	0	0	0	0	0
10	9	8	7	6	5	4	3	2	1	0

Table 2. Bottom row is dBs.

dB	Power Ratio	Calculator
0	1.00	1.00
1	1.26	1.26
2	1.58	1.59
3	2.00	2.00
4	2.51	2.52
5	3.16	3.17
6	3.98	4.00
7	5.01	5.03
8	6.31	6.35
9	7.94	8.00
10	10.00	10.07

Table 3.

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Silence is Golden

—reassemble noisy transformers to eliminate hum

Radio Shack provides the experimenter/builder with a convenient, relatively inexpensive source of power transformers. These transformers are available in a good selection of voltage and current ratings and many are in use by builders of electronic gizmos. I have used several of these transformers over the years with good success.

Unfortunately, many of the transformers have, or develop, an annoying problem—they hum, and loudly at that. At first I assumed it was the way I was mounting them, but insulating the transformers with rubber strips, dipping them in glue, etc., did not help. Finally, when the 12-volt, 300-mA transformer in my alarm clock kept me awake half the night, I took some drastic action.

Taking the transformer apart, I immediately found the cause of the hum. It seems that the people who make Radio Shack transformers feel that it is not necessary to interleave the laminations on some of their transformers. They simply slip all the E-shaped pieces through the bottom of the winding bobbin and then place a laminated bar of the straight pieces across the top of the transformer. This technique is excellent for making 60-Hz buzzers, but not transformers. Not all Radio Shack transformers are made this way, but many, especially the smaller ones, are.

I tried gluing the laminations together, which worked for a while, but, sooner or later, the hum returned. The final solution was quite successful and is described here.

If your transformer hums, the chances are that it has the type of construction described above. Remove the outer metal band that holds everything together. Remove the E-shaped laminations from the bobbin winding assembly and separate the individual laminations. Although the lamination assembly is shellacked, the pieces can be separated easily by slipping a thin knife between them. Take care not to bend the laminations as this will lower the efficiency of the transformer.

Once all the laminations are separated, replace the E-shaped ones alternately from the top and bottom of the bobbin and winding assembly. Now replace the straight pieces in the spaces between the E-shaped laminations. Use a speck of glue to hold the end straight piece on, if necessary. Tap the assembly lightly with a hammer to line up the laminations. Replace the metal outer band and squeeze everything together as tightly as possible. The transformer should operate quietly now.

I have modified several of the transformers in this manner, and none of them hums now. Although the procedure may sound time-consuming, it actually takes only about 15 minutes and it is well worth it. As an added benefit, the no-load primary current also is reduced by interleaving the laminations. On a particular 12-volt, 300-mA transformer, the no-load current dropped from 55 mA to 35 mA and the transformer operates considerably cooler. Enjoy the silence! ■

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Welcome to the '80s

—Radio Shack and Macrotronics make computerized operation a reality

If you are tired of fighting the SSB QRM and bored with computer games, checkbook balance programs, and biorhythms, maybe it's time for you to try some new modes of communication and make your computer an integral part of your station.

Macrotronics, P.O. Box 518, Keyes CA 95328, has developed a ham interface board which will directly tie the PET or TRS-80 computer to your ham equipment and provide auto CW/RTTY operation. The mechanical kluge, better known as the noisy Teletype® machine, with its polar relays, rotating switches, and permeating odor of lubricant, has been replaced by the electronic keyboard and video CRT.

As with any new development in the throes of trying to get the product on the market in a timely manner, there are always some bugs which slip by. Perhaps the hardest part of business, and definitely the most important, is how the manufacturer reacts in supplying supplementary fixes and information to his customers.

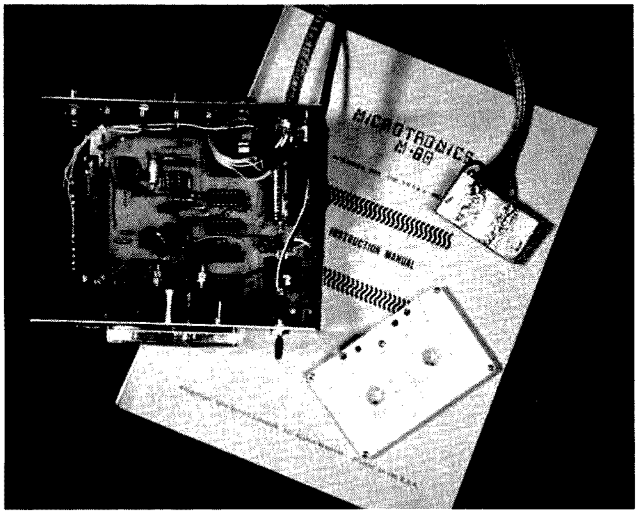
Fig. 1. Microtronics M-80 Ham Interface.

The Macrotronics M-80 Ham Interface is designed to be used with the Radio Shack TRS-80 computer, and the M-65 model is designed for the PET unit. The interface can be supplied for either Level I or Level II with 4K or 16K RAM. With 4K, you lose the capability of 10 message registers, which allow the pre-entered contents of up to 255 characters each, to be transmitted in the send mode by entering only the message number. Fig. 1 is a picture of the completed board. The ac adaptor has been replaced with a shielded 12-volt transformer to ensure enough current to supply the accessory filter/amp board described later. The specifications for the interface are listed in Table 1. It is available in kit form for $99, or ready-to-use at $129. This price includes a board of good quality, all components and integrated circuits, board edge-connector for various signals to and from your ham equipment, six-inch ribbon cable and 40-pin TRS-80 external bus connector, ac adaptor, and a cassette containing the machine language and BASIC programs.

Some of the units were shipped without documentation—a fate for most hams surpassed only by the unavailability of parts for their DX-35 or Benton Harbor Lunchbox. The kit I received contained a preliminary manual and schematic, with a note from Ron Lodewyck N6EE to the effect that there were some bugs in the software and the board had been reworked due to a problem with the RS-232 input—so the schematic was not correct. This is all to be rectified in the future.

After assembling the various components on the circuit board, I turned my attention to the ribbon cable and 40-pin bus connector. Connector problems are well known to TRS-80 experimenters—there aren't any. That is, there weren't until recently, and Macrotronics had the same problem. The connector supplied was of the no-strip, place, hold, cuss, position-cover, push-and-pray variety. Needless to say, such connectors are an exercise in futility, providing only binary operation—shorted pins or no connection. Hooking up the completed interface between the receiver output and the computer produced no smoke

but some other interesting anomalies. The computer could not be initialized when the interface was connected and the power on, but rather filled the screen with ROM character contents. With the converter power off, the computer could be initialized and the programs loaded, but as soon as the interface power was turned on the CRT screen would begin filling with −D−D from bottom right to left, line per line, until the screen was full, at which time the computer would hang.

Tracing back from the output on the board showed that the 7367 IC was never triggering the output. This IC requires a logic level low from the demultiplexer, which requires the correct DCBA code to be supplied by the A0-A3 lines of the computer bus. A checkout of the demultiplexer on the Heath Digital Design breadboard showed that all was in order on the chip. Numerous calls to Ron at Macrotronics only substantiated the fact that the computer and interface were not talking to each other.

The input signal line D0 is port 2 on the TRS-80 bus, and by writing a two-line input loop to check this port for each clock strobe, you can tell whether the port is receiving data by the value which appears on the screen (port 2 is assigned a value of 254). Since the schematic only tended to confuse the actual wiring layout, the board was returned to Macrotronics. Three weeks later I received the returned interface with a note saying that there had been an extra jumper wire installed on the board—no charge. They also included a new 40-pin connector with solder terminals, definitely worth the hassle of returning the board.

With fingers crossed, the retest proved successful. Subsequent experimentation without the schematic showed that the hex inverter originally shown as a signal output buffer is not used, the output coming directly from the 7367. Changing the circuit to allow operation according to the schematic brought back the original problems, so now I know the cause and effect.

M-80 Capabilities

As the program begins, the operator selects either Morse or Baudot RTTY. If Morse is selected, the operator then initializes the send and receive speed between 10 and 100 words per minute. The software then places the system in Morse Send Mode with keyboard entry options for transfer to Morse Receive Mode, Change Character/Word Spacing, Change Speed, Transfer to RTTY Send Mode, Create a Canned Message, Send a Pre-entered Canned Message, Code Practice, Change CW Output Keying Mode (negative or positive), Change to 32 Characters Per Line (double-sized letters), or Return to 64 Characters Per Line Mode. Special CW characters such as $\overline{AR}$, $\overline{SK}$, $\overline{AS}$, and $\overline{KN}$ also are available by pressing special keys on the keyboard which are not normally used in Morse code. The code practice mode allows Morse code practice by generating random characters or words from memory, made audible through the sidetone oscillator already on the circuit board (you supply the speaker). You also can practice sending by connecting a key to the key jack terminals.

In the RTTY mode, the operator may select Auto CW ID, Reverse Mark/Space, Change Baud Rate (initialized at 60 wpm), Create or Send a Canned Message, Turn Off Unshift-On-Space, Select 32 Characters Per Line, or Return to 64 Characters Per Line Mode.

Power Required	110-volt ac adapter supplied
External Connections	15-pin edge connector supplied
	Inputs/outputs:
	Phase locked loop LED
	Receiver audio
	+5-volt power LED
	Key or TU input
	RS-232 input (±12-volt)
	Ground
	TTY current loop keyer
	Negative-voltage solid-state switch
	Positive-voltage solid-state switch
	Sidetone out to speaker
	DIP relay, common
	DIP relay, normally open
	DIP relay, normally closed
	Computer bus (ribbon cable and connector supplied)
Software	Cassette supplied, with machine and BASIC programs
Required Memory	Will run with 4K at limited capability
Options	CW at 10-100 wpm send/receive
	RTTY at 60, 66, 75, 100 wpm send/receive
	10 CW/RTTY message registers
	Auto CW ID on RTTY
	Sidetone oscillator
	Code practice mode with random word generation
Price	Kit: $99, wired: $129
	Available for PET, TRS-80, Apple, and Sorcerer computers

Table 1. Macrotronics M-80 Ham Interface specifications.

Three main points become evident very quickly when attemping CW operation:

1. The human ear and brain are vastly superior to a computer for copying hand-sent Morse.

2. The computer is vastly superior to the human brain and hand (fist) for sending Morse.

3. The majority of CW operators do not send steady, well-spaced manual Morse code.

According to the Macrotronics specifications, the computer should copy the selected speed within ±10 wpm. However, this figure assumes that the character spacing and word separation do not change appreciably. Many fists are impossible to copy due to short dashes or lack of space between characters and words. If the speed is relatively stable and the dot/dash ratio is good, the computer will display the data as continuous characters (most often the case). Try a 60-minute CW contact sometime, and see if you can detect a change between the first and final transmission. Electronic keyers are very forgiving, and even the paddle-operated types are relatively easy to copy as long as the operator does not try to send 25 wpm or more. A good keyer and experienced operator make for armchair copy. The phase locked loop input to the interface provides a very narrow bandwidth as long as the back-to-back diodes are not overdriven. There are also input terminals for a terminal unit (TU) or de-

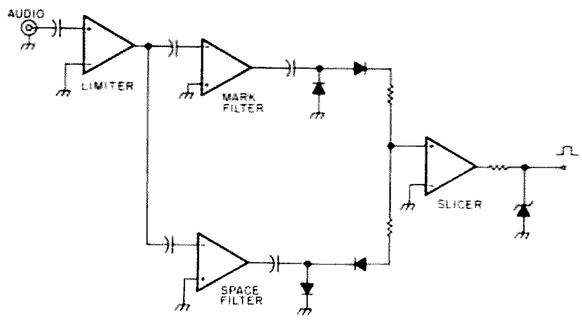

Fig. 2. RTTY terminal unit.

modulator (dc output) should you already have one.

To transmit in the CW mode you need only to connect the key input jack of your transmitter to the appropriate terminal on the interface board connector. In the send mode, all characters are entered from the keyboard just like a typewriter, and an input buffer allows convenient typing ahead. Then sit back and watch the screen as the memory contents are transmitted over the airwaves. Returning to receive mode entails pressing the CLEAR then ENTER keys; returning to send mode calls for only the CLEAR key. However, as long as there is a signal on the input port in the receive mode, the interrupt will not be recognized. Thus, if there is noise below the signal but high enough to trigger the phase locked loop, you must have a method of interrupting the interface input or lowering the signal level to change modes.

Operating RTTY is similarly simple. The receiver must be tuned to the space frequency (via the receiver RIT control) and the phase locked loop trimmer on the interface board set for a convenient frequency between 800 and 2200 Hertz. Some receiver audio sections favor a lower range of audio frequencies. The trimmer needs to be set only once for both CW and RTTY and is not too critical since you can always move the signal within the passband of the phase locked loop by tuning the receiver slightly. When you are tuned on the space frequency of a RTTY signal, the phase locked loop LED will blink. When the transmitting station is idle, the LED will not light unless you are tuned to the mark frequency. As noted in Table 1, there are numerous outputs for use in adapting a transmitter for FSK operation. Copy in the RTTY mode is relatively good, although it sometimes appears that the software misses a shift and a line or so of figure characters is printed.

CW/RTTY Operation

As supplied, the M-80 interface requires only a connection to the receiver audio output, transmitter key jack, TRS-80 bus, and ac wall socket for initial CW operation. For RTTY operation, you must have a transmitter with FSK capability (or AFSK—but no AFSK oscillator is supplied) or be willing to modify your transmitter/transceiver for FSK operation. Since FSK is a mode requiring 100 percent duty cycle, most transmitters and amplifiers will not take kindly to FSK operation at full output. However, if your transmitter/amplifier runs relatively cool, and you are not bothered with replacing output tubes on a regular basis, you normally can operate FSK at 50 percent input power or more without trouble. If you have added a fan for final cooling you may be able to run slightly more power. In any event, if you decide to modify, keep transmissions short and check the final tube current to note any change from the tune-up value.

There are three main problem areas in obtaining reliable CW/RTTY copy via electronic means: QRN—Man-made and atmospheric noise; QSB—Fading; and QRM—Adjacent channel interference.

Generally speaking, the narrower the passband filter used, the better the noise figure. However, there is a point of diminishing returns where strong signals cause ringing or oscillation and the transmitting oscillator drifts out of the passband of the filter. More important than the filter bandwidth at the 3-dB points is the skirt response, or the common 6/60-dB figure which gives an indication of the actual filter out-of-passband signal-rejection capabilities. Atmospheric noise may be considered as broadband noise for our purposes since, if it is found in one portion of the band, it also will be prominent in the rest of the band.

Normally, we operate on the band which has the longest propagation for the time of day. Therefore, when we are relegated to 80 and 40 meters late at night, there probably is no other band open, and we have to make do with any noise which may be present. A good filter will help to minimize both noise and adjacent channel interference. However, regardless of the quality of the i-f filter used in the reception of CW/RTTY signals, there still are many times when

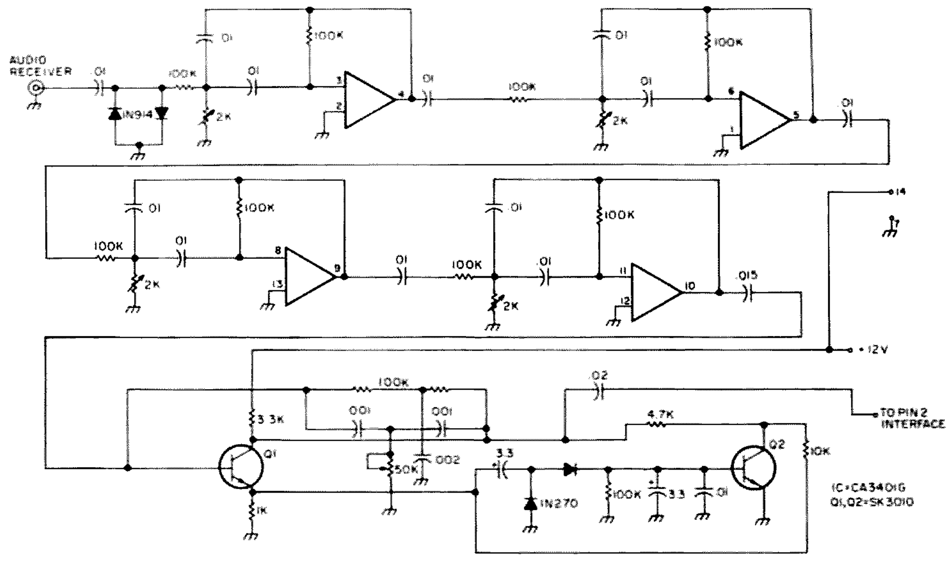

Fig. 3. Filter/amp schematic.

the noise level approaches the desired signal level (or vice versa) or somebody starts calling CQ within 100 Hertz of the signal we are trying to copy. The only hope of improving copy in these situations is to use a variable frequency filter. Those receivers which incorporate variable width and Q filters in the last i-f are easier to use. If you are going to operate CW/RTTY with your computer, I recommend an active variable audio filter of the type which installs either between the volume control and first audio stage or attaches directly to the receiver-speaker terminals. These filters normally have low-pass, null, and peak or narrow bandpass modes and controls which allow you to vary the width of the passband as well as placing the desired signal on one side of the filter skirt and the interference on the other, thereby increasing the signal level and decreasing the interference level. Any noise which gets to the phase locked loop will cause loss of "sync" and garbage to be printed on the screen. Therefore, it becomes important to maintain as good a signal-to-noise ratio as possible.

Probably the only thing worse than an intermittently fading signal is one which fades below S5 when the noise level is S3-5. When there is no appreciable noise present but strong fading, the computer will leave a space when a signal not strong enough to drive the phase locked loop is present. If there is noise which manifests itself only when the signal fades, the computer will print garbage when fading occurs. A strong adjacent signal will also produce a loss of the desired signal, and, if close enough in frequency, will cause the phase locked loop to select the signals alternately (another garbage mode).

Processing of the audio signal prior to its application to the interface, such as in a terminal unit, can be done to produce either an audio input to the phase locked loop or a dc level to the terminal unit input on the interface board. The terminal unit input is logic level high, or 1 for mark and low for space. In reality, only the low input level is recognized since the normal circuit state is high. This means that dual-processing channels, one for mark and one for space, are not necessary. The main goals for either the audio or dc unit should be to:

1. Maintain a filter bandwidth of approximately 100 Hertz.

2. Process a low-level audio signal just above the noise level and provide a signal to the interface which can be reliably copied.

3. Minimize signal fading effects on the interface unit.

You will notice that I did not say anything directly about noise. Processing a signal which is intermittently subject to noise becomes a long and expensive design procedure and is more effectively accomplished in the front end of the receiver in the first i-f section. The aim here is to do the best we can to increase the chance of good copy without a full blown, i.e., expensive, terminal unit. To this end, the receiver should have reasonably good agc and noise circuitry to start with. Although we do not have to worry about receiving the mark frequency, if we are copying a signal with 170 Hertz shift, the mark frequency is relatively close to the space frequency, and a wide passband allowing both frequencies to get through may cause desensitization of the phase locked loop circuitry. Similarly, since we do not need the mark frequency, the interface will copy any frequency shift.

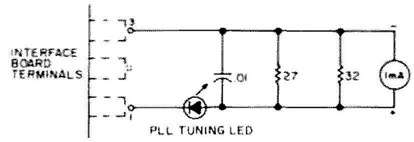

Fig. 4. M-80 board modification for tuning meter.

Both methods, audio and dc, were tried. If both mark and space frequencies were required, the method illustrated in Fig. 2 would have the advantage of producing a constant output level for either mark or space by driving the slicer positive or negative. However, since we are interested only in the space frequency, to use the dc method the terminal unit must maintain a constant high when there is no space signal, and low or ground when the space frequency is present. In addition to the extra circuitry required to meet this criterion, no advantage was found in noise immunity. It requires a healthy gain figure to increase the amplitude of a marginal input signal to a level which will drive the diodes which rectify the audio into a 10-volt dc level to drive the slicer. Accomplishing this, we still need some method of maintaining this level as the signal fades.

Add-On Filter/Amp

With the experience gained testing the dc method and the nice operating characteristics of the phase locked loop in the interface, it was decided to stick with straight audio to the phase locked loop input. The circuit of Fig. 3 will provide reliable copy for signals just barely discernible on the S-meter. The CA3401G is available from James Electronics, 1021 Howard Avenue, San Carlos CA 94070. Other op amps may be used, and those requiring dual-supply voltages will provide more gain for fewer stages. Circuit layout is not critical, but components making up each filter network (100k, .01 uF, 2k) should not be mounted too close to an adjacent network. The gain can be adjusted by changing the .01 coupling capacitors higher for more gain. The .01 capacitors in the filter network are poly film or mylar™. Transistor Q1 serves as a final shaping stage to adjust the symmetry of the output wave.

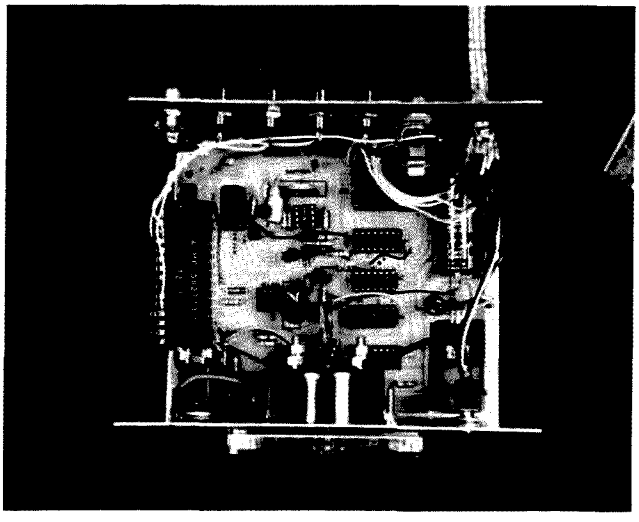

Fig. 5. CW/RTTY converter with the cover removed.

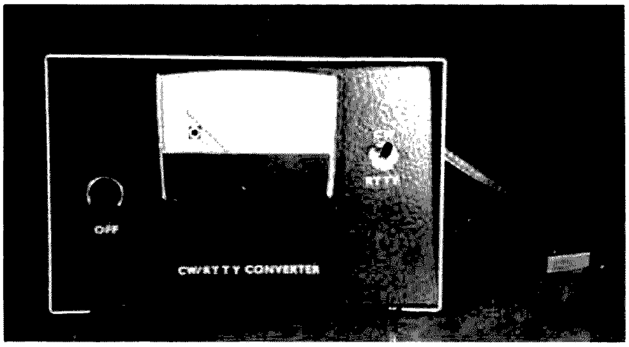

Fig. 6. The front panel of the converter.

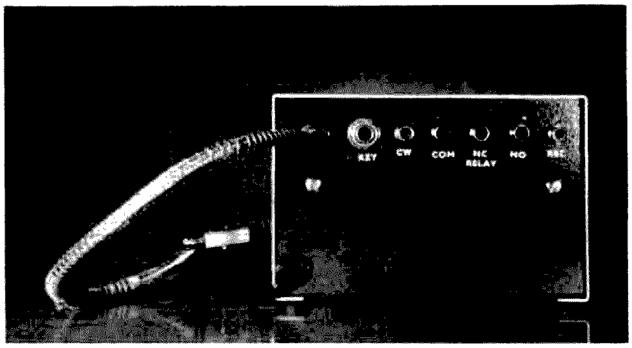

Fig. 7. The rear panel of the converter.

Transistor Q2 provides a small amount of gain control on Q1. Slow fading of over three S units will be compensated by this stage.

Fig. 4 shows a modification to the interface board circuit which allows the installation of a 1 milliampere meter to show signal level and make tuning easier than by trying to watch the brightness of the LED. Output level of the filter/amp circuit should limit at approximately 0.6 volt peak-to-peak. Tune each filter section for about 1200 Hertz, then recheck with the scope attached to filter output and interface input. Do not overdrive the filter with the signal generator. In operation, adjust receiver audio, after tuning in a signal, just slightly higher than the level required to drive the meter to maximum. Too high an input level will change the filter response and decrease the noise trigger threshold.

Fig. 5 shows the filter/amp and interface board with power transformer tucked into an enclosure ready to be added to the station equipment. The 5-volt power indicator LED has been removed from the board and placed on the front panel, as seen in Fig. 6. The CW/RTTY switch shown is not required for normal operation. Note that the six-inch ribbon cable has been replaced with six shielded cables tied together and 12 inches long. (See Notes at the end of this article.) The 40-pin connector has been enclosed in brass stock which is grounded to the cable shields and to the computer ground bus via stranded wire. The brass enclosure is held to the connector by two short pieces of no. 14 wire which fit through holes carefully drilled through the solid portion at each end of the rear of the connector. A narrow piece of brass stock is soldered over the middle seam where the ends of the brass enclosure come together. Fig. 7 shows the rear panel with input/output jacks. Only those functions of the interface board utilized in my station were brought out to the rear panel jacks. The wiring is shown in Fig. 8.

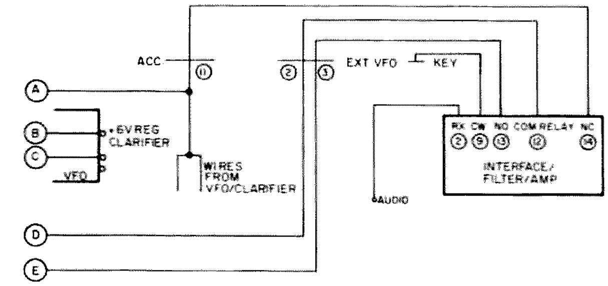

Fig. 8. Interchassis wiring.

FSK for the FT-101

It is interesting to note that, with the M-80 interface, the same amount of data can be transmitted in the CW mode as with a 100 wpm teletype station. However, since not everyone has updated his equipment to microprocessor- or computer-oriented operation yet, we still need the capability of contacting stations using teletype equipment. Modifying the Yaesu FT-101 for FSK operation is relatively simple, and the same method should be applicable to most transceivers employing receiver incremental tuning. In normal FSK operation the space frequency is 850 or 170 Hertz below the carrier frequency. The lower shift gives better noise immunity and is utilized by most ham RTTY stations. Fig. 9 shows the modifications made to the FT-101, and Fig. 10 shows how the enclosure is mounted to the side of the transceiver. In Fig. 11, the mods are completed, and the equipment is ready for on-the-air testing.

To perform the modification, remove the bottom cover and unsolder the leads going to the clarifier terminal on the vfo case (two green wires). Solder a short length of hookup wire from pin 11 of the accessory jack on the rear of the chassis to the wires just removed from the clarifier terminal. Solder another length of hookup wire from the same pin 11, and bring it out to the front corner of the transceiver on the side which has the handle attached. This is where the enclosure will be mounted.

Bring two wires from the location of the vfo terminals to the same side of the rig. Solder one to the vfo clarifier terminal and the other to the vfo regulated 6-volt terminal (blue wire and resistor). Install two more wires from the side of the rig to the external vfo socket. All five wires will enter the chassis in the bottom corner beside the capacitor trimmer board. When spread singly and wrapped with tape, there should be enough clearance so that the bottom cover does not have to be altered.

Solder one of these wires to pin 2 of the external vfo socket and the other to pin 3. (All of these pins normally should be unused.) Solder a short piece of hookup wire to pin 11 of the accessory plug, and attach a dc jack to the other end. A test-lead jack works well. If you use your rig portable, and have the accessory output in use in the shack, the plug must remain installed during portable operation because it contains a factory-installed jumper. By adding a dc jack, the converter can easily be disconnected for taking the transceiver out for remote operation.

If you do not have a plug for the external vfo socket, they are available at most

supply houses. Be careful, however, when soldering leads to the plug, since the pin connections are probably different than the socket numbers. The single-pole double-throw miniature toggle switch allows normal operation when the converter is disconnected —such as in portable or mobile use. When the interface is connected to the rig, the switch will not affect normal operation since the normally closed contacts of the DIP relay on the interface board make the "normal" connection.

The momentary-action push-button allows tuning on the space frequency for test purposes when in the RTTY mode. When using the tune push-button, the wiring to the DIP relay on the interface board is shorted at the switch. The lack of the wire resistance will make the clarifier voltage high and cause a 40- to 50-Hertz high reading. This could be compensated by a resistance at the switch, but since it is used only for testing and we are aware of the resulting high reading which will vary from band to band, no extra components were added.

All circuitry is enclosed in an LMB 3-1/2 × 2-1/8 × 1-5/8 box which is mounted to the lower right side of the FT-101, using the existing screw hole. (The original screw was replaced with one slightly longer to ensure a solid mounting and a good ground connection.)

The hole for the mounting screw in the LMB box is made toward the top of the side of the box with the overlapping lips. The bottom of the box is held steady by a small angle which is screwed to the front side of the box with the opposite end of the angle resting on the front panel of the transceiver just inside the protruding edge of the rig. An 8-connection terminal strip was used to solder the incoming wires and various switch lugs. The wires enter the box through a rubber grommet on the rear of the box. The RTTY bandswitch is a miniature, single-section, 2-pole, 5-position type.

After the circuit and wiring have been completed, make up cables and connect the converter interface/filter/amp to the FT-101. Attach frequency counter leads to chassis and through a .01 microfarad capacitor to the rf output jack on the rear of the transceiver chassis. This jack provides an rf output from the driver stage. Set the FT-101 bandswitch for 80 meters and tune into a dummy load at a frequency of about 3.6 MHz with a carrier level of 2, as noted on the panel behind the carrier level control. When tuned, reduce the carrier level to just enough to give a stable reading on the frequency counter and set the frequency at 3.625170 MHz.

Allow the equipment to warm up for at least 30 minutes before beginning calibration. Set the RTTY bandswitch for 80 meters, the Normal/RTTY switch to RTTY, leave the FT-101 Mode switch in the Tune position, and activate the transceiver with the MOX/PTT/VOX switch in the MOX position. Recheck the carrier frequency, then short the Common and Normally Open plugs at the interface. Adjust the frequency at the 80-meter trimmer in the mod box for a frequency of 3.62500 MHz. If the three wires to the DIP relay jacks on the rear of the converter are unplugged, a double alligator clip may be used to short the Common and Normally Closed wires for carrier frequency reading and the Common and Normally Open wires for adjustment of the space frequency. Repeat frequency adjustment until no improvement is noted; normally this is within 5-6 Hertz. Return the FT-101 switch to the PTT position. Adjust other bands for 170 Hertz below carrier in the same manner, remembering to set the RTTY bandswitch and change the shorting alligator clip for the desired carrier or space frequency.

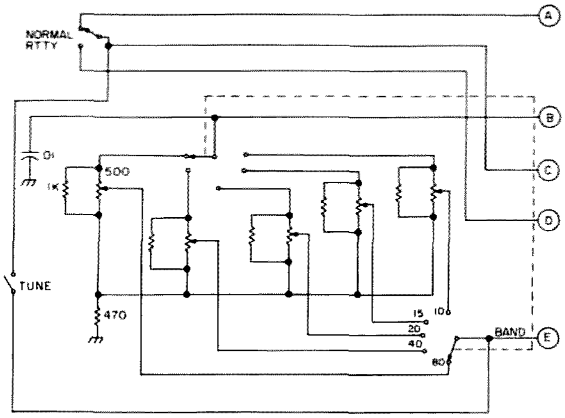

Fig. 9. FT-101 FSK modifications.

The frequencies for the space frequency on the other bands are 7.090, 14.090, 21.090, and 28.090 MHz. These are in the portion of the bands normally operated by RTTY. Set the carrier frequency 170 Hertz higher to make trimmer adjustment to 0000 kHz easier. Before replacing the bottom cover, move the frequency counter to the vfo output terminal and check to see if the frequency is the same with the clarifier off and on, in the zero position. If a difference is noted, adjust the trimmer located in back of the clarifier control until the frequencies coincide.

Modified FT-101 Operation

For CW operation with the computer ready, place the MOX/PTT/VOX switch on the FT-101 to VOX, the Mode switch to CW, and the computer will control send and receive. For RTTY operation, you are required to send your callsign in CW at least every 10 minutes. The M-80 software provides a register in which you can store ID information which is sent in CW when the CLEAR, SHIFT, and # keys are pressed. However, this output comes from the CW Keyer output of the interface which must be grounded for FSK operation with

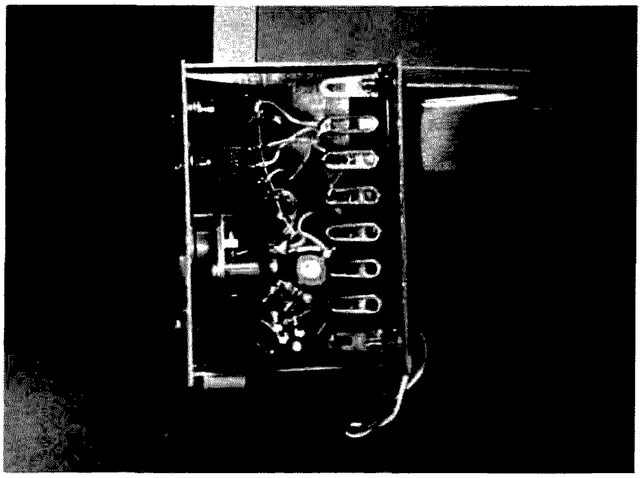

Fig. 10. FT-101 FSK modification box.

Fig. 11. FT-101 ready for FSK.

the FT-101 Mode switch in CW position. The easiest way around this problem is to place the FT-101 Mode switch in the Tune position, the RTTY bandswitch to the desired band, the RTTY/Normal switch to RTTY, and activate the transceiver with the MOX/PTT/VOX switch in the MOX position. This procedure also gets rid of the annoying sidetone oscillator output. After pressing the applicable keys for CW ID and seeing the words CW ID FOLLOWS appear on the screen, move the Mode switch to the CW position, and the contents of register O will be sent in CW. Return the Mode switch to the Tune position and the MOX/PTT/VOX switch to PTT and you are ready to copy. This procedure is much easier than using a hand key with a shorting bar.

TRS-80 RFI Notes

Like most computers, the TRS-80 emits a lot of RFI at different frequencies, depending upon the software operation being performed at any particular time. Since the 1.77 MHz clock is divided down, birdies can be expected just about anyplace in the spectrum. Unfortunately, at my location the antenna is only about 40 feet from the operating position and computer. I can tell what portion of a particular program is executing just by listening to the bleeps and warbles being radiated by the computer to the antenna and through the ham gear. The worst problem is probably on 15 meters, neglecting the VHF scanner.

Individual parts of the system were checked for extent of radiation and possible simple solutions. One problem which had me talking to myself for awhile was manifested by a 24-hour digital clock which displays UCT and is situated within an ac distribution box and 12-volt power supply. I first noticed that every once in a while, the clock would be fast, sometimes as much as 10 minutes. I checked the drivers (60-Hertz line clock) and the display with a stopwatch, and day-to-day comparisons would show little change until all at once it would be fast again. Although the thought had crossed my mind that the computer might be triggering the clock circuit, I had moved the computer power plugs to a different outlet. To make a long story short, at the time I was working on "Sorcerer," a game program from *Kilobaud Magazine*. It appeared that every time the program called a subroutine, the digital clock had a good chance of receiving an extra strobe for the seconds pulse! Changing the wall plug did not help much since they were both on the same circuit.

The CRT display is transformerless and radiates in the lower part of the HF spectrum, but doesn't appear to be a problem unless you are working 160 meters. The video/sync/sweep lines from the monitor have only one shielded lead and do put out some radiation. Surprisingly, the keyboard/computer only radiates at the output/input connections. When a cable is attached to any of these jacks, it performs just like an antenna.

The following modifications dropped the interference level from a maximum of S7-8, in the worst case, to S2:

1. Shielded power supply leads.
2. Shielded all leads to monitor.
3. Replaced ribbon cable with shielded leads.
4. Installed 110-volt isolation transformer in monitor to supply ac for display and keyboard/computer power supply.

Conclusion

In this article I have tried to present an evaluation of the Macrotronics M-80 interface for those amateurs who may be interested in working CW/RTTY with a PET or TRS-80 computer. The filter/amp will serve as the minimum piece of equipment to help provide better copy. With a variable audio peak filter between the receiver output and filter/amp, operation has been found to be better than anticipated, with the ability to copy signals which don't move the needle on the S-meter, minimum noise interference, and lack of adjacent channel interference or QRM unless the signal is over S9 and within 50 Hertz of the desired station in frequency. The transceiver modifications presented should be applicable to the majority of ham transceivers, and are relatively easy to implement without affecting resale value of the equipment.

Macrotronics Update

Since this article was originally authored, Macrotronics has available a new software package featuring deluxe RTTY/ASCII with split screen capability. The price of $99 also includes two new integrated circuits incorporating a PTT capability. Modification to the M-80 circuit board is minimal and the software offers so many additional capabilities that the operator will be hard pressed to remember how to use them all.

In addition, the M-80 kit is no longer offered; the ready-to-use board now lists at $149 with software cassette. I recommend ordering a catalog from Macrotronics before making a decision on what to purchase. They also offer a filter/demodulator board if you prefer not to build your own. ■

Notes On Connecting the M-80 Interface and Computer

The specifications for the demultiplexer integrated circuit used in the Ham Interface state that the cable length should be limited to six inches. Since such a short cable tends to make placement of equipment difficult and contributes to the breaking of the individual leads where they enter the board or connector, different lengths of cable were painstakingly tried utilizing W1AW bulletins as a reference signal. At 36 inches no abnormal effects were noted on CW. However, RTTY reception was degraded to about 30 percent copy on W1AW, to less than 10 percent on other stations. Still unexplained were the errors which repeated on a regular basis, such as the same extra letter every time the same word appeared, or the same apparent misspelling on the word "OSCAR." As the cable was shortened, the error rate decreased to the point where, at 12 inches, no measurable difference was noted from the six-inch length. All cables were individually shielded and laced together.

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The Multi-Media Bench Tester

—this audio/visual device will test your diodes, SCRs, transistors, and more

After admiring the qualities of the new transistor testers on the market and realizing that I could not afford one, I decided to construct my own.

The new breed of transistor testers possessed several qualities that I liked:

1) The ability of testing a device without having to know whether it is a PNP or an NPN.

2) Being able to test the device when the collector, emitter, or base leads are not known.

3) Getting both an audio and a visual response from the tester.

After several weeks of trial and error and several prototypes, the final product was very satisfactory, and produced additional features that have made it the ultimate in portable test equipment.

Theory of Operation

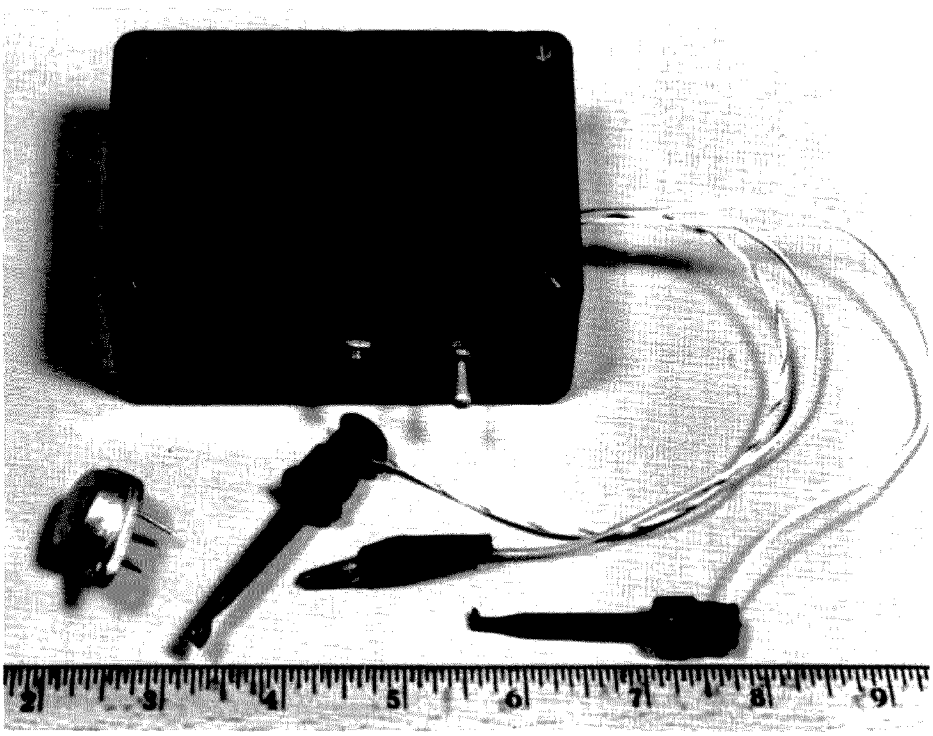
The quad two-input NAND gates (7400) are connected so that three of the gates act together as an oscillator with the frequency (about 15 kHz) determined by the 1-μF capacitor. The final gate acts as a buffer/driver.

The 15-kHz output is fed into a 7490 decade counter which is connected in a divide-by-ten configuration. The 15-kHz signal also is used to provide base bias, or base driving signal, when S1 is closed while S2 is switched to R1 or R2.

The output of the 7490 decade counter, a signal of approximately 1.5 kHz, is fed to the clock input of one of the J-K flip-flops. The Q output is externally tied to the clock input of the remaining J-K flip-flop. The frequency at this point is about 750 Hz.

The Q output of the second flip-flop is attached to the collector of the transistor under test through the use of an alligator clip. The $\overline{Q}$ output is connected through two paralleled LEDs (connected back to back) and an 8-Ohm speaker to the emitter of the transistor under test.

S2 determines the base current by selecting either a 470-Ohm series resistor or a 4.7k resistor. The 470-Ohm resistor would be used to test transistors with a low gain. The other half of S2 acts as an on-off switch.



The finished transistor tester.

Construction

Any method of construction may be used. Of the several transistor testers

that have been built by others (using my design), some were wire-wrapped, some were soldered point-to-point, and some were actually built on a prototype PC board.

All you need is a suitable box to house the device, a battery pack, and a few hours for construction. If you are careful, the tester can be built for under $10.

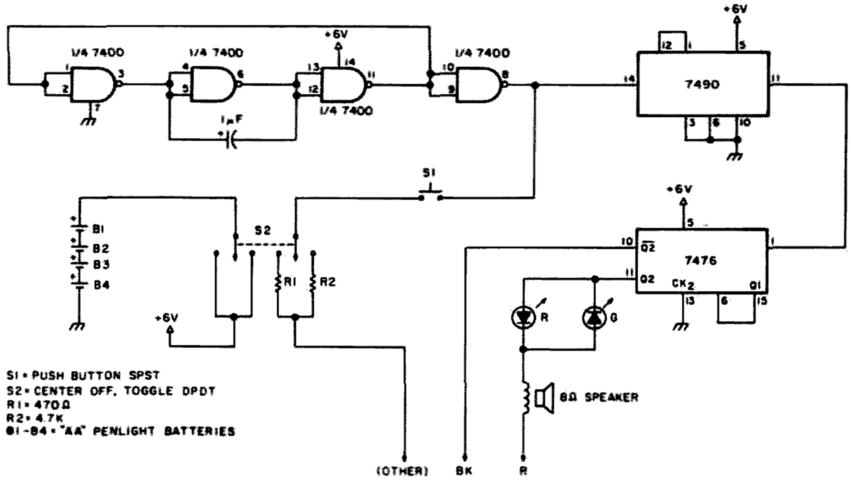


Fig. 1. Transistor tester schematic diagram.

How It Works

The Q and $\overline{Q}$ outputs of the J-K flip-flop are alternating from high to low at a rate of 750 Hz; thus, at one instant the Q output would be positive and the $\overline{Q}$ output would be zero. To the transistor under test, this would look as if the collector is positive and the emitter is negative. If the transistor is an NPN, then the positive pulses from the base lead (when S1 is depressed) would turn the transistor on, thus allowing current to flow through the speaker and the LEDs.

When the Q output is zero and the $\overline{Q}$ output is positive, this would correspond to a negative on the collector and a positive on the emitter of the transistor under test. If this transistor is a PNP, then the negative pulses (periods when the signal is at zero) from the base lead would turn the transistor on, allowing current to flow through the LEDs and through the speaker.

Because of the fact that Q and $\overline{Q}$ are changing at a rate of 750 Hz, a tone is produced by the speaker (if a good transistor is being tested). The loudness of the tone depends upon the gain of the transistor.

How To Use It

1) When used as a continuity tester, the red and black leads are used. Continuity between these two leads will result in a tone being produced by the speaker (S2 must be on).

2) To check diodes, each diode is connected between the red lead and the black lead. A good diode will stop current flow in one direction, thus lighting only one LED (S2 must be on). Possible test results are: tone and one LED lit—diode is good; tone and both LEDs lit—diode is shorted; no tone and no LED lit—diode is open.

Note: If collector and emitter leads are not known, the tester will test the transistor anyway, even if collector and emitter connections are backwards.

3) To check transistors, the red lead is connected to the collector, the black lead is connected to the emitter, and the blue lead to the base (press S1 with S2 on). The results could be: a tone (when S1 is depressed) indicates a good transistor; a tone (prior to S1 being depressed) indicates: 1) with one LED lit—transistor is connected wrong, or 2) with both LEDs lit—transistor is shorted. No tone (when S1 depressed) indicates an open transistor.

To determine if a transistor is a PNP or an NPN, remove the collector lead and place it on the terminal occupied by the blue lead (S2 must be on). If the red LED lights—NPN; green LED lights—PNP.

4) To check junction FETs, connect the red lead to the drain, the black lead to source, and the blue lead to the gate (S2 must be on—indications will be the same as for a bipolar transistor).

5) To check SCRs, connect the red and black leads to the anode and cathode (red and black leads can be reversed), and connect the blue lead to the gate. Depress S1—S2 must be on. Possible results are: tone and one LED lit—SCR good; tone and both LEDs lit—SCR shorted; no tone or LED lit—SCR open; tone and one LED lit before S1 is depressed—SCR connected wrong.

6) To use as an audio signal generator, switch S2 into either position (on) and a 750-Hz square wave will be available between the red and black leads. The square wave output produces usable harmonics up into the VHF region. More uses for the ultimate transistor tester will be found by experimenting further. I have also used it to test TRIACs and UJTs.

In conclusion, it seems that commercial technicians are often wary of using something that does not have a meter on the front of it. I have used this device for over a year and I haven't been misled once—I trust it.

I finally realized that I had something special when one of my co-workers asked me to check an SCR on my tester, because the $179 shop transistor tester would not check it. ■

Parts List

Quantity	Description
1	7400 Quad 2-input NAND gates.
1	7490 Decade counter.
1	7476 Master-slave J-K flip-flop.
1	SPST Momentary contact n/o push-button switch.
1	DPDT Center-off toggle switch.
1	Red LED.
1	Green LED.
1	8-Ohm Speaker (small).
1	1.0-μF Capacitor.
1	470-Ohm, ¼-Watt resistor.
1	4700-Ohm, ¼-Watt resistor.
4	AA Penlight batteries.
1	Battery holder for above.
1	Suitable box and hardware.

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CB to 10

—part XXVII: new life for SSB CB rigs

This article will describe the conversion of three 40-channel, phase-locked loop SSB transceivers to 10 meters. The three rigs are the Midland model 79-893, the original model of the President Grant, and the Cobra 138XLR. This conversion allows operation on almost the entire 10-meter band, from 28.04 MHz to 29.70 MHz. However, due to the Q of the tuned circuits, the output power and receiver sensitivity are maximized only over a range of about 600 kHz. This conversion also allows direct readout of the operating frequency to 5 kHz.

Most CB conversions consist of changing some crystals, retuning the rig, and modifying the clarifier so that it changes the transmitter as well as the receiver frequency. When I first converted my Midland, this is how I did it, but I soon became dissatisfied with the results.

A Discussion of the Changes

The first problem is trying to tune a range of 10 kHz with the clarifier. It can be done, but usually the frequencies are spread out on one end of the range and bunched up at the other end. This makes tuning difficult while driving and, in some cases, frequency instability can be caused. In one case I know of, frequency modulation was noticed at some settings of the clarifier. To avoid this problem, I rewired the LSB circuitry so that it operated in the USB mode but was offset from the normal USB frequency by 5 kHz. This allows me to tune the rig in 5-kHz steps instead of 10-kHz steps, which reduces the tuning range needed by the clarifier to 5 kHz. You lose the ability to operate in LSB, but in the year I have used my rig, I have heard only one LSB signal on 10 meters and I didn't really want to talk to him anyway.

The second problem was the limited frequency range allowed by the 40-channel selector switch plus the missing channels that were set aside for radio control operation. There were too many stations I couldn't contact because they were slightly out of my tuning range in one of the radio-control channels. Then there were the times I

Photos by Marcia Bradsher

Photo A. The Midland, showing the BCD switch in place of the rotary switch. Notice that the switch is reading 850, which is an operating frequency of 28.50 MHz.

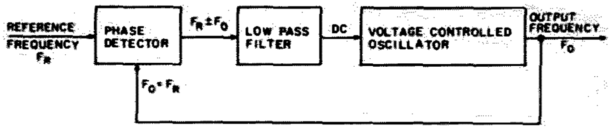

Fig. 1. Block diagram of a simple phase-locked loop.

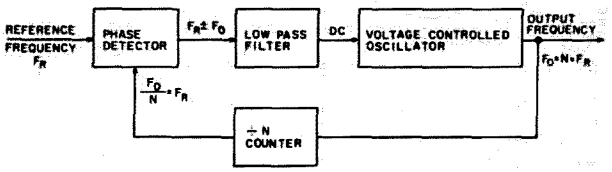

Fig. 2. Block diagram of a more versatile phase-locked loop.

wanted to QSY up 10 kHz to avoid QRM, but I didn't know whether I was going up 10 kHz or 20 kHz. Worse yet, I could go down 20 kHz when switching from channel 23 to channel 24. I made up a chart of frequencies vs. channels, but it was difficult to read while driving along the freeway at 55. Clearly, there had to be a better way, and I think I found it. By replacing the 40-channel selector switch with a binary-coded decimal (BCD) thumbwheel switch, the above problems were eliminated and, as a bonus, if the crystal frequencies are selected right, the switch reads out the actual operating frequency.

Another change I made was to replace a zener-diode voltage-regulator circuit with a 723 voltage regulator. This was to prevent a slight frequency shift caused by the input voltage changing. This change was made only on the Midland, as the other two rigs did not exhibit the problem. It would be a good idea to check your rig out in your car to see if you have a problem before making this change. It may not be needed.

The last change I made was to increase the output power. After about ten months of operating on 10 meters, I found the output power to be less than 5 Watts. By disabling the automatic load control and pruning the output coils, I was able to increase the output power to 10 Watts.

Understanding the Phase-Locked Loop Circuit

To understand how this conversion works, you must first understand how a phase-locked loop frequency synthesizer works. Fig. 1 is a block diagram of a simple phase-locked loop. Two frequencies enter the phase detector: the reference frequency, F_R, and the output frequency, F_O. The output of the phase detector is the sum $(F_R + F_O)$ and difference $(F_R - F_O)$ of the two inputs. When the two input frequencies are equal, $F_R - F_O = 0$ and the output of the phase detector contains a dc component. The low-pass filter rejects the sum frequency and passes the dc component. The dc component in turn controls the voltage-controlled oscillator (vco) output frequency to keep it the same as the input frequency, F_R. For example, if F_O tries to increase above F_R, the dc component changes in such a way as to decrease F_O; if F_O tries to decrease below F_R, the dc component changes in such a way as to increase F_O. The preceding explanation is for a very simple phase-locked loop where $F_O = F_R$. If you need F_O to be greater than F_R, then the circuit of Fig. 2 can be used.

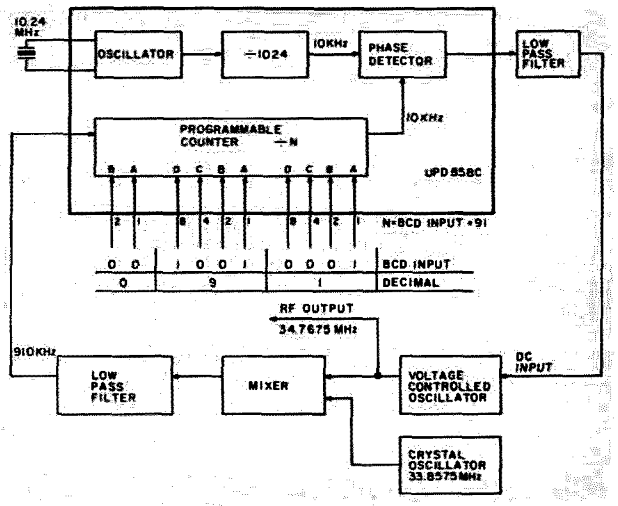

Fig. 3. Block diagram of the Midland 79-893, President Grant, and Cobra 138XLR phase-locked loop.

The output frequency of the circuit shown in Fig. 2 is N times F_R, or $F_O = NF_R$. The counter divides F_O by N: $F_O/N = NF_R/N = F_R$. Therefore, the two inputs to the phase detector are the same frequency just as they were in the previous explanation. In all other respects, the two phase-locked loops are the same. By adding the divide-by-N counter in the feedback loop, the phase-locked loop is made much more versatile. For a given reference frequency, the output can be any multiple within reason. Also, if N can be changed, then the output can be changed, in steps equal to F_R. For a more detailed explanation of PLL theory, see references 1 and 2.

The phase-locked loop for these three rigs is a bit more complicated. The block diagram for this PLL is shown in Fig. 3.

The frequencies shown are generated for USB channel 1 operation on the CB band. The operation of this phase-locked loop is as follows. The 10.24-MHz output of the reference oscillator is divided by 1024 to give a reference frequency of 10 kHz into the phase detector. For channel 1 operation in the CB band, the programmable counter divides by 91. Since the output of the counter must be 10 kHz (the same as F_R), the input to the counter is 910 kHz. The crystal oscillator is fixed at a frequency of 33.8575 MHz. Therefore, the vco output frequency is 34.7675 MHz, or 910 kHz higher. For transmitting, the 34.7675 MHz is mixed with 7.8025 MHz to get the 26.965-MHz channel 1 output. For receiving, the incoming 26.965 MHz is mixed with the 34.7675 MHz to get the difference frequency of 7.8025 MHz, which is the receiver i-f.

To change channels, the programmable counter divisor must be changed. Since the output of the counter is always 10 kHz, the channel separation will be 10 kHz. For example, for channel 2 operation, the programmable counter divides by 92. This forces the input of the counter to be 920 kHz; thus the output of the vco must be 34.7775 MHz, or 920 kHz greater than the crystal oscillator. This raises the operating frequency to 26.975 MHz, or an increase of 10 kHz.

The control input to the programmable counter must be a binary-coded decimal (BCD) value equal

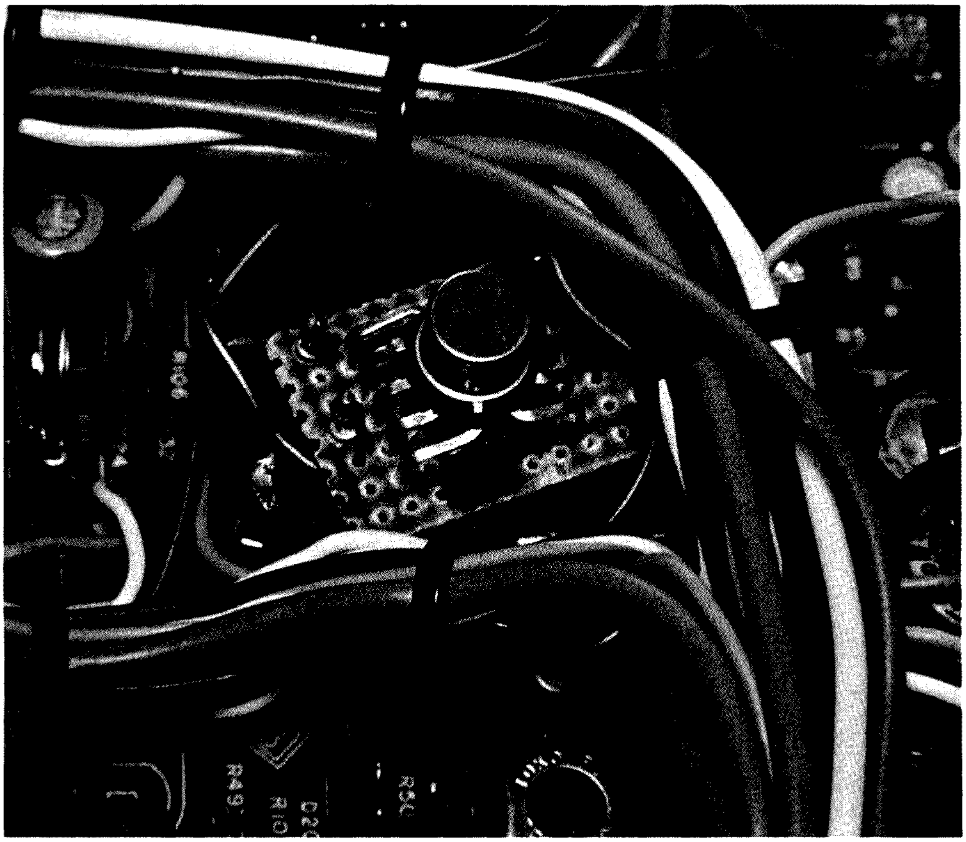

Photo B. This shows the placement of the 723 voltage regulator in the Midland.

to the number you want to divide by. In BCD, it takes 4 inputs to represent each decimal number. Each of these 4 inputs represents some power of 2. Fig. 4 explains how the BCD values represent the decimal numbers 0 through 9. To find the equivalent decimal value from the BCD value, simply add together the values that the 1s represent (a 1 is +4.7 V into a pin, and a 0 is 0.0 V into a pin). For example, decimal 5 has a BCD number of 0101. This yields $[8(2^3) \times 0] + [4(2^2) \times 1] + [2(2^1) \times 0] + [1(2^0) \times 1] = 0 + 4 + 0 + 1 = 5$.

There are 10 inputs to the programmable counter. These inputs represent two decimal digits that range from 0 through 9 and one digit that ranges from 0 through 3. Thus, the range of the divisor is from 0 to 399. In this rig, you never want to divide by less than 4, so the actual range is from 4 to 399. The BCD input portion of the programmable counter is shown in Fig. 5 with some examples of inputs.

Since each bit of the least significant digit changes the frequency by 10 kHz, the total range of frequencies that can be switched is almost 4 MHz. We need a range of only 1.7 MHz for 10-meter operation.

For normal CB band operation, the 40-position selector switch provides the BCD inputs from BCD 091 for channel 1 through BCD 135 for channel 40. The selector switch skips over BCD 94, 99, 104, 109, and 114. It also skips over BCD 118 and 119, but it then reinserts them after BCD 120. A close examination of a frequency allocation chart for the CB band will show which frequencies these represent.

To get all the frequency channels, and to get them in the correct order, I replaced the 40-channel selector switch with a 3-digit BCD thumbwheel switch. The switches I selected are back-lighted, which is very handy for night operation. I bought my switches from MHz Electronics, 2111 W. Camelback Road, Phoenix AZ 85015. They sold for $2.00 a section, at the time, and you will need 3 sections. The lamps are +5 V, so wire them in series and use +12 V for lamp excitation. Make sure the switches you use are of the 10-position BCD type.

These rigs start at BCD 91 for the lowest channel, but there is no reason why you have to start there. In fact, if you start at BCD 50 for 28.50 MHz, then the BCD switch will read the actual operating frequency. The right-hand switch changes the operating frequency in 10-kHz steps from 0 to 90 kHz; the middle switch changes the operating frequency in 100-kHz steps from 0 to 900 kHz; the left-hand switch changes the

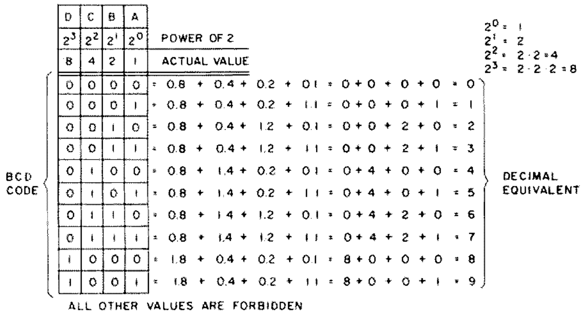

Fig. 4. BCD-to-decimal conversion for 1 digit.

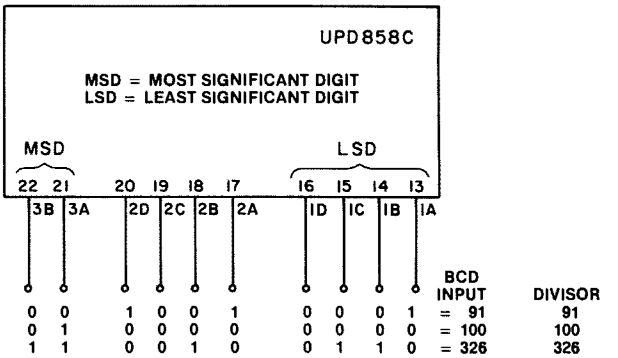

Fig. 5. Examples of BCD inputs to the programmable counter.

operating frequency in 1.0-MHz steps from 28 MHz to 29 MHz. The left-hand switch is restricted to this range because that is all that is needed for 10-meter operation. In fact, all the even number positions on the left-hand switch will give an operating frequency from 28.0 MHz to 28.99 MHz and all the odd number positions will give an operating frequency from 29.00 MHz to 29.99 MHz. This is because only the least significant bit of this switch is wired up.

To change in 5-kHz steps, a two-position switch is required to switch between the two crystal oscillators. Since there will be no LSB operation after the rig is modified, you can use the mode switch to give the 5-kHz steps. After the conversion, the AM position will give AM operation in 10-kHz steps. The USB position will give USB operation in 10-kHz steps and the LSB position will give USB operation in 10-kHz steps, but 5 kHz below the USB frequencies.

To accomplish this, change the LSB crystal to 11.934167 MHz, change the USB crystal to 11.935833 MHz, and the AM crystal to 11.933333 MHz. The crystal oscillators are followed by a frequency tripler.

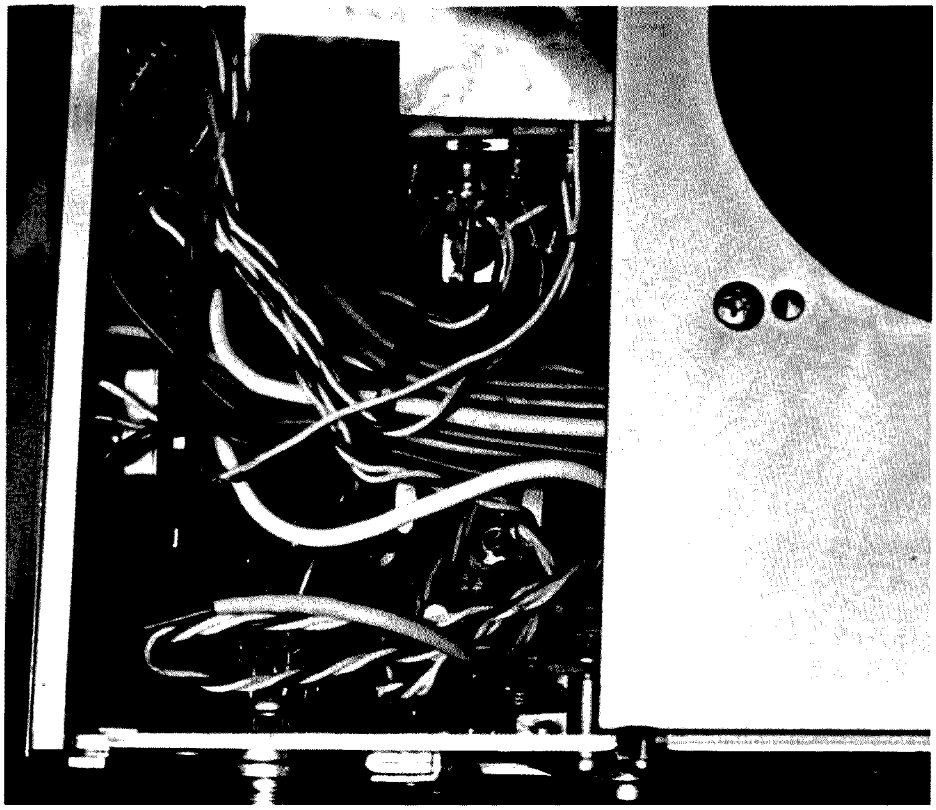

Photo C. This view of the Midland shows the placement of the diodes for the LSB and AM changes. The arrows point to the diodes added.

The Differences in the Rigs

The circuit boards for all three of these rigs are made by the Uniden Company. The PC board layout is identical for the President Grant and the Cobra 138XLR, but they may not use the same components. The Midland has a different PC board layout, but the schematics for the three rigs are identical except for a few minor differences. The component reference designators for the Grant and the 138XLR are the same, but in the Midland they are numbered differently even though the schematics are almost the same.

The Midland also has an enclosed metal box to shield the PLL circuitry, whereas the other two have only a metal strip on the PC board for a shield. The front panels and switches are also different for all three of the rigs. The Midland was the only rig modified to put the switch on the front panel. On the other two rigs, the switch was mounted external to the rig. If you have a Grant or 138XLR and wish to mount the switch on the front panel, be sure the switch clears everything before cutting any holes. I have not done this and do not know if it will fit, but there should be no problem.

After I had converted the Grant, I found that the newer Grants on the market do not use the UPD858 IC in the phase-locked loop. This new model can be identified by the fact that it has a presettable channel 9 switch. The frequency range of the newer Grant can not be extended because the PLL IC has built-in safeguards to prevent this. I can not be certain that the manufacturer will not change the other rigs in the same way. Make sure the rig you get for conversion uses a UPD858 in the phase-locked loop.

Circuit Details of the Changes

Before attempting this conversion, you will need a copy of the maintenance manual or Sams Photofact® for your rig. The Sams Photofact for each of the three rigs is available.

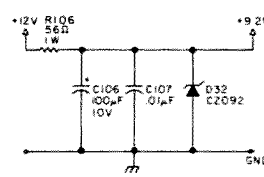

Fig. 6(a). Original regulator circuit.

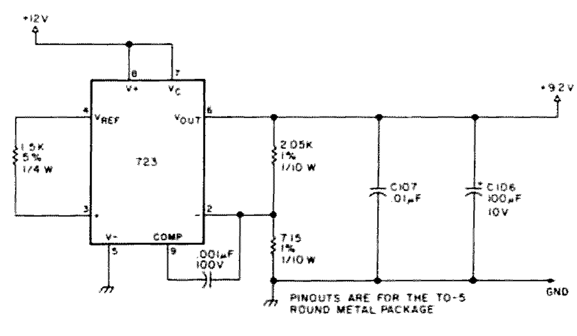

Fig. 6(b). The 723 regulator circuit.

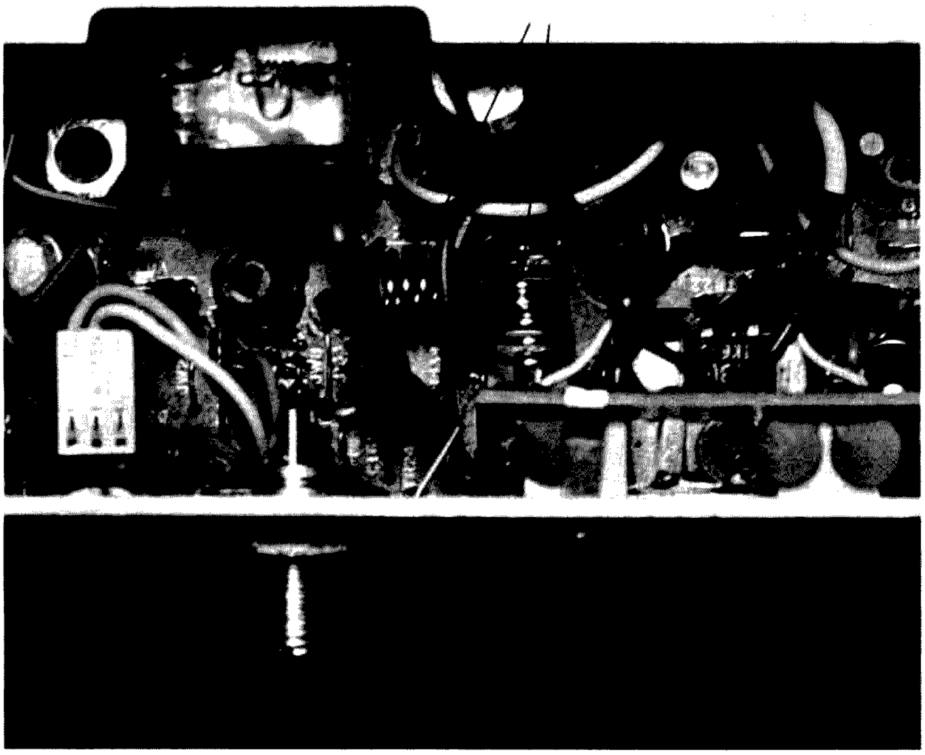

Photo D. Arrows point to the two coils (L28 and L29) in the President Grant in which the turns were spread apart. In the Midland, the turns of L5 and L6 should be spread in the same way.

I will first describe the changes for the Midland, then I will describe those for the Grant and the 138XLR. The actual circuit changes for all three rigs are the same, but the manner in which they are accomplished and the reference designators are different for the Midland.

MIDLAND 79-893 CONVERSION

Voltage Regulator Change

Note: If the operating frequency of your rig does not change with varying input voltage in your installation, this change is not needed.

Remove D32 (CZ092) and R106 (56-Ohm, 1 W) shown in Fig. 6(a). Add the 723 voltage-regulator circuit shown in Fig. 6(b). Mount the parts on a small piece of perforated epoxy board and attach to the PC board with short jumper wires. My regulator is suspended above the chassis by the leads and insulated with black electrical tape.

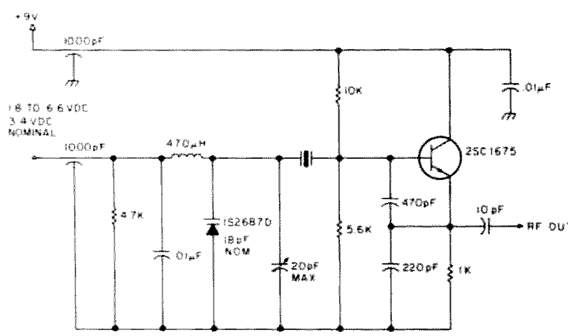

Fig. 7. Crystal-oscillator schematic.

Clarifier Change

Remove D24 (1S2473) and save it for later use. Lift the end of R61 (100 Ohms) that connects to the +9.2-V bus that originates at D39. Connect the loose end of R61 to the +9.2-V bus that originates at pin 6 of the 723 regulator just added. If the regulator wasn't added, connect the loose end of R61 to the +9.2-V bus that originates at D32.

Output Power Change

Remove D33 (1S2473) and save it for later use. Spread the turns of L5 and L6 apart. The spreading distance is not critical. Remove one turn from L7.

Phase-Locked Loop Change

To accomplish these changes, you will need new crystals. The frequencies required are 11.934167 MHz for the LSB position, 11.935833 MHz for the USB position, and 11.933333 MHz for the AM position. The Midland uses solder leads on the crystals, whereas the other two rigs use plug-in crystals.

The crystals are available from Jan Crystal Co., 2400 Crystal Drive, Fort Myers FL 33901. Order the CB-type crystals with a tolerance of ±0.0025%. They were priced at $3.50 each for fewer than 10, or $3.25 each for 10 or more, in the 1978 catalog numbered 21. Order the HC-18-type holder for the Midland 79-893 and the HC-25-type holder for the President Grant and Cobra 138XLR. When ordering, include the following information on the rig: manufacturer's name, model, crystal frequency, holder type, and a copy of Fig. 7 to ensure that the crystal is cut properly.

Note that the Sams Photofact for Midland uses the same reference designators for parts inside the PLL and parts on the chassis. To avoid the confusion of this duplication, the Midland maintenance manual adds 500 to each of the reference designators in the phase-locked loop. I will follow this practice also, so each of the parts referred to in the phase-locked loop will be numbered between 501 and 599.

The PLL is enclosed inside a shielded box which must be removed from the PC board before the crystals can be replaced. Mark and remove the wires from the shielded box feedthroughs. Unsolder the shielded box tabs from the bottom of the PC board. The tabs must be completely clean of solder and flux before the box can be removed. Once the box is free, the wires to the 40-position switch can be disconnected from the switch. Use these wires to connect to the new switch.

The new crystals can now be soldered in place. Put the 11.934167-MHz crystal at X502, the 11.933333-MHz crystal at X503, and the 11.935833-MHz crystal at X504.

Remove R530 (1k Ohm) from the bottom of the PLL PC board. This resistor will not be used later. Pin 19 of the 858 IC is grounded on the PC board. This pin will be used, so it will have to be isolated from ground. Use a sharp knife to cut the circuitry between pin 19 and ground, then add a 4.7k, 5%, ¼-W resistor and a .01-uF capacitor in parallel from pin 19 to ground. Add a short jumper between pin 19 and the solder pad that has the violet wire connected to it. This completes the changes to the phase-locked loop. It can now be resoldered to the main PC board and the wiring reconnected.

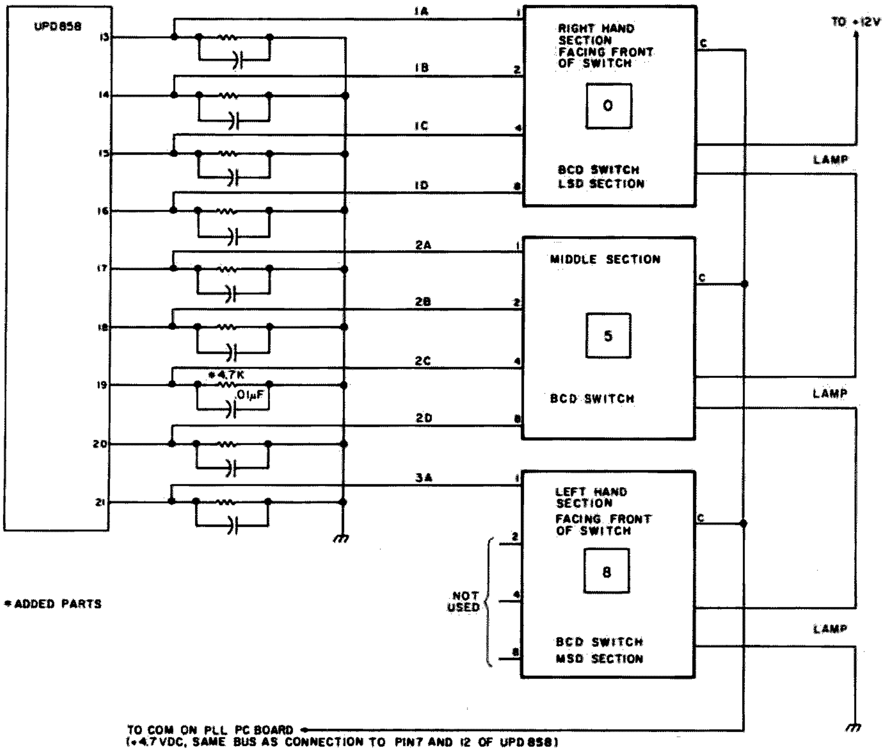

Fig. 8. PLL-to-BCD switch wiring.

Front-Panel Change

Remove the knobs and the four small screws at the sides of the panel and remove the panel. If you are careful, all the work can be accomplished without removing the wires. Remove the 40-position channel-selector switch from the steel frame. You will need to cut a clearance hole in the steel frame for the BCD switch, but make sure it lines up with the hole in the front panel, and don't cut completely through the frame since it is needed for support. Carefully mark the front panel for the size of hole to fit your switches. The front panel is made of plastic with a thin sheet of metal glued to the front, so use caution while drilling and filing.

You will probably need an indentation on the right-hand side of the hole in order to be able to change positions on the right-hand switch section. Try the switch out before permanently attaching it to the panel. I used glue to hold my switch in position. Make sure everything clears before gluing the switch in position. To allow clearance in the back, I had to cut some of the PC board away from the backs of the switches. Leave enough printed circuit to solder the wires to. Before remounting the front panel, wire between the PLL and the switch as shown in Fig. 8.

LSB Change

Remove D50 (1S2473), which is mounted on the underside of the main PC board, and replace it with a piece of wire. Save the diode for later use. Remove the red wire between L1 and C539 on the PLL shield. Remove the brown wire between L2 and C542 on the PLL shield. Using two of the diodes previously removed, attach one anode to C539 and the other anode to C542. Tie the two cathodes together and wire them to L2. Do not remove the wires that go to the mode switch. Fig. 9 shows the details of this change.

AM Change

Add the remaining 1S2473 diode in series with the blue wire going to C541 on the phase-locked loop shield. Attach the cathode to C541 and the blue wire to the anode. Remove the cathode of D43 from S403A and connect it to C541. Connect a wire between L1 and D43 anode as shown in Fig. 10.

This completes the wiring changes for the Midland. However, if you study the photograph of the front of the rig (Photo A), you will notice some differences that haven't been explained. I will describe these changes briefly but will not go into detail since they are not required to make the rig operate on 10 meters. They are easy to implement if you wish to incorporate them.

There are three toggle switches, one for tone, one for CB/PA, and one for noise blanker on or off. I

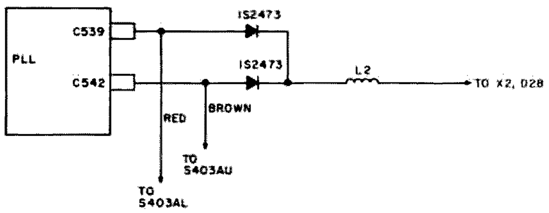

Fig. 9. PLL wiring for LSB.

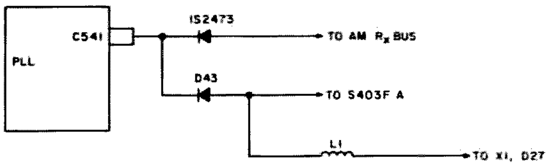

Fig. 10. PLL wiring for AM.

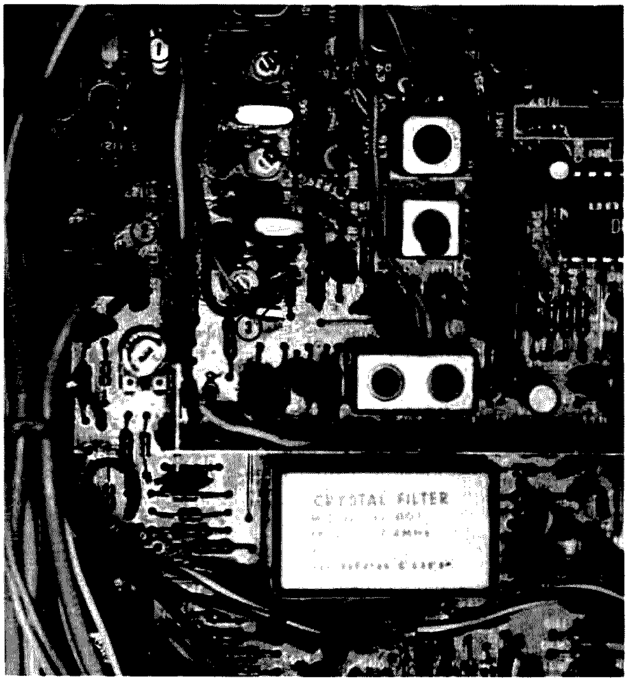

Photo E. Details of some of the President Grant changes show here. Arrow #1 points to L13, #2 to L12, and #3 to where jumper JP11 was located originally. D38 is located between L12 and the shield.

wired around each of these switches to get a low tone, CB operation, and the noise blanker on all the time. I used one of the switches to control a remote homebrew linear. Another switch is used to switch between the two crystals to give the 5-kHz steps. The other switch is to select the internal BCD switch or an external BCD switch mounted in the dash. I use an external BCD switch most of the time because the rig is mounted in the glove compartment.

PRESIDENT GRANT AND COBRA 138XLR CONVERSION

Clarifier Change

Remove D30 (1S2473) and save it for later use. Lift the end of R119 (100 Ohms) that connects to the +9.2-V bus that originates at D28. Connect the loose end of R119 to the +9.2-V bus that originates at D44.

Output Power Change

Remove D46 (1S2473) and save it for later use. Spread the turns of L28 and L29 apart. The spreading distance is not critical. Remove one turn from L30.

Phase-Locked Loop Change

Unplug the original crystals from X3, X4, and X6 and plug in the new crystals. X3 receives the 11.93533-MHz crystal, X4 receives the 11.934167-MHz crystal, and X6 receives the 11.933333-MHz crystal. For information on how to order the new crystals, see the PLL change for the Midland.

Remove D40 and save it for later use. Use a sharp knife to cut the printed circuit between pin 19 of IC7 and ground, then add a 4.7k-Ohm resistor and .01-uF capacitor in parallel between pin 19 and ground. Remove both ends of the flat wire cable between the 40-position channel-selector switch and the PLL. Mount the BCD switch and wire it to the PLL as shown in Fig. 8.

LSB Change

Locate L12 and L13. Lift the lead nearest the metal shield of each of these coils. Lay each of the coils on its side to expose the holes the leads were removed from. Using two of the diodes previously removed, solder the anode of one into one of the exposed holes and the anode of the other into the second exposed hole. Solder both cathodes to the exposed lead of L12.

AM Change

Lift the cathode of D38 and bend the lead over to touch the exposed lead of L13. Remove jumper JP11. It is located near C148 and X6. Replace JP11 with the remaining diode. Place the cathode toward the front of the rig. Solder one end of a jumper to the cathode of this diode and solder the other end to L13 and the cathode of D38.

This completes the wiring changes for the Grant and 138XLR.

Retuning for 10 Meters

All that remains is to retune to the 10-meter band. Following the instructions should allow you to operate between 28.50 MHz and 29.10 MHz. The following test equipment will be required for the retuning: a 50-MHz frequency counter, a 12-V power supply, an rf generator for the 10-meter band, a VTVM with an rf probe, a 10-W rf power meter, and a 10-W dummy load. To keep from blowing your final transistor, never plug in the mike unless the dummy load is connected to the antenna connector. This procedure assumes that the rig was operating correctly before the changes were made.

The alignment procedure for all three rigs is identical except for the reference designators. I will list the Midland reference designator in the text of the procedure, and the reference designators for the Grant and 138XLR will immediately follow in parentheses.

Alignment of Phase-Locked Loop

Remove the mike from the rig; set the BCD switch to 850; set the clarifier to the 10 o'clock position; set the mode switch to the AM position.

Note: The following adjustments are to components within the shield.

1) Connect the rf probe of the VTVM to TP502 (TP6), which is the secondary of L509 (L24). Adjust L508 (no coil exists) and L509 (L24) for a maximum indication on the VTVM. The indication may be less than 1 volt.

2) Connect the dc input of the VTVM to TP501 (TP7), which is pin 4 of IC501 (collector of TR35). Adjust L507 (L17) to obtain 2.0 V dc on the VTVM. Set the BCD switch to 870.

3) Connect the rf probe of the VTVM to Local Out (TP8), the secondary of L506 (L16). Adjust L506 (L16) for a maximum indication on the VTVM.

4) Connect the frequency counter to Local Out (TP8). Adjust CT503 (CT6) to obtain 36.5000 MHz. Set the mode switch to the LSB position. Adjust CT502 (CT5) to obtain 36.5025 MHz. Set the mode switch to the USB position. Adjust CT504 (CT4) to obtain 36.5075 MHz.

For the above adjustments, the clarifier (voice lock) position will affect the frequency reading. Also, the setting of CT502 (CT5), CT503 (CT6), and CT504 (CT4) will affect the *range* of the clarifier. You will need to check the range of the clarifier after you have adjusted CT502 (CT5) and CT504 (CT4) to ensure that you can vary the frequency more than 5 kHz and that the bands overlap when switching between USB and LSB. If the clarifier range is incorrect, readjust CT502 (CT5) and CT504 (CT4) until

it is correct. On mine, the 10 o'clock position on the clarifier was the best choice for adjusting CT502 (CT5) for a frequency of 36.5025 MHz and CT504 (CT4) for a frequency of 36.5075 MHz. Decreasing the value of R132 (R116) slightly will also increase the range of the clarifier.

All of the following adjustments are to components mounted on the main PC board.

Alignment of the Carrier Oscillator

Remove the mike from the rig. Set the BCD switch to 870. Set the mode switch to the LSB or USB position.

1) Connect the rf probe of the VTVM to TP2 (TP9). Adjust T8 (no coil exists) for a maximum indication of the VTVM.

2) Connect a frequency counter to TP2 (TP9). Adjust CT3 (CT2) to obtain 7.8025 MHz. Set mode switch to the AM position. Adjust CT2 (CT3) to obtain 7.8000 MHz or as close as is possible to 7.8 MHz.

Alignment of the Receiver

Remove the mike from the rig. Set the BCD switch to 870. Set the mode switch to LSB. Set the squelch to minimum. Set the rf gain to maximum.

1) Connect an rf source to the antenna connector and adjust it to 28.70 MHz. Adjust the signal level to give an S-1 to S-3 indication on the S-meter. Adjust the clarifier for a 1-kHz beat note.

Adjust T7 (L3), T6 (L4), T5 (L5), T4 (L8), and T3 (L7) for a maximum indication on the S-meter. Reduce the rf signal to keep the indication below S-5 on the S-meter.

Alignment of the Transmitter

Connect the mike to the rig. Set the BCD switch to 870. Set the mode switch to the AM position. Connect the rf wattmeter and dummy load to the antenna connector.

1) Key the mike and adjust T13 (L39), T10 (L37), L10 (L32), and L7 (L30) for a maximum indication on the wattmeter. A sharp steady whistle into the mike when in the USB or LSB position should give an indication of about 10 Watts on the wattmeter. If you have a receiver that will receive the third harmonic of the output signal, you can adjust L8 (L27) to minimize the third harmonic.

This completes the alignment. All that remains is to connect an antenna to the rig and get an on-the-air report.

Results

I have operated for over a year mobile with a 102-inch whip and have had hundreds of QSOs. I have worked all states and many foreign countries in a period of less than 8 months, with less than 10 Watts. I always receive good reports on the audio quality of the rig, and I sometimes get signal reports of S-9 or greater, but this is rare.

Operating QRP can be frustrating at times, but the contacts you make are more enjoyable, and operating with low power is more of a challenge. Converting a CB rig to 10 meters is an inexpensive method of getting on 10 mobile. With sunspots at their peak, you can be assured of many hours of enjoyable QRP operation. CU on 10.■

References

1. Bob Marshall WB6FOC, "Phase-Locked Loops," *Ham Radio*, July, 1978, p. 54.
2. *Signetics Analog Data Manual*, Signetics Corporation, Sunnyvale CA, 1977.
3. David Gray WB8ZBA, "A 2-Meter Frequency Synthesizer," *QST*, August, 1978, p. 11.

✓ Reader Service—see page 195

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Build the ZL Paddle

—brass with class

After gaining my New Zealand Post Office Grade 2 license, I decided to set myself up for CW as the license gave me 160m, 80m, 6m, and 2m, plus several other frequencies and most modes.

I had recently built a keyer and looked at the possibility of building a paddle key. After reading several magazine articles concerned with both CW and paddle keys, I came up with this design which is a mixture of several other designs.

I was extremely pleased with the prototype and gave it to my father, Fred ZL2AMJ, who used it to make CW tapes for some beginners who are now hams. The second key built, which was a little more advanced than the first, I gave to my uncle, Hugh ZL2BHK. After this, I got paddle key-making down to a fine art.

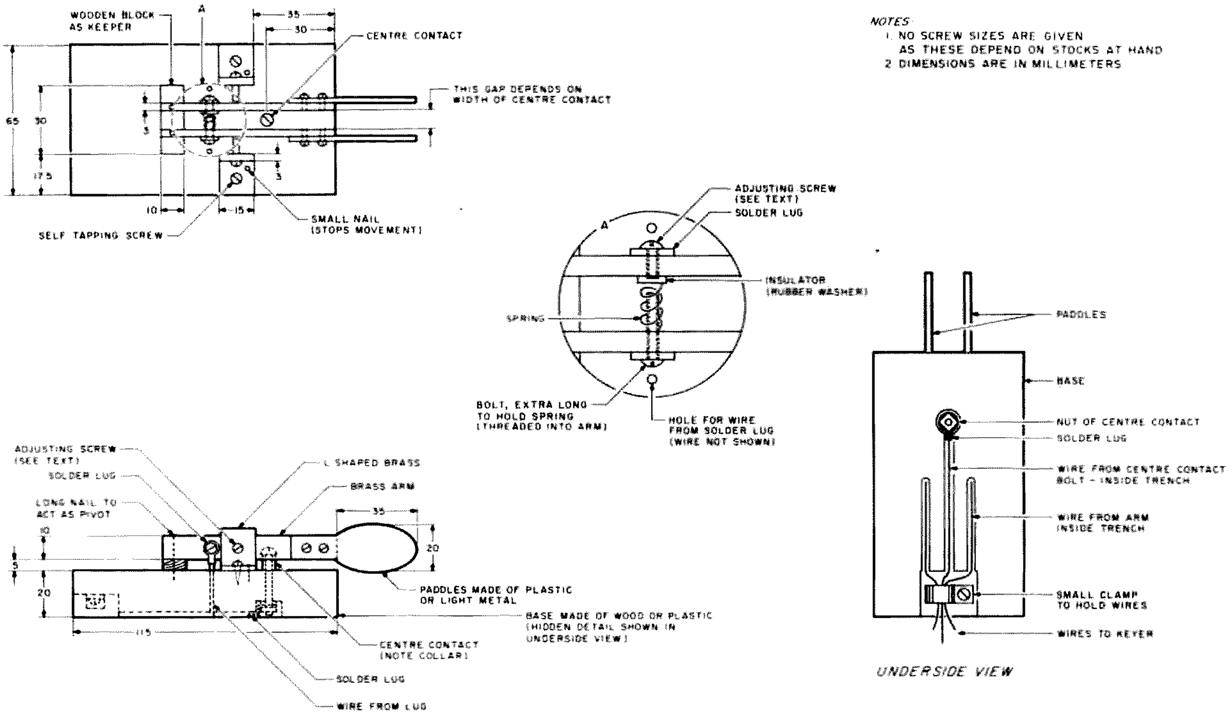

Fig. 1. A simple paddle key.

Construction Details

It is an easy key to build and anyone with a slight knowledge of metalwork should be able to produce a key to be proud of.

Perhaps the hardest part of the construction is the drilling of the vertical holes through the ends of the arms. To do this, a vise or a jig must be used to hold the arm straight, and the drill bit should be put in a drill press to keep the hole vertical. Also, with most of the holes, a center-punch hole must be punched to guide the drill. Note also that it may be necessary to put hexagonal nuts on the adjusting Ls.

The method of wiring is but one of many and can easily be changed to suit your own desires. The spring used came out of a ballpoint pen. Note also that the center contact has a collar around it, and that the contact's head is round.

The base is made extra long so that a clamp or other fastener can be used—or the wires going to the keyer can be wound around it. If the key were being used in a permanent situation, then the extra length of base could be cut off and the key screwed or nailed down.

Finishing Details

When finished, it is a good idea to take the key apart, clean all the brass with either steel wool or some type of chemical cleaner, and then spray with clear lacquer to hold fast the shine. The base can be painted or varnished, depending on the type of material used. A plastic frame or box over the key will protect it from dust.

So have fun, and you can end up with the proper end product which people will admire ■

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Repeater Time-Out Warning

—put time on your side (relatively speaking)

In the November, 1978, issue of *73*, there was an article by WB4CEO describing some circuits using the 555 integrated circuit timer chip. After reading his article, it occurred to me that this IC could be utilized for a useful circuit for amateurs who operate through repeaters on 2m FM. Using three 555 chips (or one 555 and one 556), it is possible to build a circuit that would warn an operator when the time-out circuitry of the repeater is about to drop the repeater carrier.

This article will describe a circuit for this purpose, giving details of its operation and an explanation of how each 555 chip is interfaced with the others. This time-out warning circuit has an adjustable timing interval so that it can be used on different repeaters, and is operated from a nine-volt battery.

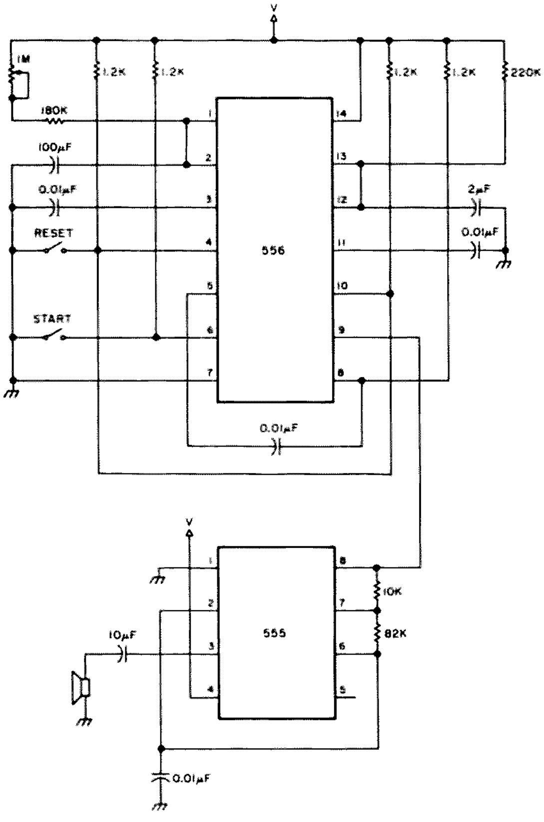

Fig. 1.

The time-out warning circuit consists of three parts, each using one 555 timer chip. The first timer chip measures a specific time interval which has been adjusted to be slightly less than the timer interval of the repeater. At the end of this interval, a pulse is generated which triggers a second timer circuit. The second timer supplies power to an audio oscillator (the third 555 chip) for a short, fixed duration. the result is a short audio tone at the end of a time interval specified by the operator. The entire circuit requires only a handful of parts, and can be assembled for under five dollars.

The actual circuit for a 30-second to 3-minute adjustable timing interval is shown in Fig. 1. This version of the circuit uses one 556 and one 555, but the same circuit can be obtained by using three 555 chips. The circuit of Fig. 1 works as follows: The operator presses a momentary-contact SPST switch (START) connected to pin 6 of the 556 chip (trigger). This begins the timing interval of the monostable multivibrator built from the left side of the 556 chip. During the timing interval, the normally low output of the multivibrator (pin 5) is high. The timing interval is determined by the RC combination of the 100-uF capacitor and the 180k resistor and 1 megohm potentiometer. For this combination of values, the interval is variable between 25 and 175 seconds. The output (pin 5) of this part of the circuit is shown in Fig. 2.

The right side of the 556 chip is also in a monostable multivibrator configuration and serves as the driver for the audio oscillator. The output of this multivibrator has a fixed-interval duration of slightly greater than 0.6 seconds. This duration is determined by the 2-uF capacitor and the 220k resistor. The trigger input (pin 8) for this multivibrator is taken from the output of the first multivibrator through a 0.01-uF capacitor. The voltage waveform of pin 8 is shown also in Fig. 2. The

0.01-uF capacitor differentiates the first stage output waveform and puts the generated pulses across the input (trigger) of the second multivibrator. The positive pulse at the start of the interval is ignored by the second stage, while the negative pulse at the end of the interval triggers the second stage. The output of the second multivibrator (pin 9) is normally low, but goes high for a duration of about 0.6 seconds. This voltage waveform is also shown in Fig. 2.

The third stage of this circuit is simply an audio oscillator. The output frequency is about 900 Hz and the oscillator is powered directly from the output of the second multivibrator.

To use the circuit, the operator adjusts the interval to be 5 or 10 seconds less than the repeater timer and presses the START button at the beginning of each transmission. When the tone sounds, he has just enough time to pass the conversation. If he finishes sooner, he presses the RESET button which immediately returns the output of the first multivibrator to its normal low value. Pin 10 of the 556 is the reset pin for the second multivibrator, and the short circuit between pins 4 and 10 allows the RESET button to return both timer outputs to their original low value. Without the short circuit between these pins, the tone will sound both at the end of the timing interval and when the RESET button is pressed.

Appropriate changes in the values for the timing resistors and capacitors would allow this circuit to be used for other timing applications. Some examples are: as an oven timer, as a 10-minute ID reminder, or even as a delay circuit for an automobile windshield wiper. For mobile operation, the START and RESET buttons could be wired directly into the microphone or connected to the microphone button so as to START when the microphone button is pressed and RESET when the button is released. Such an arrangement would allow for completely automatic mobile operation.

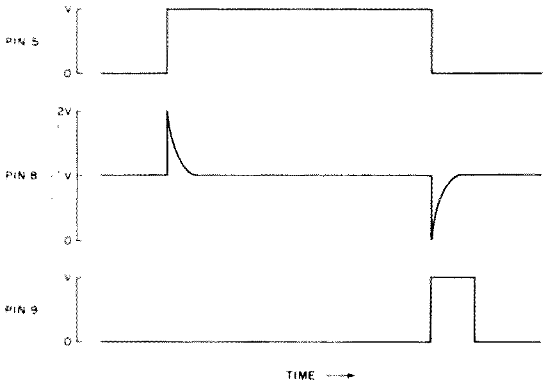

Fig. 2.

This circuit was designed for Walter WD6EBW, who is blind and confined for the most part to a wheelchair. Amateur radio, and particularly 2m FM, is his principal pastime. With this circuit, he can avoid being "timed out" on the repeaters he uses. Other blind amateurs also may find this circuit useful. ■

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CB to 10

—part XXVIII: double your channels in SSB conversions

In the course of converting several different types of SSB CB rigs for 10-meter amateur use, I've come up with a simple, no-cost modification which will *double* the number of channels available on these rigs. The idea seems to be applicable to almost all types of SSB CB transceivers, whether they use crystal-plex or synthesized circuits for frequency generation. Instead of having 23 (or 40) channels spread at 10-kHz intervals, you'll wind up with 46 (or 80) channels at about a 5-kHz spacing. And, if you modify the delta-tune circuit found on most of these rigs to swing ±2.5 kHz, you'll have just about continuous coverage on 10 meters. Sounds too good to be true? Read on!

The seed of the idea comes from the fact that *all* 10-meter SSB activity is on upper sideband. Therefore, the lower sideband function of the transceiver will never be needed and can be deactivated at no loss. Now the upper and lower sideband signals are generated by one or more carrier oscillators, sent to a balanced modulator (gets rid of the carrier), and then to a filter which selects the desired sideband and rejects the other, unwanted, sideband. Sideband selection is accomplished by shifting the carrier oscillator frequency in such a way as to place the desired sideband *inside* of the filter's bandpass and the unwanted sideband *outside* of the bandpass. See Fig. 1.

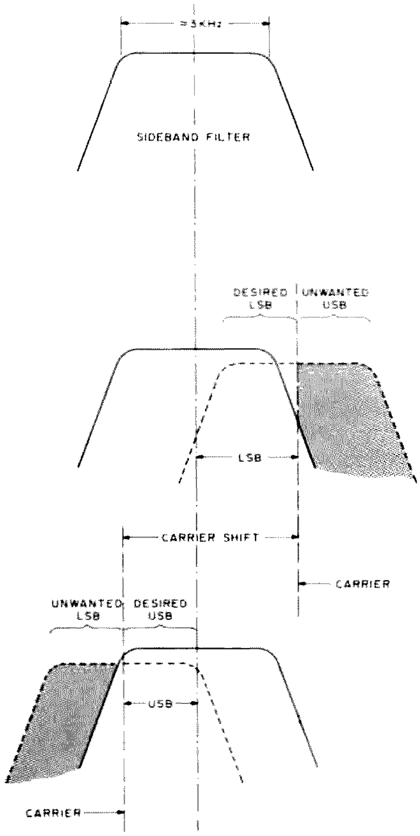

Fig. 1.

Note that the carrier is shifted by about 3 kHz, to put the desired sideband into the filter's passband. This means that the signal's actual frequency will be shifted by the same amount, i.e., changing sidebands also would move you by 3 kHz. To keep the signal on the same frequency (channel) regardless of the sideband selected, these rigs all shift another oscillator somewhere in the frequency generation chain by 3 kHz, but in the opposite direction. This exactly cancels out the frequency shift caused by the sideband change.

Suppose that we rewire the sideband selector switch so that the carrier oscillator ran in upper sideband mode at all times but left the other frequency shifters intact. Then, switching from USB to LSB still would give us a USB signal, but shifted in frequency by 3 kHz, providing a new set of 23 (or 40) channels offset between the original channels. Further, it is usually possible to readjust the USB frequency shifter up (or down) in frequency a kHz or so and the LSB frequency shifter down (or up) a kHz also, by means of the built-in trimmers. This results in about 5-kHz spacing between the two sets of channels with practically gap-free coverage.

Then, dig into the delta-tune circuit, modify it for ±2.5-kHz swing, and rewire it (if necessary) to make the delta-tune function on transmit as well as receive. That's all, folks! ■

Ham Economics: Selling Used Gear

—be wily

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So it's springtime, and you are chomping at the bit for that new chrome super-duper Belchfire-8 rig pictured so beautifully in the color ads. You look at old faithful on the table in front of you, knowing that buying the new super-chrome model will require relinquishing old faithful in the most favorable manner. (Basically, this means that you will want to somehow make the move with the smallest possible outlay of your cash!)

Now, there are two ways of managing the exchange. First (and requiring the least effort for the owner), you can look for a dealer who will trade. Be aware, however, that the dealer is in business to make money. He doesn't really want your old rig, and he has to plan for contingencies in the cleaning, repairing, and marketing of the used equipment before he can realize his profit. In other words, he will either offer you the lowest possible price for your rig or else will not allow you a discount on the new item, in order to make the deal attractive to him—not you!

The other route to take is that of selling your rig and then buying the new one. This takes some work, but is well worth the trouble. Why? Simply because you will get the best market price for your equipment; then, with cash in hand, you can negotiate for the best discount prices for the new gear—a double savings to you. How does one go about creating this magic? There are a few relatively simple steps to take which will put you on the right track. Let's look at these one at a time.

First, what price to set? Unfortunately, with ham gear there is no "Blue Book" available, such as exists for used autos. You will have to do a little investigating on your own. Check the ads in the magazines for similar equipment. Visit the local stores. Take note of the prices asked. After establishing the current popular pricing, adjust it upward or downward according to the actual condition of your equipment. Take into account both appearance and function. Based on this, set three prices in your mind:

1. The asking price—this is the price you will advertise; it's what you think the rig should bring on the market, based on your research.

2. The negotiating price—this price is the one you will work to in negotiations with potential buyers.

3. The lowest price—this is absolutely the lowest price you will accept. Never, never, never go below this price in your negotiations.

The next steps to take are those of clean-up and check-out. This takes some elbow grease, but is well worth the effort. Most gear will look very much better after a simple clean-up with some warm water and mild detergent. Simply clean off the panel, knobs, cabinet, and accessories. Shine it up as well as you can. Now, make sure the gear is working—simple things such as making sure pilot lights are all on, switches all work, etc., should be taken care of. Nothing will unsell or drop the price of a rig faster than poor appearance or the unexpected failure of some operating feature.

Now, display the rig for your prospective buyers. Here, let's assume the item is a major piece of equipment. For goodness sake, clean up your operating table and even your shack. Try to have adequate lighting so the buyer can see what he is shopping for. If you have another, newer, similar piece of equipment, hide it! Otherwise you will quickly draw interest to it and not to your sale item.

Advertising comes next. Fortunately, most hams have many possibilities here. List with the local ham networks. Many have "bulletin boards" and welcome listings. Write a simple ad to go in your local club paper. Place a card on the club bulletin board. Many suppliers have bulletin boards—place an ad card there. If you want even more coverage, send an ad to the national magazines. When writing the ad, describe the features of the equipment in a positive way. However, make sure the ad is honestly stated. Remember, as you choose the extent of advertising, that dealing long distance puts both parties in some jeopardy. Where it's reasonable, the local market seems to be a more comfortable place to do business.

Let's assume you have followed the previous steps and have had a prospective buyer call. Remember, you know your piece of equipment better than anyone else in the world and are in a strong bargaining position. You have a good piece of equipment for which you

want a fair price. Remember also, at this point, your three prices. These are the cornerstone of your negotiation. Never reduce your stated price unless there is a firm counter offer. Many times the other party will say something such as: "What is your lowest price?" or "Can't you drop the price a bit?" without making an offer himself. Should you lower the price on this basis, you have simply reduced your asking price before starting to negotiate. If your prospect is serious and makes an offer, the negotiation range is established, and then you may haggle a bit before reaching agreement. Again, keep in mind your prices; be careful not to fall back too far.

Assuming you reach agreement, there is one more piece of advice. Be careful about payment. Cash is preferred; a cashier's check and certified check are acceptable. A personal check is a dangerous thing; be very cautious if you are offered payment by this method. Unless you are personally familiar with, and completely trust, the individual who offers payment in this manner, don't accept a personal check.

Well, you've done it. You've cleaned up, marketed, and sold old faithful. You've got a handful of bills in your hand and are ready to invade the local emporium to pick up your new super-duper Belchfire-8 rig. Just keep in mind what we have gone over, because now you are on the opposite side of the table. Use your knowledge to find what you want at the best price for you. By working both ends of the game, you are a two-time winner! ■

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A Final Solution

—make life easy for your filaments

Having just purchased a new 3-500Z for my home-brew linear, I resolved that the empty feeling in my pocketbook warranted a bit of conservation on my part. When you turn on the filament switch on your linear, nasty things happen, like 14.1 Amperes flowing through a cold filament. That's quite a jolt in anybody's language. Most linears have a separate filament transformer, and therein lies a simple solution for the calm, cool, and conservative treatment for your 3-500Z (or a pair of them).

Our local hardware store had a sale on 600-Watt, 110-volt ac light dimmers. Inserting this dimmer in series with the primary of the filament transformer will provide a variable transition from a cold filament to rated operating temperature. You can control the warm-up period to suit your operating habits. This particular dimmer has a push-pull on-off switch which is coupled to the pot controlling the SCR. Bypassing this switch is no problem and allows you to use the existing filament on-off switch on your linear. The dimmer is marked "RFI filtered," but at low settings (about 1 to 2 volts), I was able to detect a very low level of hash at 14 MHz. When the tube was brought up to operating temperature, no trace of hash was heard.

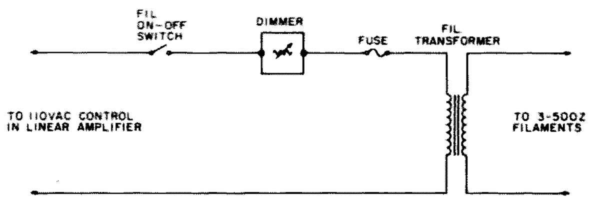

Fig. 1.

Mount the dimmer wherever convenient. I had to mount mine on the outside of the linear cabinet because I did not have room inside. If you should install it inside, the usual precautions for adequate RFI shielding should be observed. Fig. 1 is a schematic of my installation. Credit must be given to W4YFS for suggesting this idea. ■

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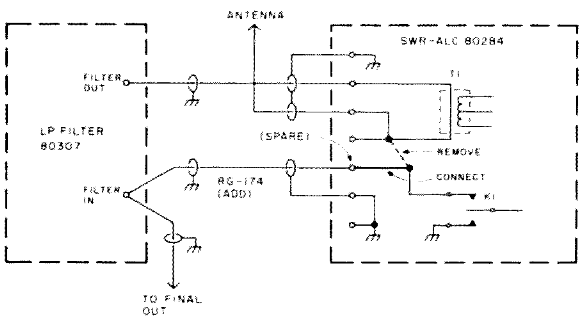
Triton IV Quick Trick



With the rf pollution being what it is in this metropolitan area, my Ten-Tec Triton IV (Model 540/544) did not do very well with regard to front-end selectivity. I did not try to analyze all of the beats, buzzes, and assorted crud coming in on the various bands, but all of the broadcast, TV, FM, paging, microwave, and VHF communication stations in the area certainly were suspected.

An external low-pass filter (below 30 MHz) will do a pretty good job of cleaning up the bands, but why have this add-on equipment when a good set of low-pass filters is built in for the transmitter section? These filters also cut off just above each band, so why leave the receiver open to possible HF interference below 30 MHz as would be the case when using the single external filter?

My modification is rather simple. Move the receiver pick-up point from the output of the transmitter section low-pass filter to the input of it. This change is shown in the diagram. The bands are now clean of spurious crud and the excellent sensitivity is not affected by receiving through the filter on any band. ■

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The NMX Relay Deceiver

—pull in those 24-V relays with a mere 12 V

Here's a way to make use of those 24-V dc relays that you find at hamfests and in surplus stores. Often you'll see high-quality rf relays or transfer switches at very reasonable prices. The problem is having to build a separate power supply to actuate them.

There is a way to operate them from 12-V dc: It uses the idea that a relay takes less voltage to hold up than it does to pull in. Also, the scheme saves current by not wasting unnecessary power when the relay is pulled up.

Looking at Fig. 1, S1 applies 12-V dc to the relay when it is closed, through S2C, which goes to ground. This probably will pull the relay up, although sluggishly. While we are looking at the circuit, notice that capacitor C is charging to +12-V dc through R1, S2A, and S2B. If we operate S2 at the same time that we close S1, look what happens: S2A disconnects the + end of C from the power supply and grounds it. S2B and S2C unground the negative end of C and the coil, respectively, and connect them together. The coil now has +12-V dc on its top end and −12-V dc on the lower end. Now, the −12-V dc is *not* the negative end of the positive supply, but is another voltage in series, adding to the power supply voltage to give 24-V dc—at least until the capacitor discharges. See Fig. 2.

Now we have a problem when the capacitor discharges to zero and tries to charge in the other direction, and the voltage across the coil goes to zero because the capacitor is in series with it. This method is impractical, but it should illustrate the principle of the circuit that we'll look at next.

In Fig. 3, we have replaced some of the switches with a diode. C charges from the supply as before. Simultaneously, S1 and S2 are closed. S1 applies +12-V dc to the top end of the coil, S2 grounds the + end of C, and the negative end of C applies −12-V dc to the lower end of the coil. D1 is reverse-biased by the negative voltage from C. Now, instead of C charging in the opposite direction after it discharges to zero, D1 conducts and holds the coil in with +12-V dc from the power supply. When S1 and S2 open, the cycle repeats. The method is not without its faults. R1 must be made smaller and smaller to speed up the recharging of C, which limits the speed of operation. If you try to operate it too quickly, it won't get the full kick, since C won't have time to charge fully.

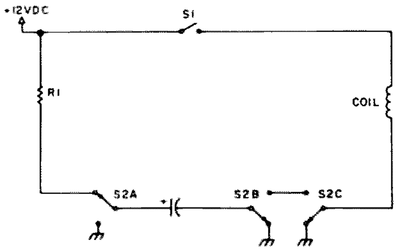

Fig. 1.

Coil Resistance	Coil Current	R1	R2 and R3	C
24 Ohms	1.0 A	120 Ohms	220 Ohms	4000 uF
600 Ohms	40 mA	3k Ohms	5.6k Ohms	200 uF

Table 1.

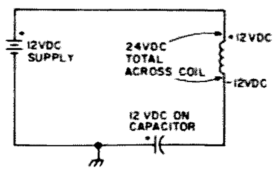

Fig. 2.

Now we have a functioning circuit. Not the most practical—so look at Fig. 4. This is the same as Fig. 3 except that S2 is replaced by Q1 and R2. Now when S1 closes, R2 causes base current to flow in Q1 and turns it on, grounding the + end of C.

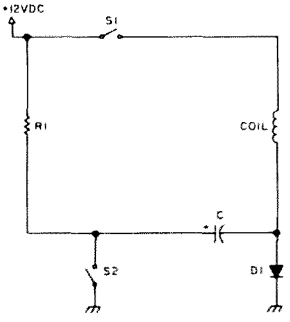

Fig. 3.

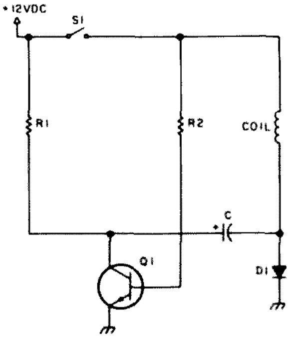

Fig. 4.

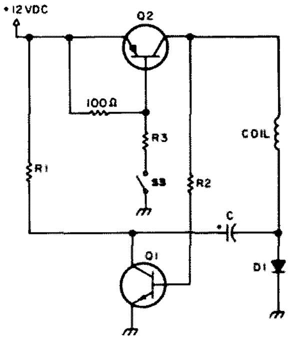

Fig. 5.

There is only one more improvement to be made. The circuit of Fig. 4 requires a floating contact for S1. A PNP power transistor can replace S1 as in Fig. 5. R3 and S3 control the base current in Q2, turning it on and operating the relay when S3 is closed. Another possibility would be to use an NPN power transistor with an optocoupler at Q2.

D1 can be a 1N4002 or almost any silicon rectifier, Q1 can be a 2N3055 or TIP-41, or almost any NPN silicon power transistor capable of handling the current of the relay coil. Q2 could be a TIP-42.

This circuit will operate a relay, of course, but it will not power anything which requires 24-V dc continuously, like an ART-13. One possible use for the circuit would be flashing a 12-V dc bulb. The extra voltage warms the filament up quickly and gives a bright flash.

The typical values in Table 1 were arrived at by figuring on a 0.1-second time constant for the boost to pull the relay up, and a 0.5-second time constant for C to recharge. To give a longer boost, increase the size of C. To speed the recharging, decrease the size of R1, but if you make R1 too small, the current will blow Q1 when it conducts. Note that some current is wasted through R1 when Q1 conducts, so you may not want to use this where current drain is critical, as in portable operation. See Fig. 6 for more on this. ■

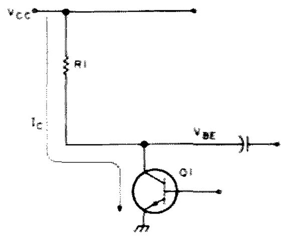

Fig. 6. Too much current through R1 when Q1 is conducting will blow Q1.

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Who Needs SSB?

—using your FT-101 on 10m AM

Low-power "channelized" 10 meter activity is certainly on the increase. Most of it consists of recrystalled (recycled?) CB rigs operating between 28.8 to 29.4 MHz. So far, the majority of these stations are using the AM mode.

FT-101 owners may want to try a little of this, too, as an interesting diversion. Turn the MODE switch to AM, and adjust the CARRIER control for 150 mA plate current. Also, adjust the MIC GAIN to the level where your voice barely kicks the plate current upward. That's what the owner's manual says.

But, wait a minute. Unless your FT-101 is equipped with an AM filter ("CB version"), you may run into an interesting nuisance. Assuming that your CLARIFIER is at the OFF or ZERO position, if you zero-beat the AM carrier in either the TUNE or CW mode and then switch back to AM, the AM station's audio will be severely distorted due to the SSB filter's narrow passband.

Or, if you instead leave your FT-101 in the AM mode and tune for a peak S-meter reading, you will actually see two peaks close together. That is probably caused by filter passband ripple. Which peak do you tune for? Actually, either peak will work. However, one of the peaks will center your signal better into the other station's (ex-CB rig) somewhat broad i-f passband. It can be confusing to try to remember which peak is which.

A Better Way

Instead, tune for a zero-beat on the CW or TUNE modes, with the CLARIFIER set at ZERO or OFF. Now switch back to AM, turn on the CLARIFIER, and set the CLARIFIER to minus one kHz. This is the first mark to the right of the CLARIFIER's zero-center mark. Setting up the CLARIFIER like this for AM is easier with the "B" or "E" models because of the separate ON-OFF switch. After you do it this way a couple of times, you will see how it eliminates any mental guesswork.

Many CBers and their lobbyists are hungrily looking at "vast, seemingly empty" ten meters. Maybe they should listen a little more—above 28.8 MHz when the skip is in. That's where some of the action is!

I'll gladly answer inquiries accompanied by an SASE. ■

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Like to See My Etchings?

—chemical technique keeps your property at home

Have you ever lent out one of your tools and then wondered where it was when, later, you needed it? You begin to think, to try to remember who might have borrowed it. As time goes on you start inquiring, but no one seems to know anything about it. Probably, your tool has wound up in the bottom of somebody's tool box mixed with all the others. It now "belongs" to that somebody, although there has been no dishonest intent involved.

About 15 years ago at some exhibit, I saw a method of engraving metal by electrolysis that intrigued me and I tried it to see if it worked. I was so pleased with the results that I engraved my name on all my tools.

Here is the way it works—engrave your name by the use of a typewriter. No, you don't place the tool in the typewriter, you type your name on a mimeograph stencil and, by electrolysis, engrave it on the tool. The engraver is very simple to build.

The engraver is made up as shown in Fig. 1: a block of wood (any size that you wish) with a dowel for a handle. The dowel has a hole drilled down through the center to receive a wire which is soldered to the copper electrode. The felt pad is used to retain the electrolyte and is held in place with a rubber band.

After you have assembled the etcher, try it out on a scrap piece of metal. First, wet the felt pad with water, then squeeze it so it's just damp, and then apply some electrolyte. Connect one lead from the transformer to the work and the other to the etcher. Place the stencil on the work, turn on the power, then place the etcher on the stencil using moderate pressure and hold for about 20-30 seconds. Lay the etcher aside and, holding one corner of the stencil with one hand, peel the stencil back, being careful not to displace it.

Examine the etch to see whether it needs more time or not. If it is too weak, either reposition the stencil so that it will be in the exact place and etch some more or try again on a fresh spot. (If you don't think it *was* etched, just try to remove it with steel wool or sandpaper! You'll be surprised how deep it really is.)

This method of using ac will just engrave the metal, but suppose that you would like a little contrast. By using dc, you have about the same principle as electroplating: removing the metal from one electrode and applying it to another. There is only one addition needed, and that is a small rectifier hooked in series with the lead going to the work.

When I first started to engrave my tools, I made up an electrolyte made up of 1 tablespoon of table salt in one pint of water. This provides enough conductivity between the electrode and the work. It works fine on ferrous metals, but when I tried it on aluminum, I was unable to obtain a dark impres-

Photos by Bill Trackler KA6BDB

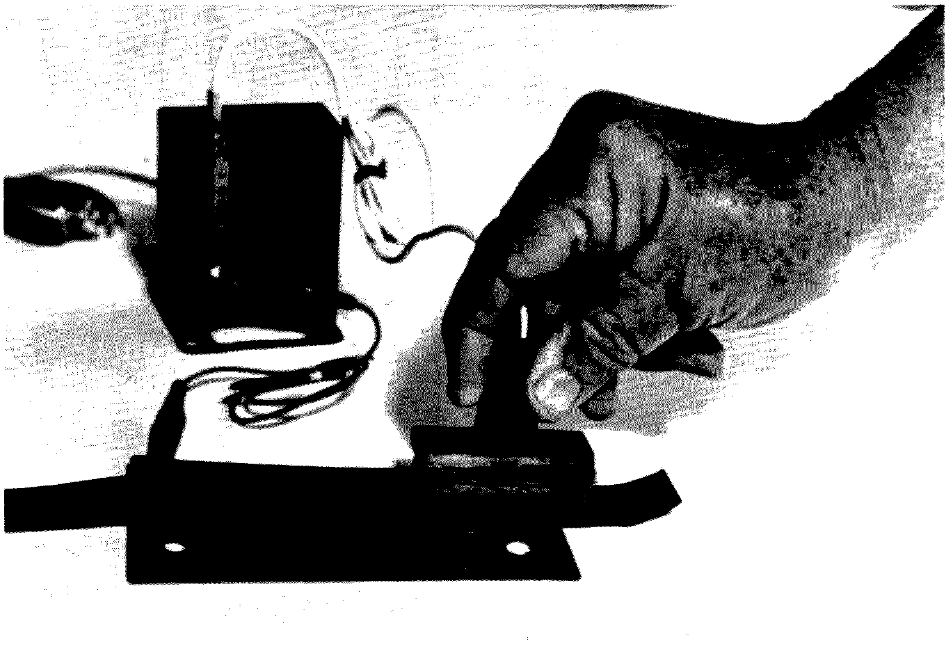

Photo A.

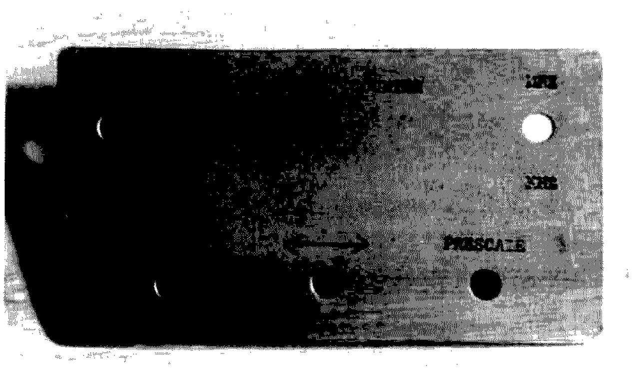

Photo B.

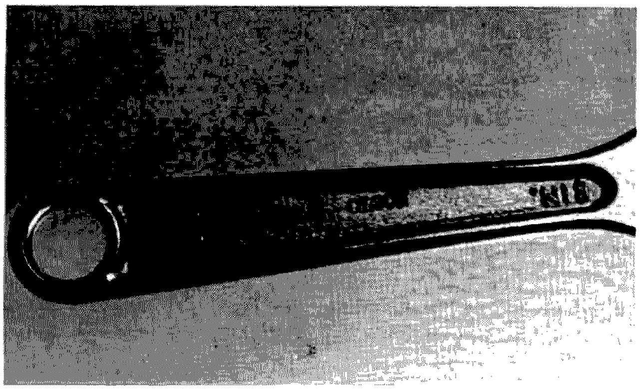

Photo C.

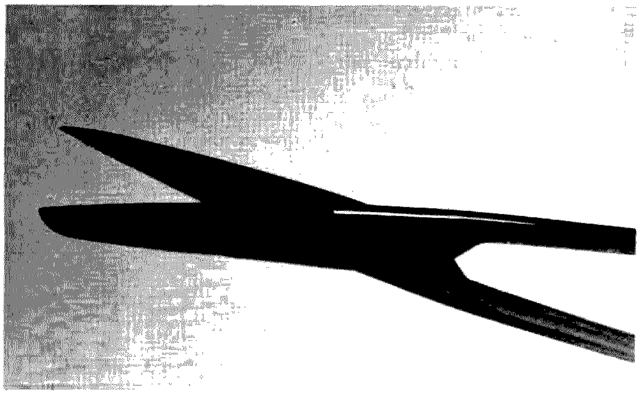

Photo D.

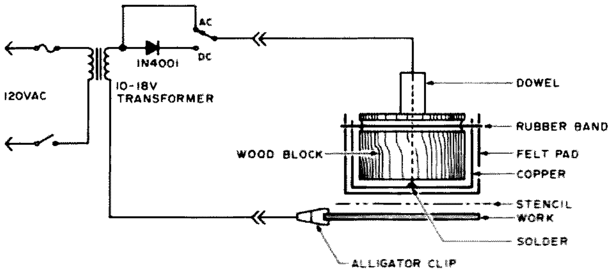

Fig. 1.

sion. I experimented with several types of salts, but was unable to obtain the desired results. So, I thought I would try an acid. I had some muriatic acid which I had planned to use to clean my driveway, so I diluted it 4 parts water to 1 part acid and that did the trick. I recommend using rubber gloves, but this solution seems so weak that it does not have any detrimental effects on the parts of the etcher.

A rip-off artist will attempt to destroy marks which he believes will identify ownership. To beat him at his game, use a mark which is not too obvious, something which resembles a serial or model number. This may be done by using the last two groups of your social security number—or your first initial plus the number: G-40-459. It is a good idea to contact your local police and ask about the procedure for registering your ID with them.

You also can etch parts locations on your chassis and names of controls on your panels. If you have an artistic touch, you can make special designs on your panels. Just use a fine ball-point pen and draw the design on the stencil. If the design is a large one, just increase the size of your etcher.

Ham radio is frowned upon by many XYLs, but don't give up; show her that through your hobby you can do interesting things that she can appreciate. As I said, if you have an artistic touch, you could, for example, come up with some sort of a plaque. This she might award to one of her bridge players. And if *she* is the one who has the artistic touch, you can make another etcher for her! Make her happy and get off the hook! ■

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A Low-Life Antenna

—tune in on the life below 500 kHz

There has been a resurgence of interest in the low-frequency bands (0-500 kHz) of late among many radio amateurs. Twenty-four hour weather broadcasts, navigational beacons, standard time broadcasts, the license-free 160-190 kHz communications band, as well as many other services residing in this lowest end of the spectrum, make it a very special challenge to the active amateur.

Unfortunately, many experimenters shy away from LF due to the misconception that antennas for this band must be gigantic to work well. I have spent several years experimenting in this band, using all shapes and forms of antennas, but I have found the antenna described here to be an excellent performer, as well as being practical and of low construction cost.

Description

There are three basic rules to follow in designing a low-frequency antenna.

1. It must be vertical. A horizontal antenna of any practical size on this band is a real exercise in frustration and will perform about as well as a dummy load.

2. It should use a tuning network of some kind. Antennas on this band are very high Q devices, and some kind of tuning arrangement will be of great help.

3. It should have a good ground system. Although I have gotten good results with nothing more than a 6-foot ground rod, results are directly proportional to your ground system's efficiency.

The antenna is basically a center- and base-loaded vertical with a capacitance "top hat." The major components are the tuning box, loading coil, and top hat, shown in Fig. 1.

Tuning Box

A suggested tuning network is shown in Fig. 2. In this configuration, the tuning is all done by the variable capacitor, C1. C2-C5 are switched into the circuit to give the capacitor an effective range of 0-2365 pF. If you happen to have a switch with more than five contacts on it, you can extend this range, but I do not recommend going overboard. L1 is wound on a 2.5-inch-diameter, 5-inch-long form (I used a large pill bottle), using about #28 wire. Several layers may be required, but be sure to secure each layer as it is finished. There is little more maddening than to finish 299 turns and then have your winding go flying off the end of the form.

The coil is tapped at 50 turns in order to tie in the feedline. The best method of doing this is to bring out some slack at the 50th winding, twist together, and solder. Be sure to secure the tap to a terminal strip when you mount it so that you won't have to strangle your kids when they trip over the coax and pull the tap out of the coil. If you have another rotary switch on hand, you can tap the coil at several other places to give even more tuning range.

The manner of mounting components in the tuning box is a matter of personal preference as, at this frequency, long leads do not show an appreciable inductance (within reason, of course).

The network can be mounted in the shack, but in most cases this would require a long horizontal run to the first standoff sup-

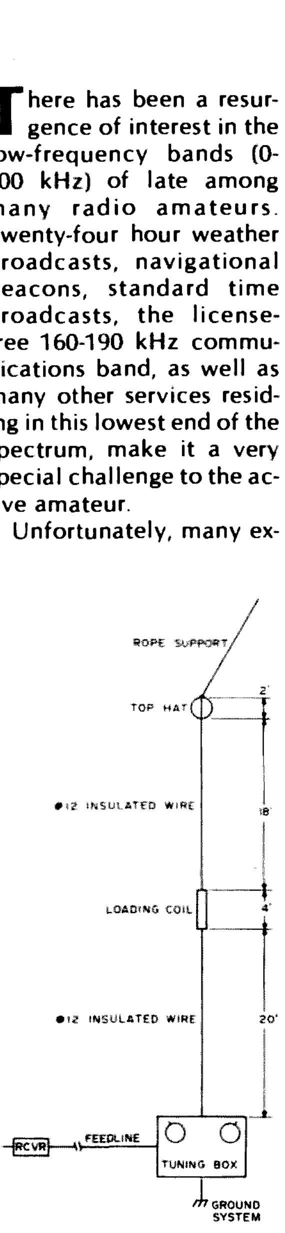


Fig. 1. Antenna.

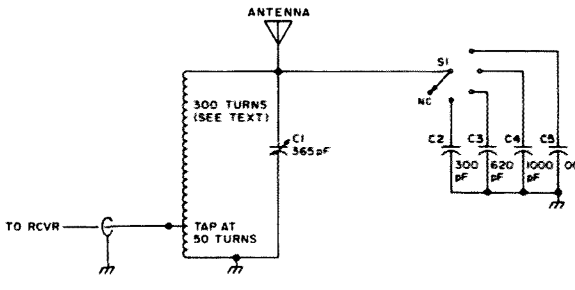


Fig. 2. Tuning box.

porting the end of the vertical element. As much of the antenna as possible must be kept vertical.

Loading Coil

The loading coil is constructed from a 4-foot length of 1.5-inch PVC pipe available from any hardware store. Start the winding six inches in from the end and wind to within six inches of the other end. This leaves enough space at either end to secure the vertical wire elements. Alternate every six inches with close- and wide-spaced winding. I don't know why, but this seems to work better than using consistently close- or wide-spaced winding. Have patience!

I was able to secure the enameled wire I needed by going to a TV repair shop and getting some old television yokes. These contain a lot of #24-28 wire that can be gotten out with little effort. The owner of the TV shop gave me the bad yokes just to get them out of his way.

Always keep a piece of electrical tape close at hand to secure the winding should you have to get up from the table. When the winding is finished (if you haven't gone crazy by now), cover the entire length with electrical tape and plug the ends to keep the bugs and other undesirables out.

Top Hat

The top hat's function is to increase the antenna's capacitance to its ground plane, thus increasing its efficiency. My top hat was constructed from two 2-foot-diameter loops of coat-hanger wire joined at right angles, with a brace down the center to support the weight of the rest of the antenna. (See Fig. 1.)

Installation

Fig. 3 shows my method of installation. This system was chosen simply because the tree was in the right place and tall enough, and I have a friend who is good at climbing 75-foot tall sweet gum trees. (Not recommended!) You can erect your LF antenna by likewise sloping it up any kind of support, of course. Use the bow-and-arrow trick or just throw a rock up there with a string tied to it. (A case of cool 807s to the first one to do that!) Use your own ingenuity; just keep the antenna as vertical as possible.

Ground System

I recommend an 8-foot ground rod with a minimum of four radials, each about 20 feet long. The more ground, the better. However, you can get surprisingly good results with no radials at all. The tuning network does not have to be mounted directly on the ground. Remember, we are talking about low frequency.

Some Results

The antenna is at its best between 50 and 500 kHz, the most active part of the band. Fourteen states have been logged on TWEB stations (24-hour aviation weather stations). Some of the best DX has been CUT in upper Michigan—227 kHz, MF in southern Florida—365 kHz, LE in North Carolina—350 kHz, and CMH in Ohio—391 kHz. None of these was even faintly detectable with a standard loop antenna.

On occasion, I have copied beacon TUK in New England on 194 kHz with a solid signal. However, it is my understanding that this is a high-power beacon. (Most TWEB stations run about 100-1000 Watts.)

Performance on the 160-190 kHz band is really super. By the way, if you mount the transmitter right at the base, this is a legal and effective antenna for use on this band. WWVB on 60 kHz is much more readable with this system than with the loop.

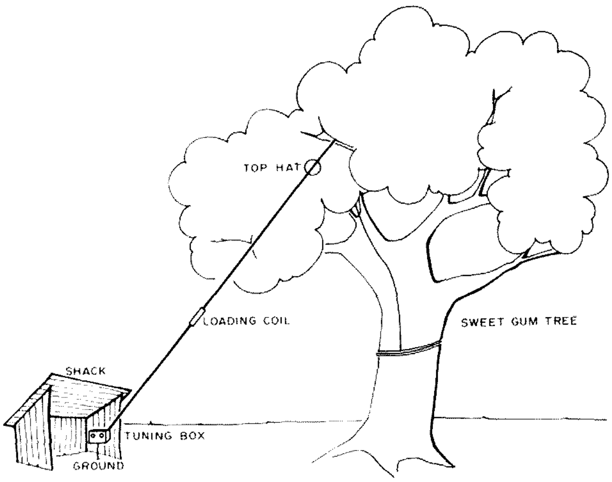


Fig. 3. The AB5S installation.

Conclusions

I have found this antenna to be a real winner for anyone interested in long-wave work who will put forth the effort to construct it. Many refinements can yet be made, I am sure, and I hope those of you who construct this system will try your own ideas. By the time you read this, my beacon, AB5S, should be back on 188 kHz, using this antenna. I will gladly answer any questions with an SASE. Good luck, and see you on long-wave! ■

Robert B. Grove WA4PYQ
Rt. 1, Box 156
Brasstown NC 28902

The Don Nobles Descramblers

—listen to what you're not supposed to hear

With the proliferation of programmable scanning receivers capable of tuning in virtually any land mobile frequency at the whim of the user, law-enforcement agencies have been hard put to find ways to protect their privacy. Every time a new security technique is devised, some enterprising individual will devise a way to defeat it!

For many years, one of the favorite methods to encrypt speech has been frequency inversion. Just as an incoming frequency is mixed with an oscillator in a superheterodyne receiver to produce another frequency, the speech inverter mixes normal speech with a tone to produce a different frequency which is transmitted as scrambled speech. This sounds to the unaided listener like a sideband signal badly out of whack!

To decode the inverted speech, however, one merely has to pass the encrypted speech back through a device similar to the one that inverted it in the first place. This process will re-invert the inverted speech; in other words, the voice spectrum has gone a full 360 degrees—first out of phase, then back in phase again, so to speak.

Several manufacturers produce speech decoders, but one name stands prominently against the field: Don Nobles.

The Nobles descramblers are certainly straightforward enough. The scrambled speech is extracted from the speaker output of the scanner and fed into a 1496 double-balanced mixer. There it is mixed with a reference frequency injected by a sine-wave oscil-

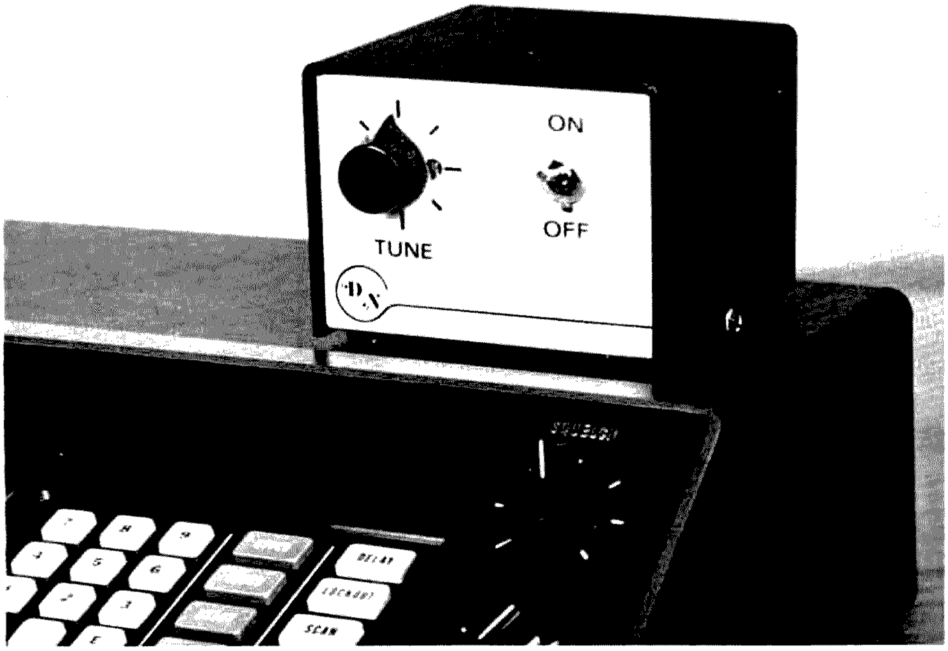


Photo A. The D-12 scramble decoder shown working here with a Bearcat 210 scanner.

lator. The resultant inverted audio is passed on to a Motorola 1306P amplifier and out to the user's speaker.

Because virtually any reference tone can be used by the transmitting agency to encrypt their voice transmissions, all speech-inversion decoders have a potentiometer to control the frequency of the local reference oscillator to match the original inversion frequency.

Nobles has taken a proven circuit and used it in his various models. The D-12 (Photo A) is the standard version designed to hook to a conventional scanner. It features a front-panel toggle switch for the dual purpose of turning the unit on and off and bypassing the decoder when switched off to allow normal speech to be fed from the scanner to the speaker.

The TUNE control adjusts the frequency of the internal reference oscillator, varying the baseband of the audio until the recovered speech sounds normal. Once set, this control is usually forgotten. Most law-enforcement agencies like to leave their speech inverter codes set to one particular frequency to avoid the confusion which would arise from constant changing. Some agencies, however, code several scrambler settings, referring to RED or a number to signify the particular code they are switching to. If this is the case, the listener may wish to rotate his Nobles TUNE control until the speech is normal and mark the position on the panel for later reference.

The descrambler is powered by a standard nine-volt transistor radio battery which is held to the back of the decoder cabinet by a small spring clamp. A three-conductor cable protrudes from the back of the cabinet to allow attachment to the monitor receiver. In virtually all cases, a simple plug attachment chosen to mate with the radio is all that will be necessary to defeat the internal speaker. An extension speaker will have to be supplied by the user; otherwise, internal speaker rewiring will be necessary to utilize the receiver's built-in speaker.

A miniature edition of the D-12 is available as the P-20 "Pocket Pal" (Photo B); it is designed to attach to pocket scanners with a minimum of bulk. Measuring a scant 2" × 2" × 3" (approximately), it does the job neatly.

Comments regarding the hookup and operation of the P-20 are the same as for the D-12. Both units give a fine accounting of themselves in actual use.

Finally, I would like to mention a handy additional accessory from Don Nobles: the TM-100 Tapemate (Photo C). It is designed to record telephone conversations directly into a tape recorder. Automatic activation of the recorder's remote jack is provided by the TM-100 when the telephone handset is lifted from the cradle. Yes, it's legal, and it is useful for verifying orders and recording crank calls.

All of these clever Nobles innovations are inexpensive and reliable. The Tapemate is $24.95; the scramble decoders are somewhat more. For further information, check with your local radio equipment supplier or write Don Nobles Electronics, Route 7, Box 610, Hot Springs AR 71901.■

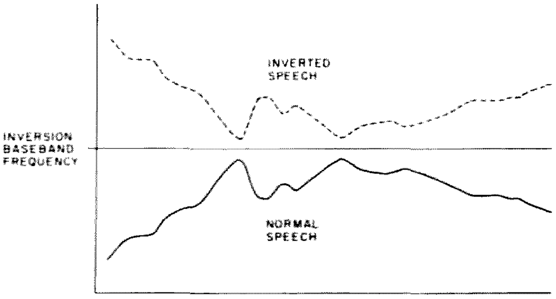


Fig. 1. Simplified representation of common speech inversion.

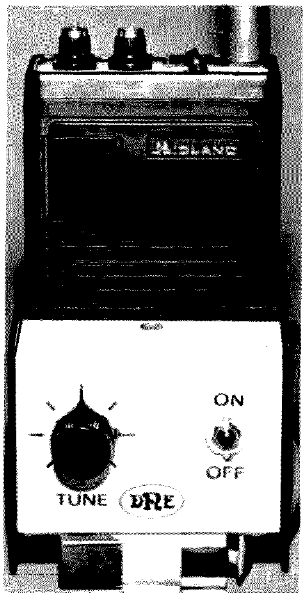


Photo B. The tiny P-20 is designed to fit against a pocket scanner like this Midland.

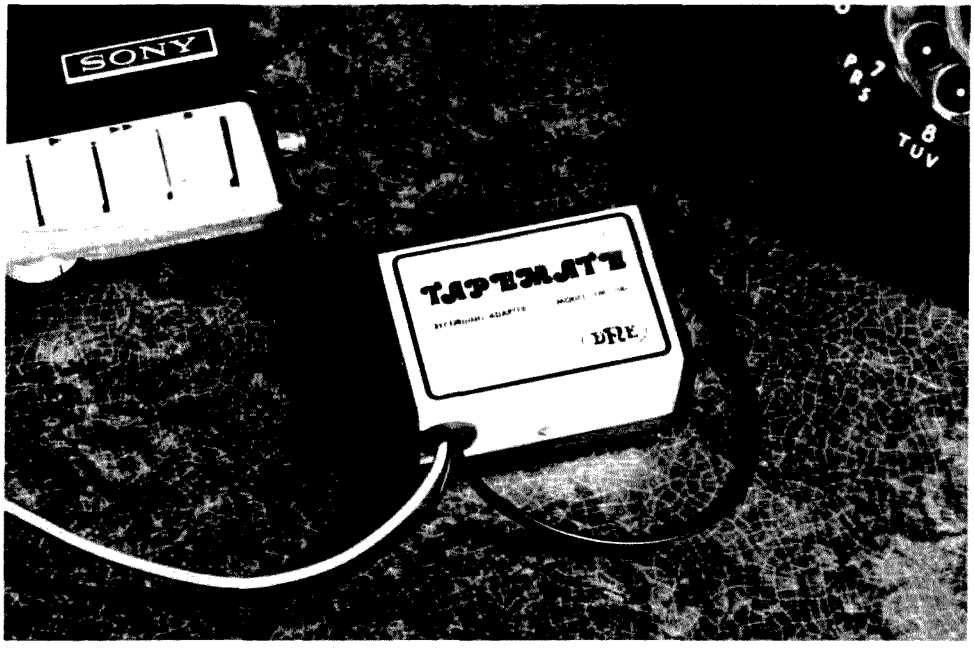


Photo C. The TM-100 Tapemate automatically activates a tape recorder when the telephone handset is lifted from its cradle.

Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, *Pine Street, Peterborough NH 03458, Attn: Social Events.*

INDIANAPOLIS IN
JUL 1

The Central Indiana Section of IEEE and the corresponding IEEE Computer Society Chapter will hold the fifth annual IEEE Indy Microcomputer Show on Tuesday, July 1, 1980, from 9:30 am to 8:00 pm at the Sheraton Motor Inn East, located at I-465 and SR-67 in Indianapolis. There will be exhibits, demonstrations, and technical seminars addressing the engineering, industrial, scientific, medical, business, and personal applications of microcomputer sytems.

HARRISBURG PA
JUL 4

The Harrisburg RAC Annual Firecracker Hamfest will be held on Friday, July 4, 1980, at the Shellsville VFW Picnic Grounds. Take exit 27 off I-81 north of Harrisburg at PA route 39, then follow the signs for one mile or call for talk-in information. There are shade trees and a pavilion. Parking for 1,000 cars will be available. Food will be available or bring your own picnic. Admission is $3.00; XYLs and children are free. Tailgating is $1.50. Many valuable prizes will be awarded.

BURLINGTON ONT CAN
JUL 5

The Burlington Amateur Radio Club will hold its 6th annual Ontario Hamfest 1980 on Saturday, July 5, 1980, at the Milton Fairgrounds, just south of the intersection of Highways 401 and 25 (Exit 39). General admission is $3.00; children and ladies are free. Pre-registration before June 15, 1980, is $2.00. Gates will open Friday, July 4, 1980, at 12:00 noon and Saturday, July 5, 1980, at 7:00 am. The flea market opens at 8:00 am and tables are free. There will be camping available and food and prizes. Talk-in on 147.81/.21 VE3RSB. For information, write BARC, Box 836, Burlington ONT, CAN L7R 3Y7.

OAK CREEK WI
JUL 12

The South Milwaukee Amateur Radio Club will hold its annual Swapfest '80 on Saturday, July 12, 1980, at the American Legion Post #434, 9327 S. Shepard Avenue, Oak Creek WI. Admission is $2.00 and includes a happy hour with free beverages. Prizes include a $100 first prize, a $50 second prize, and a variety of other prizes. Activities will begin at 7:00 am and continue until 5:00 pm. Parking, a picnic area, and hot and cold sandwiches, as well as liquid refreshments, will be available on the grounds. Overnight camping is also available. Talk-in on 146.94. More details, including a map, may be obtained from the South Milwaukee Amateur Radio Club, Inc., Robert Kastelic WB9TIK, Secretary, PO Box 102, South Milwaukee WI 53172.

INT'L PEACE GARDENS MANITOBA
JUL 12-13

The International Peace Garden Hamfest will be held on July 12-13, 1980, at the International Peace Garden on the North Dakota/Manitoba, Canada, border. Featured will be a flea market and various activities for hams and their families. Registrations will be taken on both days for door prizes and there will be a free breakfast for those who register on Sunday. For more information, contact the committee chairmen, VE4LB and WAØLPV.

CHARLESTON SC
JUL 12-13

The Charleston Amateur Radio Society will hold the Charleston Hamfest on July 12-13, 1980, at the Omar Shrine Temple. General admission is $3.50, which includes one prize ticket. Additional prize tickets are $2.00 each or 5 for $5.50. Children 12 years old and under will be admitted free. Flea market tables are $5.00 and commercial booths are $35.00, which includes 2 admission tickets. Saturday's prize is an Icom IC-2A synthesized 2-meter handie-talkie. Sunday's grand prize is a Kenwood TS-120S; second prize is an Azden PCS 2000 2-meter rig. There will be refreshments, ladies' activities and a hospitality room available. Talk-in on 146.34/.94, 146.16/.76, and 146.19/.79 for general use. For more information, contact the Charleston Hamfest Committee, PO Box 30643, Charleston SC 29407, or phone (803)-747-2324/563-2523.

INDIANAPOLIS IN
JUL 13

The Indianapolis Amateur Radio Convention and Hamfest will be held on Sunday, July 13, 1980, at the Marion County Fairgrounds. For further information, write Indianapolis Amateur Radio Association, Box 11086, Indianapolis IN 46201.

HIBBING MN
JUL 13

Five amateur radio clubs in northern Minnesota are sponsoring the Iron Range Hamfest on Sunday, July 13, 1980, from 9:00 am until 5:00 pm at the St. Louis County Fairgrounds, Hib-

bing MN. Camping facilities with electrical and water hookups are available for $3.50 per night. There are other accommodations available close by. Features will include a flea market, games for XYLs and children, door prizes, including a grand prize of a Yaesu FT-202 handheld transceiver, and indoor displays. Tables for the flea market are free and lunch will be available. Talk-in on .19/.79.

WILKES-BARRE PA
JUL 13

The Broadcasters' Amateur Radio Club will hold its third annual hamfest on July 13, 1980, from 9:00 am to 4:00 pm at the Pocono Downs Race Track, Rte. 315, Plains Twp., 1½ miles north of Wilkes-Barre PA. Admission is $2.50, XYLs and children are free, and there will be no additional charge for sellers. Gates will open at 8:00 am for set-up. There will be unlimited outdoor and indoor space, refreshments, prizes, a free FM clinic, and ac power available. Talk-in on 147.66/.06 and 146.52 simplex. For more information, contact Charles Baltimore WA3NUT, BARC, 62 South Franklin Street, Wilkes-Barre PA 18773, or phone (717)-823-3101.

WAUKESHA WI
JUL 19

The Kettle Moraine Radio Amateur Club (KMRA) will hold its annual hamfest on Saturday, July 19, 1980, beginning at 7:00 am, at the Badger Raceway, Waukesha WI. The Badger Raceway is located west of Dousman on U.S. 18, 3½ miles from the intersection of I-94 and State Highway 67. There will be overnight camping on the grounds on Friday. Tickets are $1.50 in advance and $2.00 at the door. Talk-in on 146.52, 52.525, and 28.650 MHz. For additional information and advance tickets, write KMRA Hamfest, 108 Shepard Ct., Mukwonago WI 53149.

CARY NC
JUL 19

The Cary Amateur Radio Club will hold its 8th annual Mid-Summer Swapfest on Saturday, July 19, 1980 (rain or shine), at the Cary Lions Club Shelter (next to the Cary Senior High School). Gates will open at 9:00 am. There will be an auction (no fees) from 1:00 pm to 2:00 pm. Prize drawings will be held from 2:00 pm to 2:15 pm and will include a Kenwood TS-520SE, a Yaesu FT-202 with nicads and charger, a CDE Tailtwister® rotor, a Hy-Gain TH3 Sr., and others. Registration is $3.00. Tables will be rented or bring your own. Talk-in on 146.28/.88 and 146.52/.52. For more information, write CARC, Box 53, Cary NC 27511.

BLYTHEVILLE AR
JUL 19-20

The 1980 Arkansas Army MARS Convention will be held on July 19-20, 1980, at the National Guard Armory, Highway 61 south, Blytheville AR. Registration is $7.50 and includes a catfish supper and pancake breakfast. Talk-in on 148.01 and .07/.67. For more information, contact Richard Duncan WB5CNV/AAR6SH, 209 Wilson Street, Dell AR 72426.

MONACA PA
JUL 20

The Beaver Valley Amateur Radio Association will hold its third annual hamfest on Sunday, July 20, 1980, at the Community College of Beaver County from 9:00 am to 5:00 pm. Registration is $2.00 each or 3 for $5.00; children under 12 will be admitted free. Refreshments will be available, as well as free parking, indoor vendor space, and a paved outdoor flea market. There will be a drawing at 4:00 pm and door prizes all day, including a first prize of a Kenwood TS-520SE transceiver, a second prize of a Kenwood TS-2400 synthesized hand-held, and a third prize of a Cushcraft ATB-34 triband beam. Talk-in on 146.25/.85 WR3AAA, 223.26/.86 WR3AAA, and 146.52 simplex. For further information and advance registration, contact either Gary Mohrbacher WB3FKE, 3417 47th Street, New Brighton PA 15066, (412)-843-9546, or Adam Horniak WB3JZN, 182 Edgewood Street, Aliquippa PA 15001, (412)-378-9667.

WRIGHTSTOWN NJ
JUL 20

The West Jersey Radio Amateurs, Inc., hamfest will be held on July 20, 1980, at McGuire AFB, Wrightstown NJ, from 9:00 am to 4:00 pm. Admission is $2.50 and advance orders receive an additional chance at door prizes. Spouses and children are free. Tailgate or table space is $2.50 per space; bring your own table. Refreshments and activities will be available. Door prizes will be awarded continuously and a

major door prize of a 2-meter transceiver will be drawn at 3:30. Talk-in on .52 and 146.925. Advance tickets are available from club members or send an SASE to Mary Lou Shontz WB2QIU, 107 Spruce Lane, Route 16, Mt. Holly NJ 08060. For additional information, call Mark Millman N2ME at (609)-871-6691.

WASHINGTON MO
JUL 20

The Zero-Beaters ARC will sponsor the Washington Hamfest on Sunday, July 20, 1980, at the Washington Fairgrounds, Washington MO. There will be prizes and good buys for the ham, and bingo and a candy scramble for other family members. Features will include a commercial dealer exhibit, a large traders' row, and delicious food. Talk-in on .52 simplex. For more information on tickets, prizes, and camping, write ZBARC, Box 24, Dutzow MO 63342.

MCKEESPORT PA
JUL 20

The Two Rivers Amateur Radio Club will hold its annual hamfest on Sunday, July 20, 1980, at the Penn State University McKeesport Campus, McKeesport PA. A flea market will be held outside on the hard surface and car spaces will be $5.00. There will be food and drink, door prizes, and free admission. Talk-in on 146.22/.82.

GOLDEN CO
JUL 20

The RMRL will hold its annual Field Day Demonstration and Swapfest on Sunday, July 20, 1980, at 10:00 am at Karl Ramstetter's (WAØHJZ) Ranch. It is located on top of Guy Hill, Highway 93, Golden CO. Signs will be posted. There will be door prizes. It would be appreciated if everyone would make his contribution to the potluck lunch by bringing his favorite dish and chairs and/or blankets. Soft drinks will be provided. Talk-in on .34 and .94.

LOGANSPORT IN
JUL 20

The Cass County Amateur Radio Club's third annual hamfest will be held on Sunday, July 20, 1980, from 7:00 am to 4:00 pm at the 4-H Fairgrounds. Go north of Logansport on Highway 25, turn right at Road 100, and follow the QSY signs. Advance tickets are $1.50; $2.00 at the gate. Outside setup is free; undercover is $1.00. Bring your own tables. Free overnight camping, refreshments, and door prizes will be available. Talk-in on 146.52 and Logansport Repeater 147.78/.18. For information, write Roy E. Mannikko WB9PKN, 530 North Cicott Street, Logansport IN 46947.

CANTON OH
JUL 20

The Canton Amateur Radio Club and the Tusco Amateur Radio Club will hold the 6th annual Hall of Fame Hamfest on Sunday, July 20, 1980, at the Nimishillen Grange near Louisville OH, just off of Route 62, East of Canton OH. Admission is $2.50 in advance and $3.00 at the gate. Talk-in on .52/.52, .19/.79, and .72/.12. For reservations and information, contact Max Lebold WA8SHP, 10877 Hazelview Avenue, Alliance OH 44601, or phone (216)-821-8794.

DETROIT LAKES MN
JUL 20

The Detroit Lakes Amateur Radio Club will hold its 4th annual picnic and swapfest on Sunday, July 20, 1980, from 10:00 am to 4:00 pm at Long Lake Park, 1½ miles west of Detroit Lakes on Highway 10. Tickets for the drawing are $1.00. Picnic and swap tables will be available. Talk-in on 146.22/.82 and 146.52/.52. For additional information, contact Russ Berger NØARZ, 1406 Long Avenue, Detroit Lakes MN 56501.

BELVIDERE IL
JUL 20

The annual Big Thunder ARC Hamfest will be held on Sunday, July 20, 1980, at the Boone County Fairgrounds. There will be a large indoor facility and plenty of outdoor space available, as well as camping after 6:00 pm on Saturday. Talk-in on 146.52 simplex and 147.375 repeater. For more information, write Mike George, 6159 Broadview, Belvidere IL 61008.

RAPID CITY SD
JUL 25-27

The Black Hills Amateur Radio Club will hold its 1980 South Dakota Hamfest and Picnic on Friday, July 25, through Sunday, July 27, 1980, at the Surbeck Center, South Dakota School of Mines campus, Rapid City SD. Registration will be $6.50 before July 1st, and $7.00 after July 1st and at the door beginning at 4:00 pm on Friday, July 25th. Door prizes will be awarded along with a pre-registration prize. There will be forums, tours, exhibits, a transmitter hunt, a flea market, contests, and YL activities. Flea-market tables are free. A Sunday noon meal will be catered and tickets will be available at the door. Assistance will be provided in obtaining lodging or trailer parking facilities. Talk-in on 146.34/.94, or contact WØBLK. To pre-register or obtain further information, contact Black Hills Amateur Radio Club, PO Box 1014, Rapid City SD 57709.

OKLAHOMA CITY OK
JUL 25-27

The Central Oklahoma Radio Amateurs will hold the Oklahoma State ARRL Convention and "Ham Holiday" on July 25-27, 1980, at Lincoln Plaza, 4445 Lincoln Boulevard, Oklahoma City OK. The program will include an ARRL forum and technical talks. In addition, a full program is scheduled for the ladies. Pre-registration will be $5.00 if received before July 19. After that date, it will be $6.00. A special award is being given to encourage pre-registration. There will be many other awards. Adequate rooms are available for commercial exhibitors and flea market swappers. Unlimited parking space is also available. Mail your registration to CORA, PO Box 15013, Oklahoma City OK 73155.

SEATTLE WA
JUL 25-27

The 26th National ARRL Convention will be held on July 25-27, 1980, at the SEA-TAC Airport Red Lion Motor Inn, 18740 Pacific Highway South, Seattle WA 98188. Basic registration is $7.00 before July 1, 1980, $9.00 after that date; additional family registration is $6.00, $7.00 after July 1, and student registration is $7.00. Features will include prize drawings, forums, displays and new equipment exhibits, tours, and much more. Roy Neal K6DUE of NBC News will be the featured Saturday-night banquet speaker. For additional details, write John H. Brown W7CKZ, Promotion Chairman, SEANARC '80, PO Box 68534, Seattle WA 98168.

NASHVILLE TN
JUL 27

The Nashville Hamfest will be held on Sunday, July 27, 1980, beginning at 8:00 am CDT at the National Guard Armory, Sidco Drive, Nashville TN. Admission is $1.00 and tables are $3.00. Refreshments will be available and the hamfest will be all indoors. Talk-in on .90/.30. For more information, contact Radio Amateur Transmitting Society (RATS), PO Box 2892, Nashville TN 37219.

WEST FRIENDSHIP MD
JUL 27

The Baltimore Radio Amateur Television Society will hold its annual BRATS Maryland Hamfest on Sunday, July 27, 1980, at the Howard County Fairgrounds, just off I-70 and Route 32 at Route 144, West Friendship MD. Beginning at 8:00 am, activities will be held rain or shine. Talk-in on .63/.03, .16/.76, and .52 simplex. For information or table reservations, write BRATS, Box 5915, Baltimore MD 21208.

YELLOWSTONE
AUG 1-3

The Wyoming-Idaho-Montana-Utah Amateur Radio Council will hold its Yellowstone National Amateur Radio Convention on August 1-3, 1980, at the convention center in West Yellowstone MT. The convention will feature a full program starting Friday morning and running through Sunday. Activities will include forums, contests, crafts, movies, swap tables, dealers, banquets, and much more. There are hotel-motel accommodations available adjoining the convention center and RV parks and campgrounds close by. There are airports and gas available in West Yellowstone. For more information, write WIMU, PO Box 20116, Salt Lake City UT 84120.

MACON MO
AUG 2

The Tri-County ARC, NEMO ARC, and Macon County ARC will hold the 2nd annual North Central Missouri Hamfest on Saturday, August 2, 1980, from 9:00 am to 5:00 pm at the Macon County Fairgrounds Park, Highway 63 south, Macon MO. There will be free parking, an enclosed

area for commercial displays, food available on the grounds, and YL activities. Tailgaters are welcome. Tickets for the prize drawing will be available for $1.00 each at the door. The major prize will be either a color TV, an allband receiver, or a handheld two-meter transceiver. Talk-in on 146.52, 147.69/.09, and 146.07/.67. For more information, contact Charles Coy WB0ENV, 601 McKinley, Moberly MO 65270.

JACKSONVILLE FL
AUG 2-3

The Jacksonville Hamfest Association is pleased to announce that the 1980 Jacksonville Hamfest and ARRL Florida State Convention will be held on August 2-3, 1980, at a new location, the Orange Park Kennel Club at the intersection of I-295 and US Highway 17. Advance registration is $3.00 and is available from Jacksonville Hamfest, 1249 Cape Charles Avenue, Atlantic Beach FL 32233. Price at the door will be $3.50. A large indoor swap mart will be featured, with tables available at $5.00 per day. The table reservations can be ordered from Andy Burton WA4TUB, 5101 Younis Road, Jacksonville FL 32218. Interesting programs and forums are planned, as well as door prizes and many manufacturer and dealer exhibits. Plenty of family activities are available close by. The headquarters hotel is the Best Western located just across the street from the hamfest. Special rates of $23.00 single and $28.00 double are available; reservations should be made through the local number (904)-264-1211 to get the low rates. A special DXers' forum and dinner banquet will feature a Spratly Island presentation by Stu Woodward K4SMX. Also, Bill Barr N4NX will present a show on the VP2KC world record effort of over 32 million points in the CQ WW contest (1979). Reservations for the banquet can be obtained for $11.50 each by writing N4KE, 258 Wesley Road, Green Cove Spring FL 32043. For the fly-in ham, Herlong Airport is the closest landing site. Free weekend parking and rental automobiles are available. Phone (904)-783-2805 for more information. For more general information, write JHA, 911 Rio St. Johns Drive, Jacksonville FL 32211.

LEVELLAND TX
AUG 3

The Hockley County Amateur Radio Club and the Northwest Texas Emergency Net will sponsor their 15th annual picnic and swapfest on Sunday, August 3, 1980, beginning at 8:00 am at the city park in Levelland TX. This is an event for the entire family. A $3.00 registration fee is requested but not required. Lunch will begin at 12:30 pm with a bring-your-own-picnic-basket lunch. There will be swapping all day, with tables provided. Talk-in on 146.28/.88.

ANGOLA IN
AUG 3

The Steuben County Radio Amateurs will hold their 22nd annual FM Picnic and Hamfest on Sunday, August 3, 1980, at Crooked Lake, Angola IN. Admission is $2.00. There will be prizes, picnic-style BBQ chicken, inside tables for vendors and exhibitors, and overnight camping (with a fee charged by the county park). Talk-in on 146.52 and 147.81/.21.

BURLINGTON VT
AUG 9-10

The Burlington Amateur Radio Club will hold its annual International Hamfest on August 9-10, 1980, at the Old Lantern Campground, 14 miles south of Burlington VT. Admission is $4.00. Planned events include a flea market, commercial exhibitors, interesting and useful door prizes, and the traditional Can-Am tug-of-war. Talk-in on .34/.94. For more information, contact Hap Preston W1VSA, PO Box 312, Burlington VT 05402.

CEDARTOWN GA
AUG 10

The Cedar Valley Amateur Radio Club will hold its annual Cedar Valley Hamfest on August 10, 1980, from 8:00 am to 4:00 pm at the Polk County Fairgrounds, on US 278, two miles east of Cedartown GA. There will be food, drinks, and prizes. Talk-in on 147.72/.12 (WR4AZU). For more information, contact Jim T. Schliestett W4IMQ, Secretary, Cedar Valley ARC, PO Box 93, Cedartown GA 30125, or phone (404)-748-5968.

ST. CLOUD MN
AUG 10

The St. Cloud Radio Club will hold its annual hamfest on August 10, 1980, at the Whitney Park Senior Center from 9:00 am until 5:00 pm. There will be free overnight camping available one mile from the site at the Sauk Rapids Lions Park. Food will be available and Uncle Tom's (W0CF) chili will be featured. There will be a swapfest and prizes. For more information, write William (Bill) R. Zins WA0OTO, RR 4, St. Cloud MN 56301 or phone (612)-253-3428.

LEXINGTON KY
AUG 10

The Bluegrass Amateur Radio Society will hold its annual ARRL Central Kentucky Bluegrass Hamfest on August 10, 1980, starting at 8:00 am at the Fasig-Tipton Sales Paddock, Newton Pike, Lexington KY. Admission is $3.00 in advance and $3.50 at the gate. This fee includes parking. There will be grand prizes, hourly door prizes, indoor exhibits and distributors, a paved outside flea market, and food service will be available. Talk-in on 146.16/.76. For details, write Bluegrass Hamfest, Attention: Edward Bono WA4ONE, 2077 Dogwood Drive, Lexington KY 40504.

WILLOW SPRINGS IL
AUG 10

The Hamfesters Amateur Radio Club will hold its 46th annual hamfest on Sunday, August 10th, 1980, at Santa Fe Park, 91st and Willow Springs Road, Willow Springs IL (near Chicago). Gates will open at 6:00 am. Tickets at the gate are $3.00 each or $2.00 each in advance. There will be free coffee for the early birds, games for the kids, prizes for the YLs, and the world-famous shoppers' row. Children under fifteen are free. For more information and advance tickets, send an SASE and a check to Hamfesters Amateur Radio Club, PO Box 42792, Chicago IL 60642.

OAKLAND NJ
AUG 16

The Ramapo Mountain Amateur Radio Club will hold its annual flea market on Saturday, August 16, 1980, at the American Legion Hall, Oak Street, Oakland NJ. Indoor tables are $5.00 and tailgating is $3.00. There is no admission fee for buyers. Refreshments will be available on the premises. Talk-in on 147.49/146.49 WR2AHD or 146.52 simplex. For advance reservations and information, call Bud Hauser WA2JUO at (201)-797-8471 or (201)-791-0589.

FT BRAGG NC
AUG 16-17

The Cape Fear Amateur Radio Society's 4th annual hamfest will be held on August 16-17, 1980, at the Main Officers' Club, FT. Bragg NC. Tickets are $1.00 in advance and $2.00 at the door. There will be 9,000 square feet of air conditioned space available. Prizes will include a TS-120S, a triband beam, a handie-talkie, and a rotor. There will be a Saturday night social and a QCWA luncheon meeting on Sunday. Talk-in on 146.31/.91, 147.93/.33, and 146.52. Send an SASE to Marie Presler WA4YMM, PO Box 35171, Fayetteville NC 28303, for tickets.

NORTH HAVEN CT
AUG 16-17

The South Central Connecticut Amateur Radio Association will hold its Super Scarafest '80 on August 16-17, 1980, at the Ramada Inn, at Exit 12 of I-91, North Haven CT 06473. Booths will be available. Features will include a ham and computer flea market, an auction, special events for non-ham spouses and children, and drawings for prizes throughout the show. Prizes will include a solid-state low-band transceiver, a synthesized two-meter HT, a microcomputer, and a 600-MHz frequency counter. Admission will be $4.00, pre-registration before July 1, and $5.00 at the door for both days. Talk-in on 146.01/146.61. For further information, write Super Scarafest '80, PO Box 5265, Hamden CT 06518, or call Jeff Wayne K1YLV at (203)-281-6038 between 9:00 am and 9:00 pm EST.

HUNTSVILLE AL
AUG 17

The North Alabama Hamfest will be held on Sunday, August 17, 1980, at the Von Braun Civic Center in Huntsville AL. Admission is free. There will be prizes, exhibits, forums, an air-conditioned indoor flea market, and ladies' activities. Tours of the Alabama Space and Rocket Center are available for the family. A hamfest supper will be held on Saturday night. A limited number of camping sites with hookups are available at the

VBCC on a first-come-first-served basis. Flea market tables are available for $3.00. Talk-in on 3.965 and .34/.94. For more information, write NAHA, PO Box 423, Huntsville AL 35804.

WARREN OH
AUG 17

The Warren Amateur Radio Association will hold its 23rd hamfest on August 17, 1980, at Trumbull Branch, Kent State University. There will be five acres of flea market, tech forums, DX programs, inside dealer displays, and XYL activities. For further information, QSL to WARA, PO Box 809, Warren OH 44482.

BEAR DE
AUG 17

The Fifth Annual New Delmarva Hamfest will be held on Sunday, August 17, 1980, at Gloryland Park, Bear DE. Admission will be $2.00 in advance and $2.50 at the gate. Tailgating will be $2.50 and tables under the pavilion, $4.00. Prizes, food and drinks will be available. Talk-in on .52 and .13/.73. For more information, send an SASE to Stephen Momot K3HBP, 14 Balsam Road, Wilmington DE 19804. Make checks payable to Delmarva Hamfest, Inc.

REND LAKE IL
AUG 17

The Shawnee Amateur Radio Association Hamfest will be held on August 17, 1980, at the North Marcum access area on Rend Lake in southern Illinois. Complete recreational facilities, including beach and campsites, will be available. Talk-in on 146.25/.85, 146.52, and 3.925.

TACOMA WA
AUG 23-24

The Radio Club of Tacoma (W7DK) will hold its annual Hamfair on August 23-24, 1980, at the campus of Pacific Lutheran University, 122nd and Park Avenue. Registration is $4.00 and the banquet is $6.00. Events include a flea market, door prizes, commercial displays, a banquet, a loggers' breakfast, seminars, and much more. Talk-in on .88/.28. For additional information, contact Joe Winter WA7RWK, 819 No. Mullen, Tacoma WA 98406 or phone (206)-759-9857.

LA PORTE IN
AUG 24

The annual LaPorte County Hamfest will be held, rain or shine, on Sunday, August 24, 1980, at the County Fairgrounds on Highway 2, west of LaPorte IN (50 miles SE of Chicago). There will be an outdoor paved flea market area, indoor tables at $1.00 each, and overnight trailer hookups available on site for early birds. Advance tickets are $2.00. For reservation or information, send an SASE to PO Box 30, LaPorte IN 46350.

MARYSVILLE OH
AUG 24

The Union County Amateur Radio Club will hold its fourth annual Hamfest-80 on Sunday, August 24, 1980, at the fairgrounds in Marysville OH. There will be a free gate until 10:00 pm Saturday; then admission is $2.00 each or $1.50 in advance. Features will include free overnight camping, free movies Saturday night, breakfast served all night until 10:00 am Sunday, many prizes, including a Kenwood TR-2400, a flea market, ARRL forums, and MARS and FM meetings. For more information or advance tickets, write UCARC, 13613 US 36, Marysville OH 43040, or phone (513)-644-0468.

SEWELL NJ
AUG 24

The Gloucester County ARC will hold its second annual hamfest on Sunday, August 24, 1980, from 8:00 am to 3:00 pm at Gloucester County College, Tanyard Road, Sewell NJ. Tickets are $2.00 in advance, $2.50 at the door, and dealers' and tailgaters' admission is $5.00. Tailgaters can set up at 7:00 am and indoor and outdoor spaces will be available. There will be food and prizes. Talk-in on .52 and .78/.18. For information and tickets, contact Bob Grimmer KN2QWO, 229 William Avenue, Barrington NJ 08007.

SYDNEY NS
AUG 29-SEP 1

The Sydney Amateur Radio Club will host the 1980 Maritime Convention, Ham Ceilidh 80, on Labor Day weekend, August 29 – September 1, 1980, at the Isle Royale Hotel, Sydney, Cape Breton Island, Nova Scotia, Canada. There will be plenty of free parking and shopping for the ladies. The program will include many items of interest and will cater to amateurs along with their XYLs. Friday evening, August 29, will be a special event with registration and a ham get-together. For more information, contact the Sydney Amateur Radio Club, Box 1051, Sydney, Cape Breton, Nova Scotia CAN B1P 6J7.

GEORGETOWN IL
AUG 30-31

The Illiana Repeater System, Inc., amateur radio club will hold its 11th annual Danville, Illinois, Hamfest, Saturday and Sunday, August 30-31, 1980, at the Georgetown, Illinois, Fairgrounds. Advance gate donations are $1.50 per adult; $2.00 at the gate, with children 14 years and younger free. Activities will include two days of flea markets, commercial exhibitors, RTTY setups, an Antique Wireless Association display, a home-brew builders contest, a USAF MARS station, and other interests. Meals and refreshments will be served both days and overnight camping facilities are available. For more information or advance tickets, send an SASE to Illiana Repeater System, Inc., PO Box G, Catlin IL 61817.

PECATONICA IL
AUG 31

The third annual Rockford Hamfest and Illinois State ARRL Convention will be held at the grand exhibition hall at the Winnebago County Fairgrounds at Pecatonica, just west of Rockford on US Route 20. Tickets are $2.00 in advance or $2.50 at the gate and are available from any RARA member. They may also be obtained by mail by writing to RARA, PO Box 1744, Rockford IL 61110 and including a business-size SASE. Food and campsites (with electric and sanitary hookups) will be available, as well as plenty of free parking. For flea market dealers, there will be 300 tables available at a nominal charge. There will be speakers and forums, demonstrations and discussions, and prizes. Talk-in on 146.01/.61 Rockford repeater, or 146.52.

MARSHALL MI
AUG 31

On Sunday, August 31, 1980, from 8:00 am to 5:00 pm, "Historic Marshall's" 72/12 E. S. Team will hold Its Trunk 'n Trailer Bash on the whole block of 615 S. Marshall Avenue, Marshall MI (1830 site of Michigan's capitol and governor's mansion). The donation is $2.00, spaces are $5.00, and inside space is 50 cents a foot. There will be free parking and a huge consignment area for the mini-swapper. For further information, send an SASE to K8UCQ, 110 Perrett, Marshall MI 49068.

PENSACOLA FL
AUG 31

The Five Flags Amateur Radio Association, Inc., will hold its 1980 Ham-A-Rama on August 31, 1980, from 8:00 am to 4:00 pm at the Pensacola Municipal Auditorium, Pensacola FL. Admission will be $1.00 and swap tables will be available for $5.00 each. Additional information can be obtained by writing to the FFARA, PO Box 17343, Pensacola FL 32522.

MELBOURNE FL
SEP 6-7

The Platinum Coast Amateur Radio Society will hold its 15th annual hamfest and indoor swap-and-shop flea market on September 6-7, 1980, at the Melbourne Civic Auditorium. Admission is $3.00 in advance and $4.00 at the door. Swap tables are $5.00 per day. There will be food and plenty of free parking available, as well as awards, forums, and meetings. Talk-in on .25/.85 and .52/.52. For reservations, tables, and information, write PCARS, PO Box 1004, Melbourne FL 32901.

SOUTH DARTMOUTH MA
SEP 7

The South Eastern Massachusetts Amateur Radio Association will hold its annual picnic and flea market on Sunday, September 7, 1980, from 9:00 am until 4:00 pm at the Stackhouse Fairgrounds, Faith Street, South Dartmouth MA. The rain date will be September 14, 1980. Sales space is $6.00 and tables for rent are $4.00. There will be free parking, entertainment, and food and beverages for sale. Talk-in on 147.60/147.00 or CB channel 11. For information, write SEMARA, PO Box P-105, South Dartmouth MA 02748, or phone (617)-997-3674 or (617)-994-4838.

VALPARAISO IN
SEP 14

The Porter County Amateur Radio Club, Inc., will hold its annual hamfest on September 14, 1980, at the Porter County Fairgrounds, Valparaiso IN. Featured will be a flea market, technical sessions, door prizes, and bingo. Food will be available. Advance tickets are $1.50 and

tickets at the gate are $2.00. There will be dealers and commercial exhibitors, as well as free indoor and outdoor space. Gates will open at 6:00 am. Talk-in on 147.96/.36 and 146.52. For tickets and information, write Charles Baker W9SJN, PO Box 251, Portage IN 46368.

LOWER BURRELL PA
SEP 21

The Skyview Radio annual swap and shop will be held on September 21, 1980, at Sokol Camp, Lower Burrell PA, from 12:00 noon to 4:00 pm. Registration is $1.00 per ham, and XYLs, YLs, and children are free. There will be plenty of parking and lots of shade. Talk-in on .04 and .64. For more information, send an SASE to Jim Jackson K3VRU, RD 1, Box 7A, Apollo PA 15613.

PHILADELPHIA PA
SEP 25-28

National Computer Shows (formerly Northeast Expositions) will hold the Mid-Atlantic Personal and Business Computer Show from Thursday, September 25, through Sunday, September, 1980, at the Philadelphia Civic Center, Philadelphia PA. Show hours are: Thursday through Saturday, 11:00 am to 9:30 pm and Sunday, 11:00 am to 6:00 pm. General adult admission is $5.00. For further information, contact National Computer Shows, PO Box 678 Brookline Village MA 02147, or phone (617)-524-0000.

FINDLAY OH
SEP 27

The Findlay Radio Club will hold its 38th annual Findlay Hamfest on Sunday, September 27, 1980, at a new location, the Hancock Recreational Center, just east of I-75 exit 161, on the north edge of Findlay, 40 miles south of Toledo. Tickets are $2.00 in advance and $2.50 at the door. Reserved tables are $2.50 per half. There will be forums on Saturday evening and setup Sunday at 5:00 am. Main prizes are a TS-120S with supplies, two TR-2400s, and an AT-120 matcher. For tickets, information, and reservations, send an SASE to PO Box 587, Findlay OH 45840.

ELMIRA NY
SEP 27

The 5th annual Elmira International Hamfest will be held at the Chemung Country Fairgrounds on September 27, 1980. Featured will be an ARRL Forum and talk by Atlantic Division Director Jesse Bieberman W3KT. Also on the agenda is a similar forum and discussion with officials from the Federal Communications Commission's Buffalo NY office. There will be a free outdoor flea market and some indoor space, as well as several electronics dealers from across the northeast. The usual abundance of prizes and good food will be part of this year's event once again. Gates open at 8:00 am. Advance sale tickets are available from John Breese WA2FJM, 340 West Avenue, Horseheads NY 14845 at $2.00 each (save a dollar per ticket off the gate price!). Talk-in on 147.96/.36, 146.10/.70, and .52 simplex.

TYSONS CORNER VA
SEP 27-28

The National Capitol DX Association will sponsor DXPO 80 on Saturday and Sunday, September 27-28, 1980, at the Ramada Inn, junction of Rte. 7 and I-495, Tysons Corner VA. Saturday's half-day session will include Phase I of the DXPO Program, an Attitude Adjustment Party, and a banquet with prizes and surprises. Sunday's session will feature Phase II of the DXPO Program. Unless you have previously attended DXPO, write to Dick Vincent K3AO, Rte. 1, Box 230, Bryantown MD 20617, for more information. If you have any program suggestions, contact John Boyd W4WG, 8424 Reflection Lane, Vienna VA 22180.

ADRIAN MI
SEPT 28

The Adrian Amateur Radio Club will hold its 8th annual hamfest on Sunday, September 28, 1980, at the Lenawee County Fairgrounds, Adrian MI. Featured will be prizes, games and programs. Tables are available for $5.00 per 8-foot space, $3.00 per 4-foot space, $1.00 per 8-foot trunk space, and $2.00 for an inside space for your table. Talk-in on 146.31/.91 and 146.52. For ticket and table information, write Adrian Amateur Radio Club, Inc., PO Box 26, Adrian MI 49221, or call Bob and Sally Fay of Sword Enterprises at (517)-263-3592.

ERIE PA
SEP 28

The Radio Association of Erie, Inc., will hold its HAMJAM 1980 on Sunday, September 28, 1980, at the Rainbow Gardens at Waldameer Beach Park, Erie PA. Hours are from 9:00 am to 5:00 pm. The $3.00 admission fee includes a chance for the main prizes, hourly door prizes, and a free cup of coffee. Featured will be commercial displays, huge outdoor flea market ($1.00 per car space), large indoor display area (tables available at $5.00). Food will be available on site. Talk-in on 146.34/.94 (primary) and 146.22/.82 (secondary). For information about overnight parking and other details, write Lee Robinson WA3HJC, HAMJAM Chairman, PO Box 844, Erie PA 16512.

BOULDER CO
SEP 28

The Boulder Amateur Radio Club will hold Barcfest '80 on September 28, 1980, beginning at 9:00 am at the Boulder National Guard Armory, North Broadway, at the city limits, Boulder CO. There will be an auction and a snack bar. Admission is $2.00 per family and includes a door prize drawing and swap space. Talk-in on 146.10/.70 and .52/.52. For further information, contact Mark Call NØMC, 4297 Redwood Ct., Boulder CO 80301, or phone (303)-442-2616.

CHICAGO IL
OCT 16-19

National Computer Shows (formerly Northeast Expositions) will hold the Midwest Personal and Business Computer Show from Thursday, October 16, through Sunday, October 19, 1980, at McCormack Place, Chicago IL. Show hours are: Thursday through Saturday, 11:00 am to 9:30 pm and Sunday, 11:00 am to 6:00 pm. General adult admission is $5.00. For further information, contact National Computer Shows, PO Box 678 Brookline Village MA 02147, or phone (617)-524-0000.

FRAMINGHAM MA
NOV 9

The Framingham Amateur Radio Association will hold its annual fall flea market on Sunday, November 9, 1980, at the Framingham Police Station Drill Shed, Framingham MA. Admission is $1.00 and sellers' tables are $6.00. Sellers are advised to pre-register. Doors will open at 9:00 am. Talk-in on .75/.15 and .52. For more information or to register, contact Ron Egalka K1YHM, FARA, PO Box 3005, Saxonville MA 01701, or phone (617)-877-4520.

BOSTON MA
NOV 20-23

National Computer Shows (formerly Northeast Expositions) will hold the Northeast Personal and Business Computer Show from Thursday, November 20, through Sunday, November 23, 1980, at Hynes Auditorium, Boston MA.

Ham Help

I need any information on hints, kinks, and modifications for the Yaesu FT-101E. I am willing to pay.

Brian Stoll N8AFX
3025 Brockman
Ann Arbor MI 48104

Greenpeace, the anti-whaling organization, is in need of a San Francisco Bay area site for its ham station. The site must be able to accommodate a tower, a large log periodic antenna and high power. Those with a site or suggestions should contact me at the address below.

Dick Dillman N6VS
435 Utah Street, No. 4
San Francisco CA 94110
Phone: (415)-864-6320

I need a blower motor assembly P/N DEB067-A01 and power transformer P/N PU015-A01 (Waterman Products Co., Inc., Philadelphia PA) for an OS-51/USM-24C oscilloscope. I will pay a reasonable price for these parts.

Elmer H. Melvin WA8DJY
5050 New Market Road
Hillsboro OH 45133

I need a schematic and/or circuit information for a suitable noise-blanker circuit to use in a Hammarlund HQ-180A receiver.

Robert F. Cann W4GBB
1606 Lochwood Drive
Richmond VA 23233

New Products

from page 28

parallel mode, the two filters can be used to peak the mark and space signals used in RTTY and ASCII transmissions.

Because the Signal Enforcer is an audio filter, it can be hooked in line with the audio output of a receiver so that no connections inside the receiver are necessary. It can be used in line with the receiver speaker, headphones output, or other audio outputs from the receiver. The Signal Enforcer will drive up to 2 Watts through an 8-Ohm speaker. The audio output is adjusted through a volume control.

Each Signal Enforcer filter has its own "tuning eye" indicator, peak/notch switch, bandwidth control, and frequency control. The tuning eyes are LED indicators that make tuning fast and simple. Each tuning eye has its own very narrow filter. When one of the Signal Enforcer filters is tuned to the heart of a signal, its tuning eye will blink simultaneously with the signal's audio output. Under crowded band conditions, it is very difficult to tune signals without the aid of the tuning eyes. The Signal Enforcer is the only filter that offers that essential feature on both filters.

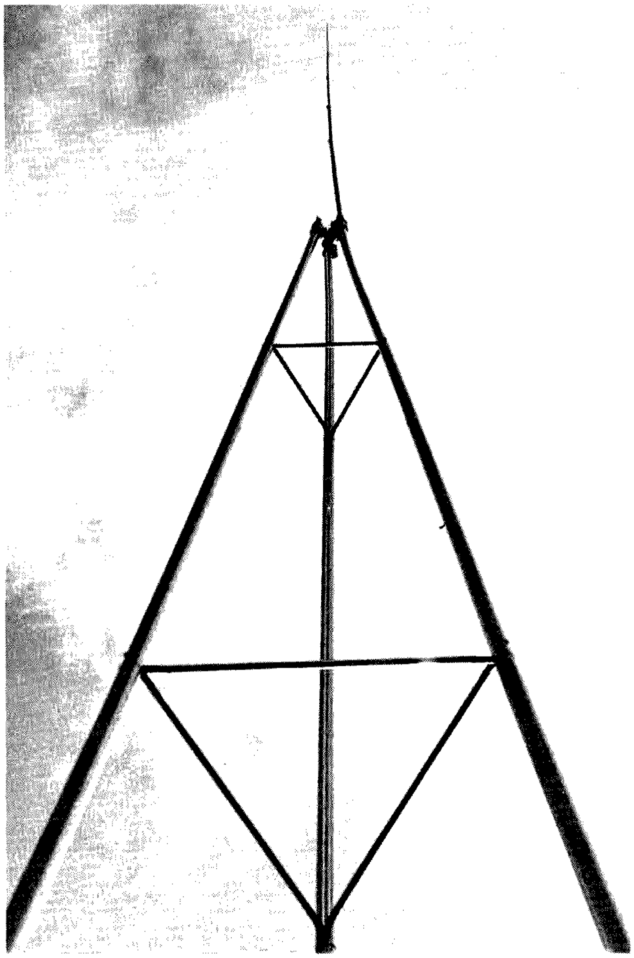
The high quality of the filters allows the bandwidth to remain constant once it has been set by the operator, regardless of the frequency tuned to. The filters are continuously variable in bandwidth from less than 30 Hz to over 1000 Hz. Their audio-frequency range runs from less than 150 Hz to over 3000 Hz.

Ultimate serviceability has been designed into the Signal Enforcer. If service or repair is needed, the modular design will allow for nearly immediate replacement and turn-around. All internal boards, components, and craftsmanship are of the highest quality.

Front-panel controls on the Signal Enforcer include POWER, POWER INDICATOR, VOLUME, BANDWIDTH 1, BANDWIDTH 2, FREQUENCY 1, FREQUENCY 2, TUNING EYE 1, TUNING EYE 2, PEAK/NOTCH switch 1, PEAK/NOTCH switch 2 and PARALLEL/CASCADE mode switch. Back-panel inputs include SIGNAL INPUT (RCA jack) and DC INPUT (2.5mm jack). Back-panel outputs include EXTERNAL SPEAKER (3.5mm phone jack), EXTERNAL HEADPHONES (¼" phone jack), and RTTY DEMODULATOR OUTPUT (RCA jack). The Signal Enforcer has its own internal power supply and can be run from 115 V ac at 60 Hz, 220 V ac at 50 Hz or from an external 12 to 18 V dc power source.

The Signal Enforcer is in a tan, cream, and brown enclosure about 2½" by 8" by 6". It comes with operator's manual and all necessary connectors used on the unit.

For further information, contact: *Kantronics, Inc., 1202 E. 23rd Street, Lawrence KS 66044.*



KLM's SSV 80-40-15.

KLM'S SSV 80-40-15

The SSV 80-40-15 is the latest addition to KLM's series of vertical multiband antennas, featuring broadband response on 80, 40, and 15 meters. The SSV is freestanding, with the lower half made up of three electrically-active tripod legs. Excellent DX is possible because the configuration of the legs contributes to a low angle of radiation on each band. Two of the legs are hinged at the base, allowing the SSV to be easily raised by two men. Only modest base preparations are needed. The upper half of the SSV is a single telescoping whip section. It is quite flexible and survives high winds by bending over to reduce its own wind load. Although the SSV stretches over 60 feet above ground, no guying is necessary. Its overall weight is only 88 lbs., and the nominal feed impedance is 50 Ohms.

A full ¼-wave resonance is possible on 80 meters through the use of one tripod leg and the upper whip section. The adjustable tip allows the SSV to be tuned from below 3.5 MHz to 6.5 MHz, in 300-kHz steps, at 1.5:1 vswr or better.

The 40-meter resonance is quite broad thanks to the effective diameter of the base ¼ wave (two of the tripod legs). Wide-range tuning is possible from 6.5 MHz on up. Performance on 40 meters appears better than a standard ground-mounted ¼-wave vertical because shock excitation of the 80-meter section improves the radiation pattern.

Performance of the ¾-wave 15-meter section is also improved by shock excitation of the 80-meter section. The vswr curve is very broad, with little change from band edge to band edge. Performance approaching a full ¼-wave vertical is also possible on 160 meters simply by adding inductance at the base of the antenna.

Experimental uses for the SSV abound. A wind spectrum vswr plot shows three more naturally occurring resonances that fall very close to the three new HF bands authorized at WARC '79 (10, 17, and 24 MHz) and are usable with slight retuning.

High-quality materials are used throughout the SSV. All aluminum tubing is drawn seamless 6063-T832 alloy. Tough fiberglass insulators are used to insulate the SSV from ground and insulate the resonant sections. Base mounting anchor plates are supplied.

For more information, contact *KLM Electronics, Inc., PO Box 816, Morgan Hill CA 95037; (408)-779-7363.* Reader Service number 480.

NEW HUSTLER FIVE-BAND TRAP VERTICAL FIXED STATION ANTENNA

Hustler recently introduced the new Model 5-BTV, a five-band trap vertical fixed station antenna. The unit covers 10, 15, 20, 40, and 80 meters (tunable to 75 meters). The 5-BTV consists of the popular Hustler Model 4-BTV, RM-80-S resonator, and spider assembly, in one UPS-shippable carton.

In restricted or unlimited space locations, the Hustler 5-BTV delivers top signal performance, consistent contacts, five-band operation, and complete coverage. Use one feedline of any convenient length. Switching or matching devices are not required.

The total antenna length is 25'5"; it is constructed of the

finest quality heat-treated seamless aluminum and all stainless steel hardware. Mounts to any 1¾" o.d. vertical support. Vswr is better than 1.6:1 at band edges and up to 100 kHz bandwidth on 75 or 80 meters. Power capability is the full legal limit on SSB and CW. For further information, contact: *Hustler, Incorporated, 3275 North B Avenue, Kissimmee FL 32741*. Reader Service number 477.

NEW BEARCAT® POCKET SCANNER HAS FOUR BANDS, SIX CHANNELS

Weighing a mere 10 ounces and measuring just 2¾" wide by 1" thick, the new Bearcat® Four-Six ThinScan™ pocket scanner recently introduced by Electra Company is designed as a reliable, high-performance scanner especially for the fireman, paramedic, or other professional on the move. Small enough to slip easily into a shirt pocket, the little unit nevertheless can receive any mix of six channels on four bands (high and low VHF, UHF, and UHF "T" public service bands). It scans the six crystal-controlled frequencies at the rate of fifteen channels per second and has built-in scan delay. The radio also features Electra's patented Track Tuning on UHF for optimum performance across the entire band. Each channel has a lockout control to permit the listener to bypass those not of current interest. A SCAN/MANUAL function switch lets the user select and hold any of the six channels manually; LED indicators show the channels being scanned.

Ruggedly constructed to take the punishment of on-the-go professional service, the trim new pocket scanner has easy-to-operate recessed controls, an anodized aluminum front panel, and flexible rubber ducky antenna (an interchangeable wire antenna is also supplied). Extremely versatile, the radio will operate from external power as well as from internal batteries. It also has provision for an optional external battery charger, earphone, and external speaker. Complete information on the new unit is available from Bearcat retailers or directly from *Electra Company, PO Box 29243, Cumberland IN 46229*. Reader Service number 476.

NEW HY-GAIN AMATEUR CATALOG INCLUDES MORE THAN 100 PRODUCTS

Hy-Gain, a division of Telex Communications, Inc., has published a new 24-page catalog featuring over 100 base and mobile antennas, towers, rotators, microphones, headphones, boom mike headsets, and accessories for the amateur radio operator.

A full line of desk and hand mikes, the new HDR300 antenna rotator, and a series of seven crank-up antenna towers are the newest additions to the Hy-Gain amateur offerings. The catalog contains detailed specifications on all products, including swr curves on all base antennas.

For a copy of this catalog (#AM 2504), contact: Kit Kitterer, *Hy-Gain, Division of Telex Communications, Inc., 8601 Northeast Highway Six, Lincoln NE 68505*. Reader Service number 484.

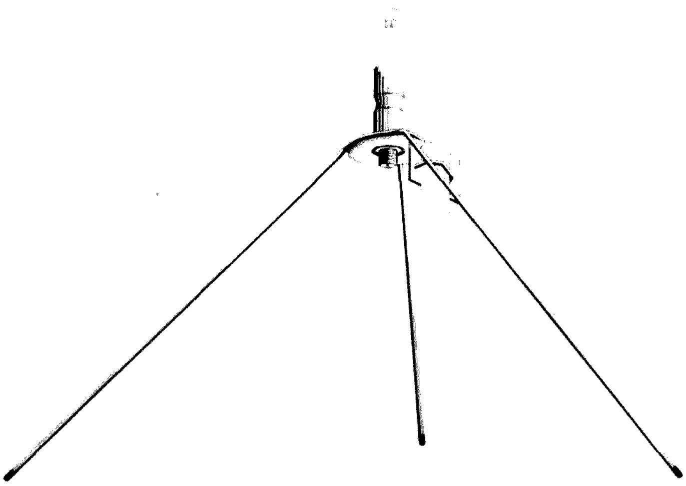
HUSTLER 2-METER FIXED STATION MOUNTING KIT

A new mounting kit, Model MKR-2, is now available for converting Hustler's line of series-fed mobile VHF antennas to fixed station operation. With the appropriate VHF antenna installed and tuned, the MKR-2 is ideally suited for temporary field day use or permanent installation for local QSOs.

The MKR-2 radial kit consists of a heavy-duty zinc-plated mast bracket and hardware with three 19" decoupling radials for correct feedpoint impedance. It accepts any VHF antenna with a standard 3/8" × 24 thread.

For further information, contact: *Hustler, Incorporated, 3275 North B Avenue, Kissimmee FL 32741*. Reader Service number 483.

Bearcat's new Four-Six ThinScan pocket scanner.



Hustler's new MKR-2 mounting kit.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

visible only in the Japanese magazines. When you visit over there, you find that some of these firms would like to export equipment to be sold here, but they are too small to set up the necessary sales offices and a repair center.

Those hams who join Sherry and me on the October tour of the Orient will have a chance to meet some of the smaller manufacturing firms in Japan (as well as Korea, Taiwan, and Hong Kong) and look into the possibility of importing ham gear for sale here. For instance, how many of you have seen a Sugiyama Electric 850 transceiver? It goes from the 1.8 MHz to 144 MHz bands! It has SSB, AM, CW, and FM modes, VOX, and so forth.

Not even the old Cortlandt Street complex of radio stores in New York came close to the mind-boggling collection of *electronics and computer* stores in the Akihabara section of Tokyo. You'll never be the same.

If interested, drop a line to Sherry for details. The trip costs a bit over $2,000, and that includes first-class hotels, all transportation, entry to consumer electronics shows in four countries, and more banquets (great banquets) than you may be able to handle.

POSTERS

COMMUNICATIONS
by
AMATEUR RADIO

As a result of the lessons learned by the group at Colorado Springs which provided the communications for the 1979 National Sports Festival, we rushed to make some posters which could be displayed by ham groups indulging in similar public service efforts. If we don't blow our own trumpet and make sure that both the general public and the media know that amateur radio is providing the communications for an event, our secret will be well kept and golden opportunities to improve the image of amateur radio will be lost.

A package of ten of these cards is available for the token payment of $2 to cover the cost of packing and shipping. This will not cover the cost of setting the type, making the artwork, making the negative, spotting the negative ready for use, making the printing plates, printing the posters, the cardboard stock, the time spent in planning the project, the cost of advertising and promoting the availability of the posters, and other such expenses. Who would pay a buck apiece to make this a paying project?

FREE MESSAGE SERVICE
To Anywhere in the United States
Via Amateur Radio

Where groups are not only providing communications for an event, but also providing a message service for the participants, this poster may be needed. If so, please mention it and a couple of these will be substituted in the above package (ten posters, $2). Of course ten of these are also available for the usual $2 handling. Let's make sure that everyone knows that amateur radio is providing the service.

SBE DIES

Another of the ham firms which went for the CB gold has bitten the dust. This is Sideband Engineers (SBE), once a well-known ham name. While ham sales are not doing wonderfully, they are a bowl of cherries when compared with CB equipment sales.

By the way, if any hams are having problems with manufacturers, even if they are in Chapter 11, they may be able to get help via the California State Consumer Protection Agency in Sacramento.

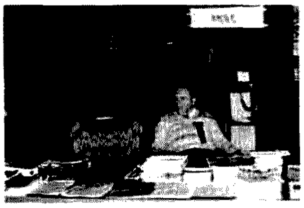
NEW HAMPSHIRE AUCTION

One of the livelier ham clubs in New Hampshire is the Interstate Repeater Society (hate the acronym) of Derry. In the past, they have held their yearly auction in the winter, but the coincidence of major snowstorms and their auction date finally convinced them to change it to early spring.

The auction was held this March near Manchester at the Bedford Sheraton convention facility. Hams packed the place. A lot of used ham gear changed hands. Here we see the auction in full swing.

Hams of all ages kept the bidding going on a wide variety of ham gear, test equipment, home-built rigs, and just plain junk . . . much of which we will probably see at the next New England auction.

Here are the Tufts booth and Chuck Martin WA1KPS. Tufts had a lot of everything with them, but the sales were mostly small items . . . quite a bit different from 1979, when many big ticket items sold and the net sales were almost double those of this year. One fact is inescapable: It is a lot more difficult to sell this year.



Don Poulin W1MXC managed to keep up with the activity at the ARRL booth. Don is one of the organizers of the popular Boxborough hamfest which will be along in October.

CASIO WATCH

When I visited Hong Kong last year, one of the exhibits in the consumer electronics show had a relatively inexpensive digital watch with a calculator built in. This could have been sold in the US for around $150 and looked like a winner to me . . . particularly when compared with the almost identical Seiko at about double that price.

The watch also had a stopwatch function, the day and date, plus an alarm. It was the gadget lover's delight. The calculator function required a ball pen or pencil to operate the keys, but this wasn't all that much of a drawback. Of course, this developed at a time when I switched over to those Pilot Razor Point plastic-tipped pens . . . which were completely incompatible with the watch. That's the way life goes . . . I'm almost used to it.

Once you have a calculator watch, you would be surprised at how many things come up which need instant calculation . . . particularly if there is an appreciative audience. Great toy, but rather clumsy to use.

Then, just recently, ads appeared for the new Casio calculator watch. Sherry did some fast work and rustled up one for me to try out. Fantastic! Here was a calculator with buttons I could operate with my fingers . . . with ease! Casio came up with a little circuit which makes it so that even if my finger touches a second button as I press down, only the first button touched will function and others are ignored.

The Casio C-80 is half the price of the Mikado . . . is backed by a major organization, so service should be a snap . . . weighs perhaps one third the weight of the older calculator watches (you won't believe how

light it is), has the stopwatch function built in, even with lap time . . . keeps the day and date for you . . . and has two times . . . 12 hours and 24 hours. You can set the two times separately so that when you are traveling you have one on the time at home . . . or a ham can keep one on Greenwich time and the other on local time.

Casio has come a long way in the last year or two. I now find myself carrying the Casio watch, an MQ-1 calculator/watch pocket unit, and a Melody-80 musical calculator/watch . . . all by Casio. The MQ-1 is great for calculating date and time differences as well as normal calculations. The Melody-80 plays long, involved tunes and gets people who haven't heard one before all excited.

And every time I use my calculator watch or pull out one of the other Casio calculators, I offer a prayer of thanks to Mort Kahn W4KR, who I feel made this all possible. Also, some credit should go to Bill Orr W6SAI, and his part in making possible the move of the world's electronics industries to Japan from our shores. Bill, too, had a lot to do with this, the way I see it.

Surely I am exaggerating when I suggest that one or two hams may have been largely responsible for the loss of billions of dollars in the sales of electronic equipment such as television sets, hi-fi systems, ham equipment, CB equipment, calculators, and digital watches. To me, there seems to be quite a clear-cut connection between the events which seem to have brought about this world change in manufacturing and marketing.

To trace the path which led us to where we are, it is easier to start from the present and work our way back. First, let's start with the ham population we have today. We now have under 400,000 licensed amateurs, of which less than half are active. In Japan, they have over 500,000 licensed amateurs of which over 400,000 are said to be active. I think this is significant.

Had the growth of amateur radio in the US not stopped in 1963 for over a ten-year period, we might today have an amateur population of around 1,680,000 with over one million active. Would this really make any difference in the ability of our country to develop and market electronic products?

You better believe it! It is no coincidence that the technological development of countries is proportional to the number of hams in those countries. All you have to do is think about the situation for a moment and you'll realize that while our technical colleges turn out engineers, few of them have any real interest in electronics . . . or else they would be hams.

I don't know about you, but I've known a lot of non-ham engineers and few have been worth the powder to blow them to hell. While about 80% of the hams who get their licenses in their teens go on to work in the electronics or communications industry, only a relatively small percentage go on to get their engineering degrees. Most of them enter the work force as technicians.

I would hesitate to say that Sam Harris W1FZJ was a typical technician, but he certainly was representative of the better of the breed. Sam was the chap who built the first working parametric amplifier. He built it to work on six meters and it revolutionized the radar equipment of the time. The tact is that the bulk of the technical development work in electronics is being done by technicians. And an amazingly high percentage of these chaps who live and breathe electronics are hams . . . and started their careers as hams.

What would be the state of the art in electronic developments in the United States if we had twice as many engineers and technicians as Japan in our labs and factories? I don't think there is any way in the world that I would be wearing a Casio watch, watching a Sanyo portable television, and listening to a Sansui stereo. Nor would I be carting around a Sony cassette recorder and a Sony stereo portable cassette player.

I believe that the stopping of the growth of amateur radio in 1963 has resulted in the loss of much of the electronics industry in our country and has cost us billions of dollars in lost sales over the last ten years.

So how do W4KR and W6SAI fit into this picture? Well, Mort Kahn was elected as director of the League in the late '50s and it was he, I believe, who engineered the coup which suddenly retired Budlong, the general manager. This left Mort firmly in control of the League, which he ran from his position as Hudson Division Director until he apparently got bored with it.

The League proposals in 1963, pushed through, I understand, by Kahn, and vigorously promoted by Orr, called for taking away most of the phone bands from most of the hams. The plan so dismayed everyone that growth stopped and sales of ham gear dropped to about 15% of their previous level . . . leading to the bankruptcy or disappearance of Hallicrafters, National, Hammarlund, Harvey Wells, and most of the other firms in the ham business. This also knocked out about 75% of the ham dealers and brought to an end the sale of parts through electronics stores in the quantities we had previously known.

For over ten years amateur radio was in the doldrums, with zero to negative growth. Only the popularity of FM and repeaters, the establishment of study classes organized by the repeater clubs, and the growing popularity of CB brought an end to this stagnation.

The electronics industry was particularly hard hit by the shutting off of technicians and truly creative engineers because the average age of the newcomer to amateur radio increased substantially through this period and far fewer of the new hams were entering the field for career work. The teenager in high school who gets involved with amateur radio has an 80% likelihood of getting into electronics in some way . . . the chap in his 30s and 40s, coming in via CB and ham classes, already has a career and is unlikely to make a career change at this time of life . . . so the result has been that even though the amateur ranks have been growing slowly over the last five years, a much smaller percentage of the new hams have been going into industry. The result of all this has been an electronics industry in the US which has had a negligible infusion of ham-technicians and ham-engineers, while the Japanese industry has been

✓ Reader Service—see page 195

growing to enormous proportions, fueled by youngsters with radio and electronics deep in their hearts.

In case you have any question about the Japanese getting started in amateur radio early, all you have to do is take a look at any of the Japanese ham magazines . . . which, by the way, are twice the thickness of ours . . . and you'll see hundreds of pages of pictures of ham clubs, most of them packed with teenagers. Their ham clubs go out for DXpeditions, special outings, fox hunts, and jamborees—and they are having a ball with amateur radio. The seed of destruction is planted early, in high school, and the result is that most of them are seriously infected with the ham bug and try to make it as contagious as possible.

In the June issue of *73*, I had a picture of the development lab at Yaesu, showing a couple dozen of their technicians and engineers. I wonder if we could get together that many such people in the US, even if we emptied out every US ham manufacturer's test labs.

WHAT CAN BE DONE?

Since it was the development of two or three thousand repeater clubs which got club license classes going back in the mid '70s and thus got amateur radio back into a growth mode for a while, I suspect that it will again be the clubs which will be able to turn the tide and get amateur growth back into the high schools. It won't happen by accident. Clubs will have to set this as a goal and it will take a lot of work to get our hobby into a growth pattern of around 15% or more. We have a lot of catching up to do if we want to have any electronics industry at all in twenty years.

Both Kahn and Orr are getting along in years and something should be done by Japan to give them recognition for the fantastic change they have helped bring about. I'll drop a note to the editor of *CQ Ham Radio*, the leading Japanese magazine, and see what can be done to right this oversight.

Meanwhile, if you are interested in getting one of those Casio C-80 watches, look for ads for it in *73* . . . I hope you enjoy this gadget as much as I do mine . . . and think often and kindly of Kahn and Orr.

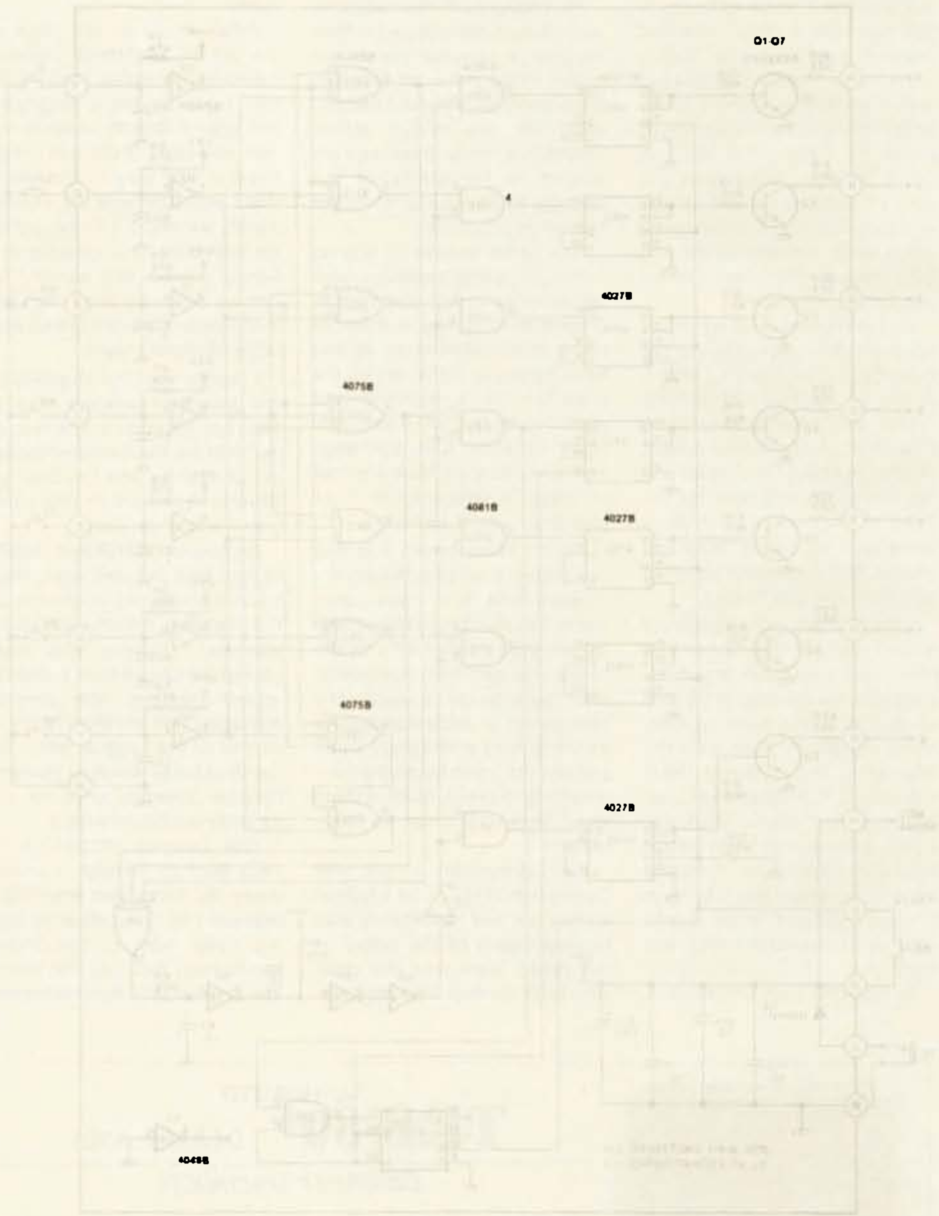
Corrections

In the program listing which accompanied my article "Antenna Engineer" (May, 1980), line 700 shows two left brackets ([). These should be up arrows (↑).

Dennis Mitchell K8UR
30-5 Briarwood Lane
Marlboro MA 01752

Several component designations were not included in the schematic which accompanied my article ("Fun with Foozle") which appeared in your June issue. Enclosed is the complete schematic.

Howard F. Batie W7BBX
Herndon VA



Revised Fig. 1, "Fun with Foozle."

Please note that a new line 152 in my article ("Prefix Challenge," June, 1980) will save a lot of misery for beginner users of the program, a conclusion I came to after seeing my fellow hams use it at a club meeting. The new line should be:

152 PRINT: PRINT "IF 'READY' SHOWS, ENTER CONT TO GO ON": PRINT

Also, changing the number 19 to 38 in line 3, column 3 of page 108 will correct a misleading suggestion that would mess up a graphic.

Ron Gunn AG6P
Livermore CA

FCC

Reprinted from the Federal Register.

47 CFR Part 97

[Gen. Docket No. 80-136; RM-2910; RM-2939; RM-3281; RM-3302; FCC 80-183]

Amending Rules Concerning Station Identification Requirements

AGENCY: Federal Communications Commission.

ACTION: Notice of Proposed Rulemaking.

SUMMARY: The FCC proposes to amend station identification requirements in the Amateur Radio Service. The present rule requires amateur radio stations to identify the station with which contact was made, at the end of the transmission. The proposal would eliminate this requirement for all communications except those involving international third party traffic. The adoption of this proposal would reduce channel usage, and would permit amateur radio operators to complete their transmissions in less time.

DATES: Comments must be received on or before July 16, 1980 and Reply Comments must be received on or before August 15, 1980.

ADDRESS: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: John Jonston, Private Radio Bureau, (202) 254-6884.

Adopted: March 31, 1980.
Released: April 9, 1980.

In the matter of Amendment of Part 97.84(a) of the Amateur Radio Service Rules, PR Docket No. 80-136, RM-2910, RM-2939, RM-3281, RM-3302.

1. The Commission has before it four petitions for rulemaking separately filed by James R. Sebolt in 1977, John C. Kanode on behalf of the Potomac Valley Radio Club in 1977, Arlington R. Kaeding in 1978, and Stephen R. Mann in 1978. The petitioners request that the Commission consider simplifying the identification requirements for amateur radio stations. 47 CFR 97.84.

2. Section 97.84(a) of the Amateur Radio Service Rules and Regulations provides that:

(a) An amateur station shall be identified by the transmission of its call sign at the beginning and end of each single transmission or exchange of transmissions and at intervals not to exceed 10 minutes during any single transmission or exchange of transmission of more than 10 minutes of duration. Additionally, at the end of an exchange of telegraphy (other than teleprinter) or telephony transmissions between amateur stations, the call sign (or generally accepted network identifier) shall be given for the station, or for at least one of the group of stations with which communicatin was established.

Two petitioners request that the Commission eliminate completely the requirement that amateur radio operators identify the station with which they were in contact, at the end of the trasmission. The third petitioner also favors elimination of this requirement, except that he would retain the restriction for international third party communications. The fourth petitioner requests that this requirement be eliminated where the entire exchange of communication lasts less than one minute. In addition, one petitioner requests that the rules be amended to allow stations completing an exchange in less than one minute to identify themselves at any time during the exchange, rather than at the beginning and end of each transmission.

3. FCC monitoring observers sample transmissions in progress, as well as the beginning or end of transmissions. For this reason, the proposal to allow identification at any time during a transmission lasting less than one minute rather than at the beginning and end of transmission, cannot be adopted. If adopted, this proposal would preclude FCC monitoring observers from identifying the transmitting station, if, for instance, the observer began monitoring the transmission after the identification was given.

4. The petitioners, and others who have filed comments pursuant to the Public Notices released by this Commission, advance the following arguments for amending § 97.84(a)'s requirement that amateur radio operators identify the station with which they were in contact, at the end of the transmission.

(1) Each station is required to identify its own transmission; therefore there is no need to require stations to also identify each other.

(2) The removal of this restriction would reduce channel usage, and therefore reduce channel congestion.

(3) This amendment would benefit United States amateur radio operators engaged in contest operations by increasing the number of communications that could be completed within a set period of time.

(4) The Amateur Radio Service is the only radio service where station operators are still required to identify the station with which contact has been made. A similar requirement was deleted from the Citizens Radio Service Rules in 1975. 54 F.C.C. 2d 841, 40 FR 33667 (1975).

Proposal

5. The Commission proposes to delete the requirement that amateur radio stations identify the station with which they were in contact for all transmission except those involving international third party communications.[1] International third party communications are excluded from the scope of the proposed amendment because of the Commission's obligation to enforce the International Radio Regulations. Article N30/41, No. 6355/1561 of the International Radio Regulations provides, in part, that "* * * [i]t is absolutely forbidden for amateur stations to be used for transmitting international communications on behalf of third parties." The United States does have bilateral agreements with 29 countries which permit third party traffic, but with regard to other countries, the prohibition is still applicable. Without the identification requirement presently imposed by our rules, enforcement of the prohibition would be very difficult.

6. We are also proposing to extend requirement that radio stations identify the station with which they were in contact where international third party communication is involved, to teleprinter communications. Heretofore, teleprinter had been excluded from this requirement, but there appears to be no reason not to require this type of identification, especially where the requirement would strengthen the enforcement mechanism available to the Commission, and only minimally impact the licensee.

7. Our proposal is not limited to only those transmissions which last less than one minute. The arguments advanced in favor of that proposition (i.e. that contest operations would be enhanced * * *) extend to the less restrictive proposal we have adopted as well.

8. In view of the above, the petitions proposing to simplify station identification requirements in the Amateur Radio Service are adopted to the extent that they are not inconsistent with this *Notice*. All proposals contained in the petitions which are inconsistent with this *Notice* are denied. The proposed amendment of the Commission's rules, as set forth in the attached appendix below, is issued pursuant to the authority contained in Section 4(i) and 303(r) of the Communications Act of 1934, as amended.

9. Pursuant to the applicable procedures set forth in § 1.415 of the Commission's rules, interested persons may file comments on or before July 16, 1980, and reply comments on or before August 15, 1980. All relevant and timely comments will be considered by the Commission before final action is taken in this proceeding. In reaching its decision, the Commission may take into consideration information and ideas not contained in the comments, provided that such information or a writing indicating the nature and source of such information is placed in the public file, and provided that the fact of the Commission's reliance on such information is noted in the Report and Order.

10. In accordance with the provisions of § 1.419 of the Commission's rules, an original and 5 copies of all statements, briefs, or comments shall be furnished the Commission. All comments received in response to Notice of Proposed Rule Making will be available for public inspection in the Docket Reference Room in the Commission's Office in Washington, D.C.

11. Regarding questions on the matters covered in this document contact John B. Johnston, Rules Division, (202) 254-6884.

Federal Communications Commission.
William J. Tricarico,
Secretary.

[1] See the Appendix for the complete text of the proposed amendment.

Appendix

I. Part 97 of the Commission's Rules is amended as follows:

1. In § 97.84, paragraph (a) is amended and paragraph (h) is added to read as follows:

§ 97.84 Station identification.

(a) Each amateur radio station shall give its call sign—

(1) When it begins or ends each single transmission or exchange of transmissions, and

(2) At least every ten minutes during a transmission or exchange of transmissions.

* * * * *

(h) At the end of an exchange of third party communications with a station located in a foreign country, each amateur radio station shall also give the call sign of the station with which third party communications was exchanged.

[FR Doc. 80-11306 Filed 4-14-80; 8:45 am]
BILLING CODE 6712-01-M

Awards

from page 24

with news about the charitable Morokulien (SJ9WL/LG5LG) activity, the unique "state" on the Norwegian-Swedish borderline, east of Oslo, featuring radio calls LG5LG and SJ9WL and a lot more.

Recognizing the independency of this area, the Morokulien activities have been stimulated to benefit the handicapped radio amateurs in Norway and Sweden. Likewise, applicants for the Morokulien Award find their donated award fees going to aid these less fortunate people . . . a cause all of us can be proud to have assisted.

The Morokulien Award

This unique DX award is available to licensed amateurs and SWLers. Only contacts after July, 1968, will count. Applicants are asked not to send QSL cards. GRC apply. Europeans must contact LG5LG and SJ9WL on two bands and on different days for a total of four days of operation.

All other applicants must work each of these same two stations, each on a different day.

You may forward your application to the attention of Ulf Strandberg LA2ZN, Konglev. 3, N-2200 Kongsvinger, Norway. Please be sure to enclose an award fee of US $3.00 or 8 IRCs. Additional contributions are most appreciated.

DX AWARD FROM ROMANIA

The Romanian Radioamateur Federation takes pleasure in announcing the YO DX Club Award available to amateurs and SWL stations the world over.

YO DX Club Award

To qualify for the YODXC Award, applicants in Europe need to confirm contact with five (5) YO DX Club members; stations outside Europe need confirm only two (2) YO DX Club membership contacts. All QSOs must be made after August 23, 1949, and may be made on any mode or combination of modes and any band in the HF, VHF, or UHF segments.

To apply, have your list verified by at least two amateurs and send your list with US $1.00 or 7 IRCs to: F R R (YODXC), PO Box 1395, R 76100 Bucuresti 5, Romania.

As of January 1, 1978, the following YO DX Club members count towards this award:

YO2: ABW, AVP, BA, BB, BN, BS, BU, BV, CD, FP, GL, GZ, IS, KAB, KAC, KAR, QY, RA, VB, VF.

YO3: AAJ, AAQ, AC, AVE, BAA, CR, DZ, FF, FU, JF, JU, JW, KAA, KBC, KSD, NN, QK, QO, RD, RF, RG, RK, RO, RX, VN, YZ.

YO4: ASG, CS, CT, HW, KAK, KBJ, KCA, WO, WU, XF.

YO5: AFJ, AMO, ATV, AUG, AVN, AY, BQ, DS, KAD, KAU, KLA, LC, LD, LP, NB, NU, NZ, UW.

YO6: ADM, AW, EX, KAF, KAL, KBA, KBM, LG, UX, XI.

YO7: BI, DL, DO, KAJ, NA, NM, VS.

YO8: AGZ, CF, DD, FZ, GF, KAE, KAN, KGA, ME, MH, OK, OP, RL.

YO9: APJ, ASS, BGV, CN, EM, GP, HH, HI, HT, IA, IF, KAG, KPD, VI, WL.

YOØ: ITU, YRØA.

In YO land, the suffix for the same licensed ham is the same for any prefix.

DX AWARDS FROM THE RADIO CLUB OF PARAGUAYO

From the Radio Club of Paraguayo comes a very nice letter from their Awards Manager, Elio Donna ZP5CE. Elio enclosed the complete awards portfolio offered by this South American organization and we'll review each one individually.

The All Mediterranean Countries Award

The AMCA is given for confirmed contacts with Mediterranean countries in three levels of achievement: Class A—41 countries; Class B—30 countries; Class C—20 countries. A ZP contact is obligatory in any class of award. The following list of prefixes qualify as valid contacts: A2, A5, AC3, C31, CP, HA, HB, HBO, HV, JT, LX, OE, OK, TL, TT, TZ, UC2, UD6, UG6, UH8, UI8, UL7, UM8, UO5, XT, XW8, YA, ZE, ZP, 3D6, 4U1, 5U7, 5X5, 7P8, 7Q7, M1 (9A), 9J2, 9N1, 9U, 9X.

All Zone 11 Prefix Award

The AZ 11 PX Award is given for confirmed contacts with prefixes in *CQ* Zone 11 as follows: Class A—30 prefixes; Class B—19 prefixes; Class C—12 prefixes.

ZP1 to ZP9, PY1 to PYØ, and the special prefixes used for WPX contests are the only prefixes which qualify for this very difficult award.

The Tropics of Cancer and Capricorn Award

The TCCA Award is afforded to those applicants who confirm contact with countries touched by the Tropics of Cancer and Capricorn boundaries. A ZP contact is obligatory for this award. For Class A, 28 country contacts are required from the list below. Class B requires 20 countries; Class C requires 12 countries.

Tropic of Cancer: S2/3, BV, BY, EA9, KH6, A4, A6, SU, TZ, C6, VU, XE, XZ, 5A, 5T5, 5U7, 7X, 7Z.

Tropic of Capricorn: A2, CE, C9, LU, PY, VK, ZP, ZS, ZS3, 5R8.

The Diploma Sud-America

The DSA Award is given for contacts with countries located in ITU Zones 12, 13, 14, 15, 16, and 73 as follows:

Class A—33 DX Countries and 6 ITU Zones.

Class B—25 DX Countries and 6 ITU Zones.

Class C—18 DX Countries and 5 ITU Zones.

Countries which are qualifying contacts are:

Zone 12—FY, HC, HC8, HK, HKØ (Malpelo), OA, PZ, 8R, YV, CP1/8/9.

Zone 13—PY6/7/8, PYØ (Fernando de Noronha), PYØ (St. Peter, St. Paul).

Zone 14—CE1/2/3/4/5, CEØX, CEØZ, CP2/3/4/5/6/7, ZP, CX, LU-A/U/Y.

Zone 15—PY1/2/3/4/5/9, PYØ (Trinidade Island).

Zone 16—CE6/7/8, VP8 (Falkland), LU-V/W/X.

Zone 73—KC4USP, LU-Z, CE9AA/AM, VP8 (Graham Land), VP8 (Georgia), VP8 (So. Orkney), VP8 (So. Sandwich), VP8 (So. Shetland).

Diploma Paraguay

The DP Award is given for confirmed contacts with 5 different ZP stations. Stations in South America are required to contact 15 ZP operators.

Worked All ZP

The WAZP Award is being offered to amateurs making at least one confirmed contact with ZP stations in each of the ZP call districts, ZP1-ZP9.

Diploma Departmentos del Paraguay

The DDP is given for confirmed contacts with the Nation's Capital and different departments into which Paraguay is divided. Class A requires 20 contacts; Class B requires 16 contacts; Class C requires 12 contacts.

Departments by prefix are:

ZP1—Boqueron, Chaco, Nueva, Asuncion.

ZP2—Alto, Pte. Hayes.

ZP3—Amambay, Concepcion.

ZP4—Canendlyu, San Pedro.

ZP5—Asuncion (Nation's Capital).

ZP6—Central, Cordillera, Paraguari.

ZP7—Caaguazu, Caazapa, Guaira.

ZP8—Misiones, Neembucu.

ZP9—Alto Parana, Itapua.

Contacts must be made on or after May 15, 1952, to qualify for any of the awards sponsored by the Radio Club of Paraguay. A certified list of contacts with a fee of 5 IRCs for each award should be sent to: Elio Donna ZP5CE, Award Manager, RC Paraguayo, PL Box 512, Asuncion, Paraguay.

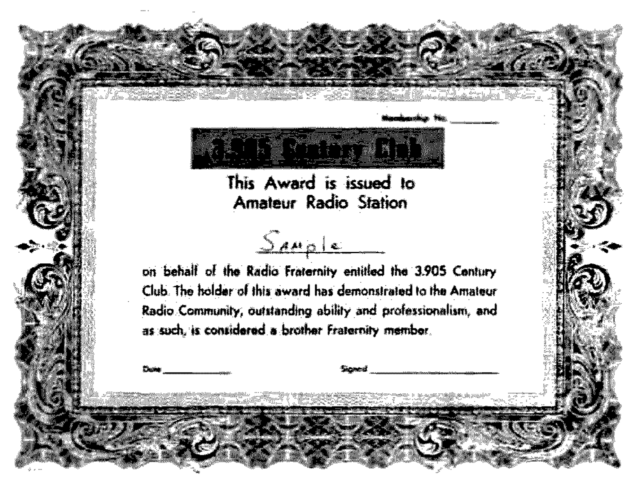
3905 CENTURY CLUB AWARDS

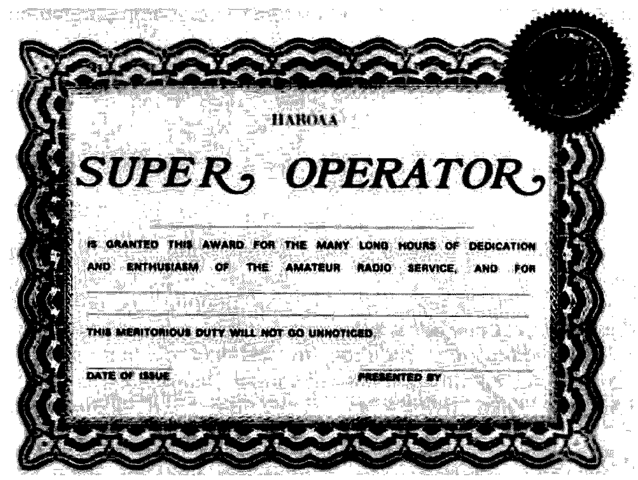
Representing the 3905 Century Club, Bill Herbert WA2ZYM writes to share with us the various awards available to amateurs who frequent their net operation.

The 3905 Century Club is basically a WAS (Worked All States) Net which grew out of the old Bicentennial Net on 80 meters back in 1976. The net now operates daily on 40 and 80 meters, 0100-0500 on 7.233 MHz and 0500-0800Z on 3.905.

Naturally, as time went on, it became apparent that an awards program of some kind was in the offing. As amateurs work each other on the band, they gather a point per contact. Once 100 points are earned, you become a full-fledged member of the club and are issued a certificate to illustrate your affiliation.

As members continue their contacts on the net, several levels of achievement are recognized, with the ultimate being the 1,000 Point Award, which is certainly no overnight venture.





Among the certificates afforded net participants is the 3905 Century Club State Capitols Award, which requires the applicant to contact at least 35 state capital cities. Endorsements are given for 40, 45, and the maximum of 50 state capitals worked on the sponsor net.

HAROAA AWARDS

We believe the many long hours of dedicated operation should not go unnoticed, nor should the high degree of enthusiasm of amateur radio operators go neglected in their pursuit of self-set goals. That is why we have an awards column in this magazine and why I introduce to you the awards and certificates made available by HAROAA.

As we review each one individually, we find that all their awards are of high quality and will make a very impressive addition to any radio shack.

GRC apply in making application for any HAROAA awards. Each award is assessed two dollars ($2) each or 5 IRCs. At your request, special endorsements will be added for CW, SSB, RTTY, SSTV, FM, QRP, All YL, or Single Band. There is no date restriction on contacts made and satellite contacts are permitted.

HAROAA DX Award

The most popular of all HAROAA achievement awards, the applicant is awarded recognition for contacting 10 DX stations. Endorsements are also given for 25/50/75/100/200 and 500 DX contacts. Keep in mind we are not speaking of DX countries, but instead DX "contacts," which makes this award unique.

Great Lakes Award

This award requires one contact from each state bordering the Great Lakes—New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin, and Minnesota.

Insomnia Award

This award is earned for communicating with a single amateur station anywhere in the world for a minimum of one hour between the hours of 1:00 and 5:00 am. Truly a super conversation piece for any ham shack.

Super Certificate Hunters Award

This award is designed for the serious certificate hunter. To earn this award, you must have a minimum of ten amateur radio awards in your possession. Simply list these awards on your application and note the certificate number of each. Special endorsements are given for your collection of 25, 50, 75, 100, and 100 plus.

Official Traffic Handler Award

This award is a self-issued achievement, allowing you to display the fact that you are indeed an official handler of radio traffic.

HAROAA Super Operator Award

This certificate is rendered for those providing a service on behalf of amateur radio, such as weather observer, public service, emergency, helping a new ham, providing communications for a community function, etc. The requirements are for the applicant to briefly describe the event or service and the officials at HAROAA will determine whether it deserves this special recognition.

For your personal copy of HAROAA award program rules or to apply for any awards presented here, write: HAROAA Awards Program, PO Box 341, Hinckley, Ohio USA 44233.

RTTY Loop

from page 12

In summary, the ST-6 kit, currently selling for under $300 with all options, represents a good, solid demodulator that most amateurs will find entirely adequate to their needs. Careful assembly (this is not a Heathkit™) will pay off in a valuable addition to the RTTY station.

For the last several months, I have been mentioning a firm, Teleprinter Arts, Ltd., that has had trouble filling orders. We are in the process of helping to straighten out some of the problems and hopefully will have more to report in a month or so. In the meanwhile, anyone who has had any problems with Teleprinter Arts, Ltd., is urged to drop me a note describing your experiences. Include as much detail as possible, and an SASE for reply.

A letter here from Robert F. Kramer, Alliance, Ohio, relates the problems with progress. Robert has a Twin Cities TU and would like to construct narrow-shift 170-Hz filters for it. For those of you unfamiliar with the unit, the Twin Cities TU was, of course, named for the twin cities of Minneapolis and St. Paul. Using three tubes, a dual triode, an amplifier, and a keyer, this was a simple design that was around in several forms for many years. Fig. 1 is a diagram of an early version which used octal-based tubes and a polar relay! Anyway, the mark and space filters are conventional 88-mH toroids, paralleled with a small capacitor to resonate at the mark and space frequencies of 2125 Hz and 2975 Hz, respectively. Typical values for these capacitors would be 0.066 uF and 0.033 uF. With 170-Hz shift, the mark frequency remains the same, so only a new space filter, tuned to 2125 + 170 Hz (2295 Hz), is needed. Start with a nominal 0.06 uF and work around until the filter is tuned. Remember, the marked value and the actual value of small capacitors is sometimes different by a factor of 50% or more!

According to my informal sources, RTTY Loop readers inundated the Stark RTTY Group out in Massillon, Ohio, with mail. I hope that this is an indication of the interest in RTTY operation in general. Let me know what is happening where you are, what repeaters are available for RTTY or ASCII, and I will pass it along to the immediate world. Here in Megalopolis (the Baltimore-Washington area to the uninitiated), for example, try 147.81/.21 for communication over the AMRAD repeater. This 300-baud ASCII repeater links amateur radio to a CBBS. If I ever get a rig on up there, maybe we can chat; meanwhile, drop me a line at the above address.

LETTERS

from page 18

as "overseas" Chinese) in Peking were required to stay in the Peking Hotel, and that's where the few foreign companies had offices. During my time in China, I was in and out of Peking five or six times, but only stayed a few days while awaiting papers and trains to other points. The CNTIC might be a good place to start a ham request, especially if you're in a good bartering position. If you were around the Peking Hotel for extended periods, you might have the opportunity to meet officials who could help, too. Of course, nothing is done quickly in China, so unless help comes from an unexpected source, it may be some time before we hear a BY on the air again.

RESTRICTIONS

I appreciated many of the remarks in the editorial in the May issue of *73* regarding ham activity and band use. I got my ticket in the fall of '38 and was on CW for about a year. I am very glad of it. I later built a 160 rig from broadcast radio parts, put up a ¼-wave against ground, and had a lot more fun, even. Got my class "A" license and converted the rig over to 75 phone a few months before Pearl Harbor. So, I hope that we do get all of 160 back.

Wouldn't it be nice if we had all of 20? Yes, we are banned from phone below 14,200, supposedly to give the foreigners, the Canadians and the Mexicans, elbow room. So, listen to 14,150 to 14,200. A QSO here, a QSO there, but plenty of room for more DX contacts. Listen from 14,200 up. A bedlam of noise. When you can decipher anything, you often hear two guys a few hundred miles apart talking to one another. Listen higher up. Try 14,325 to 14,350. Now you'll hear the foreigners! They say 15 is the phone-patch band! Listen to 14,325 to 14,350 at night!

Before you get the idea that I'm just another man who's only seen it from this side of the border, please know that I spent 6 years in Arequipa, Peru. I loved every minute of it, but that's another story. But I did have plenty of time to listen to 20 and see what was going on. The same observation could be made—few QSOs going on between 14,100 and 14,200, but things mighty crowded from 14,200 up. Why can't we use phone from 14,100 up? If anyone thinks CW is not on the wane, listen from 14,100 to 14,200 and then see how many more CW QSOs are going on below 14,100.

It is too much to expect of human nature to hope that the block-heads who use 20 for local contacts are going to change. They live in all countries. But wouldn't it be nice if we did not have such artificial restrictions as we do? Can anything be done about it?

I enjoyed the May issue. Keep them coming.

George Brumley KØWTM
Wichita KS

RADIOSPORT

While recently engaged in a QSO with SVØAE on 15m (for my first SV-land contact), an otherwise enjoyable experience was marred by the proverbial woodpecker beginning its periodic search for food on the band. As if its S9 + 20 signal was not bad enough, the +40 that Kim was getting at his end was that much worse. Of course this is nothing new to anyone who operates on 15 or 20, but in the midst of our lamentations over the assassination of a fine QSO, a discussion of the various protests that had been attempted (and totally ignored) took place in between the staccato beat of the obnoxious bird. An idea emerged, however, which could possibly be considered as a means of dealing with this problem, or at least sending a stronger message of disapproval than has been done up to this point.

In order to attract the attention of a centralized, bureaucratic establishment, some point of leverage is necessary in order to make at least someone in the organization feel like their particular ox is about to be gored. Then they can at least serve as a sounding board for your own viewpoint, but one that is heard from the inside. I won't go into all the details of how the USSR government fits this pattern, but such a point of leverage was suggested to me as I recalled something else I had read. In the April, 1980, *QST*, there was an excerpted reprint of an article written by V. Bondarenko, chief of the Central Radio Club (of Box 88 infamy) of the USSR. In this article, there was expressed a point of view concerning amateur radio which I found to be quite different from anything I had previously considered. Mr. Bondarenko, in referring to contest participation, noted that "Radiosport is . . . becoming one of the mass military-applied forms of sport." He went on and proposed a series of measures to encourage and assist Soviet "snipers of the airwaves" in their quest "to struggle seriously for superiority in the international sports arena." (What was that one, by the way, about non-political Olympics?)

With this sort of a viewpoint, perhaps there should be a rules addition for the major contests which penalized or even disqualified amateurs when their government deliberately and consciously, as a matter of state policy, engaged in actions in violation of ITU rules to the detriment of the amateur radio service on one or more bands. If desired, such a rule could even be made applicable (if deemed desirable) to violations of the recently revised WARC sections applying to the 7-MHz band. The effectiveness of such a move would be subject to a lot of uncertainty, given the scale of priorities of the Soviet government, but at least it would be doing something other than talking, which has gotten nothing at all accomplished.

I'm not sure this could or should be done, but at least it should be discussed, and possibly this may serve to stimulate a much more effective response to this continuing problem.

John S. Walker NØBOT
Brookings SD

KØ6JM

Relative to my letter published in the April *73* and the mystery of my call K6JM being used by a television translator at Gillette, Wyoming: The mystery has since been resolved.

A letter from the TV station's manager explained that there had been a typo on the license, and subsequently this was corrected to KØ6JM. A letter from the FCC Public Radio Division admitted to nothing, but confirmed that KØ6JM was legitimate.

I was unaware that translators associated with TV stations were being issued alphanumeric calls similar to ham calls, which also confused the Wyoming amateurs who brought this to my attention.

I am enclosing an excellent letter from K2PG which fully explains the allocation of TV translator calls and their resemblance to ham calls.

Peter Lovelock K6JM
Santa Monica CA

Peter A. Lovelock K6JM
1330 California Avenue
Santa Monica CA 90403

Dear Mr. Lovelock:

I have read your letter in the April issue of *73* and find it to be quite interesting. I am a broadcast technician at WABC-TV in New York and have some information for you regarding callsigns. The callsign KØ6JM is a legitimate callsign for a television broadcast translator (repeater) station. Translator callsigns consist of a W prefix for stations east of the Mississippi River (K for stations west of it), a two-digit numeral indicating the output channel, and a two-letter suffix issued systematically. KØ6JM is a ten-Watt translator which transmits on channel 6. According to Parts 2 and 74 of the FCC Rules and Regulations, translators operating on channels 2 through 9 use a zero as the first digit in the callsign, giving a two-digit numeral to avoid confusion with amateur callsigns. When the translator in Gillette was using "K6JM" as its callsign, either the FCC made a typo in issuing the translator license or the engineer responsible for setting up the system misinterpreted KØ6JM as K6JM.

Television translators do not originate programs. They operate by receiving and filtering the

signal of the primary station, heterodyning it up or down to the desired output channel, and amplifying the signal after passing it through a bandpass filter. Some translators ID automatically using Morse code as narrowband FM tone modulation on the visual carrier. When the translator does not have an automatic ID, the primary station must ID the translator periodically when giving its own ID. VHF translators are limited to 10 Watts in the west and 1 Watt in the east, while UHF translators are permitted 100 or 1000 Watts, depending upon the channel used. WABC-TV operates a 1000-Watt translator with input on channel 7 and output on channel 66. Its callsign is W66AA and it covers areas of Upper Manhattan and the Bronx which receive horrible ghosting from the World Trade Center. (The New York stations still transmit from the Empire State Building, as permission to move to the World Trade Center has gotten bogged down in red tape.) I hope that this information proves helpful to you.

Philip E. Galasso K2PG
Iselin NJ

MORE YASME

We concluded our operation as HI6XQL (10,000 QSOs) the first of April after the WPX Contest and returned to the United States, concluding a one-half year extended YASME DXpedition as J3ABV, VP2SAX, J6LOO, J7DBB, VP2K \H, and HI6XQL. We were actually "on the air" four months of that time and made 55,000 QSOs. Our equipment, a Yaesu 901DM transceiver, an SB-230 amplifier, and a TH3 beam, plus doublets, worked fine with no major failures.

During the next several months, we will give talks at a number of ham meetings throughout the USA. We plan to resume our YASME DXpedition travels in the fall.

Please pass the following two items on to all ham publications and ham clubs for information and publication.

1. Do you need the countries of Desecheo or Kamaran? There is an easy way to work either of these countries. We will go there and promise to work you if you can get permission for us to enter and operate amateur radio in either country.

2. The YASME Foundation, at its annual Board of Directors Meeting, established a YASME Award and passed the following resolution: "A beautiful and unusual certificate will be awarded free of charge to any amateur presenting proof (QSLs) verifying contact with the holders of 30 different YASME DXpedition calls, including any calls held by YASME Officers or Directors, past or present."

Dick McKercher W0MLY is the custodian of the YASME Award, and applications (QSLs) can be sent directly to him. Please include a list of the QSL cards sent.

Lloyd Colvin W6KG
Iris Colvin W6QL
Castro Valley CA

METROPLEX

The New York City Metropolitan Area's most sophisticated system of inter-linked repeaters has entered Phase II of its operations and improved its own high standards.

Metroplex was conceived in January, 1978, by K2KLN and WB2MGB to: establish repeaters on *all* allocated FCC frequencies; use all available modes; provide 24-hour emergency communications; and provide a forum for east coast and worldwide amateur radio operators via a 2-meter/10-meter FM link. Club members have already contacted over 35 countries *on* 4 continents through the 10-meter link. Autopatch facilities are completely computerized and are part of a large long-distance network which includes trunk-lines, satellites, and emergency speed-dial numbers.

Growing every day, Metroplex has over 400 members, including 50 overseas amateur radio operators! Club meetings are the second Wednesday of each month, 8 pm, Firehouse No. 4, Fort Lee, New Jersey.

Listen to Metroplex FM everywhere on 29.640 MHz/29.540 in, and on 145.450/144.850, 223.720, and 443.950, or write PO Box 237, Leonia NJ 07605. You may also call the 24-hour club phone, (201)-592-1579, to request an information package.

Hank Goldman WA2OVG
New York NY

ORDINARILY IGNORED

I believe in giving credit where it is due. I recently passed the Extra class code and theory and hopefully I won't have to do any more studying. I just want you people at *73 Magazine* to know what I think of your code tapes: Great!! The 20 + got me through the Extra and your beginner's tape procured (I love that word) a Tech license for my wife.

I'm sure you get lots of complaints and criticisms, so I thought I'd let you know that not all of us think that Wayne is a radical big-mouthed SOB.

The cliché of "the squeaking wheel gets the grease" describes some of your methods. If nothing else, the editorials generate a little controversy and stimulate people to discuss and think about things they would ordinarily ignore.

Grover Conde WA7USI
Granger WY

ALPINE COUNTY

Attention county hunters! The Antelope Valley ARC, Lancaster, California, is planning a DXpedition to Alpine County August 16 and 17, 1980. All bands, modes, and county hunter nets will be used. It will be operated under K6OX. All QSLs via K6GXO; SASE or IRCs necessary. All plans are subject to change because of weather and availability of gasoline.

Alexes Hourigan WD6GVL
Secretary, Antelope Valley ARC
Lancaster CA

SHORT IDEAS

Couple of short ideas: One—a Novice page or section each month. If you don't promote Novices, where will future hams come from? Second—In a very prominent place each and every month, a notice in good wording for all hams when they order QSLs from whomever to please put their county on the card. It is bad enough for US hams to go back through many cards received as a Novice or whatever to find out the county of origin; it must be pure hell for our foreign friends on the bands. Your wording of the notice would be better than any I could dream up, but it is a very important point for many of us.

Keep up the good work and fine editorials. You and your staff are dedicated to promoting ham radio, not greenback collecting as in Newington.

Earl Turner KA2DLK
Niverville NY

SOARING

Amateur radio station WB2VPY will be on the air July 1-10, 1980, as a special events station celebrating the 50th Anniversary of Soaring, in Elmira NY, the Glider Soaring Capital of America.

We will operate on 80 through 10 meters SSB. On July 1-3, 7-10, hours will be 2100Z until ?, and there will be continuous operation during the 3-day holiday, July 4-6.

QSL with a legal-size SASE for a beautiful certificate to WB2VPY, National Soaring Museum, RD #3, Elmira NY 14903.

John L. Wilcox Sr. WA2DHZ
Pine City NY

EYE-BALLS

The 3905 Century Club operates nets that basically are for WAS and other club-issued awards on both 75 meters and 40 meters, 357 nights a year. We have additional nets that operate less frequently on both of the above bands, plus a twice-weekly 80-meter CW net. We have about a thousand members spread through every state, the majority of the Canadian provinces, and many Caribbean and Western Atlantic islands.

We hold annual "eye-ball QSOs"—this year, "Eye-Ball III, East" will be in Bowling Green KY on August 8-10; "Eye-Ball III, West" will be held one week later, in Cimarron CO. In 1981, we will have a "Big Eye-Ball QSO" somewhere in the mid-USA.

Early each year, we elect our corporate President and Vice-President "on the air." We print a quarterly newsletter, the *Centurion*.

I would be delighted to furnish any further information.

T. L. Bowers
Public Relations/Editor,
Centurion
Star Route 1, Box 1424
Eustis FL 32726

DX

from page 15

might want to keep this in mind: If you ever have a legal hassle with the Town Board about your "monstrous aerials," have your attorney contact the PCF for legal advice.

More, more, more. We couldn't work them fast enough in April. Your scribe (that's a quaint term, isn't it?) stood at 293 countries worked the first of April and at the end of the month had 297! Terrific! Next on the list (pardon the term) was TZ4AQS. The primary, original operator of this station was a Belgian national with limited experience who had done a fine job of handling the demand for this African country since last autumn. His home-town pal ON6BC had merely taken care of the QSL demand until April, when ON6BC made the airplane journey from Belgium to West Africa for a stint at the mike and key. Jan Deneker ON6BC finished up on 16 April with 11,000 contacts from Mali, many of them on 40 and 80 meters. Jan took a couple of days off for a sightseeing tour of the surrounding territory, but still spent many days at a hot radio working the masses. The QSLs go to ON6BC.

The next big show (not necessarily in big-show order) was an operation by several hams from West Germany on Glorioso Island, off the west coast of Africa. DK9KX, DF3KX, DJ5RT, DJ6SI, and DJ3NG used the calls FR0ACB/G (on CW) and FR0ACC/G (on SSB), operating five transceivers on battery power into two beam and two ground-plane antennas. They stayed on Glorioso only a few days, but appear to have cleaned up much of the demand for this very rare spot.

Prior to Glorioso, the German team operated from Mayotte as FH0FLP and FH0ACB, and they were scheduled to put in a few days afterward from the Comoros D68. All QSLs for these operations go to Dieter Loeffler DK9KD, PO Box 620 260, 5000 Koeln 60, Federal Republic of Germany.

N6DX, JA1BK, and N2KK mounted a Pacific expedition in April to Fijis 3D2DB, Tonga A35DX, Niue and Wallis (calls not known at presstime), and Samoa 5W1CF. Their operations were concentrated on 6 meters with some HF activity, since the general demand for these spots is not as great as for, say, Glorioso. QSLs to JA1BK, Kan Mizoguchi, Central PO Box 231, Tokyo 100-91, Japan.

An operation from Aves Island which was to use the call YV0USB was postponed from the *CQ* WPX SSB weekend at the end of March until later in April, but was still not heard from at that time. There has not been an operation from Aves ("Bird Island") for several years.

JE6NEM and JE6NLL had planned to put Okino Torishima 7J1 back on the bands in June, but they postponed their trip until at least October. By that time, the ARRL may have deleted this "country" from the DXCC list. First activated in 1976, Okino Torishima is a spit of rock so small and so seldom above water that the Japanese had to mount a complex, expensive operation including the construction of steel platforms to keep the operators and their radios out of the water. Although this construction has been left in place, future operations still involve complex logistics.

LX1BW and DJ5CQ put New Caledonia on the air in April (FK0BW and FK0CQ), followed by proposed stops at Norfolk and Lord Howe Islands. They are just leaving FK as this is written. QSL to Rudi Mueller DJ5CQ, 23 Alter Main, D-8601 Ebing, FRG.

The International DX Foundation (PO Box 117, Manahawkin NJ 08050) is a small group of DXers who are using their own funds plus membership fees ($25/year) to put rare spots on the air. John Ackley KP2A operated from the Maldives as 8Q7AL in early April, then as 4S7DX from Sri Lanka. From there, he joined N2OO, VS5TX, and N2CW to operate East Malaysia 9M6MU followed by Brunei VS5KV. Manufacturers who loaned equipment to IDXF included Bencher (paddles), DenTron (amplifiers and tuners), and MFJ (keyers), while Yaesu, Hy-Gain, and KLM provided discounts on purchased equipment. QSLs for the Asian operations should be sent as follows: 4S7DX to WB2VFT, 8Q7AL to K2TJ, VS5OO or VS5KV to N2OO, and 9M6MU to N2CW. *Do not* send QSLs to the PO Box in Manahawkin!

Iris Colvin W6QL and Lloyd Colvin W6KG concluded a half-year extended YASME expedition early in April. Their operations included Grenada J3ABV, St. Vincent VP2SAX, St. Lucia J6LOO, Dominica J7DBB, St. Kitts VP2KAH, and the Dominican Republic HI6XQL. During the period, they were on the air about four months and, using a Yaesu FT-901DM, Heath SB-230, and a TH3 beam, they made 55,000 contacts. From now through this fall, the Colvins will be traveling stateside, speaking at conventions and club meetings. They will operate from Desecheo and/or the Kamarans if someone can find a way for them to get operating permission!

The YASME Foundation has established a YASME Award which will be awarded free to any amateur presenting QSLs verifying contact with the holders of thirty different YASME DXpedition calls, including any calls held by YASME officers or directors, past or present. Dick McKercher W0MLY is custodian for that award. All QSLs for contacts with YASME operations go to The YASME Foundation, PO Box 2025, Castro Valley CA 94546.

Several brief operations took place from Cocos Island off the coast of Costa Rica in April; the callsigns used were TI9s CF, CC, JVA, and XXX. There was no advance warning to any of the bulletins and consequently many missed their chance to work TI9. The operations did take place on weekends, which helped. QSL to Carlos M. Fonseca Q. TI2CF, Box 4300, San Jose, Costa Rica.

SV1JG and SV1IW put Mount Athos on the air once again in mid-April; their operation had been rumored for some time, but no direct word resulted in doubt as to exactly when and where to look for them. Their signal from Mt. Athos was very weak, making it especially difficult for US and Canadian west coast stations to work them. Mt. Athos is still very much needed among this group of DXers, although hardly any serious east coast DXers have missed one operation or another from the "Holy Mountain." QSL Box 3751, Athens.

QSLs for last fall's Equatorial Guinea 3C1AA and Annobon 3C0AB operations went into the mail in April; if you haven't received yours by now, another request to EA4LH might be in order.

April departures: Jim Bullington N4HX from Chad (TT); ZS2MI from Marion Island; ZK1DR from South Cooks; PP0MAG from Trindade after two solid months of CW only; TZ4AQS from Mali.

The Northern California DX Foundation has, according to K6SSJ, shipped a beam, coax, rotator, and cable to Khartoum, Sudan, and it should be set up and operating now, with rigs supplied by the ITU. They were supposed to use the call 6T1YP from the Children's Youth Palace building, which was donated and constructed by the government of North Korea. Martti Laine OH2BH visited and operated in early June and then planned additional air time from Southern Sudan ST0. No QSL info available at this time.

A news release concerning the operation of the US fourth call area QSL bureau came out in late March. There are actually two bureaus for the call area, which is the largest with some 60,000 amateurs. Unfortunately, only about 5200 of them maintain envelopes on file. The amount of unclaimed DX cards on file in January, 1980, if piled in one stack, would be nearly 50 feet high, according to Art Nevins WA4NTP, Bureau Manager. Although the official sponsor is the Sterling Park Amateur Radio Club of Virginia, the volunteer workers in the bureau come from all over the 1300-square-mile Northern Virginia region. Three dozen bureau volunteers process over 60 pounds of cards each week with seasonal peaks of up to a hundred pounds a week. A pound is about 150 cards.

At the present US minimum wage, the bureau volunteers provide more than $16,000 of free labor each year. And this is only one call area! Art says the three biggest headaches at *his* bureau are DXers who don't keep envelopes on file, envelopes with insufficient postage, and wrong size envelopes. Each bureau has certain specific requirements for users and you should check with your own bureau to find out exactly what they want. None of them ask for

much and they all offer a lot in return.

Next month will be QSL managers list time. Meanwhile, a very complete list of over 4000 managers is available for $1.75 US/Canada/Mexico or $2.80 overseas airmail from J. O'Brien, Electronics Enterprises, 6606 Fifth St., Rio Linda CA 95673. A yearly subscription is also available for this list, which is updated monthly. This particular listing is the latest to start up, the O'Briens having taken over from WB0MSZ. Several other publications listing managers are advertised in the various amateur magazines.

The 1980 International DX Convention at Fresno CA was a sellout. No details at this time except that Larry KS6DV won three Hy-Gain monoband yagis.

That just about wraps up April, 1980—certainly a month to remember with the concentrated operating of TZ4AQS, Glorioso, East Malaysia, Mt. Athos, many of the Pacific Islands, Trindade, and more. Band conditions were generally superb with 90 percent of the days rated High Normal or Above Normal.

Looking ahead to July, no major expeditions have as yet been announced, which is not unusual since the summer months in the Northern Hemisphere are usually pretty devoid of expeditions. But it pays to be prepared; if you take your beam(s) down for refurbishing, better keep a trap vertical or something operational in case of an "emergency" like China or whatever coming on! Last month we expounded on summertime propagation conditions; you might want to re-read that, check the bands out, and send us a report card. And keep those photos and notes coming in, too. Thanks and good DX.

All the information for this column came from the weekly *DX Bulletin* out of Vernon CT.

Looking *West*

from page 10

10-meter FM, and to that end he has developed a neat little kit which uses a CB transceiver board and a "Bob Heil"-developed modification kit to put it on that mode. For about $50, the world of 10-meter FM can be yours, in a neat little package that works well and takes very little time to get on the air. Bob was doing a "land-office" business selling these goodies from his spot at the flea market.

I had two reasons I wanted to meet with Bob. First, as stated earlier, was the chance to eyeball a person for whom I have a great deal of personal admiration. Also, we had to set up some plans for the then upcoming ARCH convention in St. Louis. That's another one I will be attending and talking at. Oh, yes, I probably forgot to mention that one of the main reasons for my trek to Dayton was to speak at the Hamvention about the Westlink Radio Network. More about this later on.

During the time I was with Bob, Joe and his cousin Bob located us and we soon departed for the innards of the arena so that Joe could give his seminar on malicious interference and how to combat it and I could audiotape it. As I was setting up, a chap whose name escapes me at the moment asked if I could find someone who could provide more light so that he could videotape Joe's presentation. He had with him a Panasonic color camera and portable VHS recorder, but no portable lighting equipment. A quick search revealed that there was no way to get higher intensity on the house lights, but where there is a will, there is always a way. I noticed that on a table almost directly in front of the speakers' rostrum there was one of those overhead projectors used for thin-film slides. With a handkerchief over the lens to diffuse the light, it made a dandy portable source of luminance. My friend with the video equipment had the illumination he needed.

One of the things you learn quickly in covering news using audio tape is never to depend on the house PA providing a place to connect a tape recorder. This time was no exception, but we had come prepared with a mike of our own and enough cable to reach the recorder. If you ever plan to do any recording at a convention, meeting, or the like, keep this in mind. A good, low-impedance dynamic mike with 30 to 50 feet of cable is all but a necessity. I usually carry an SM-61 mike and two 20-foot cables fitted with type XLR connectors. At the end going into the recorder, I transform from the balanced mike line to the unbalanced recorder input, thus getting the best quality audio with minimum hum induced by long mike line runs. This is standard procedure in both broadcasting and public address system work. True, it's the expensive way to go, but the quality of audio you get is worth it. My recorder is a Panasonic RQ-309S cassette unit that operates on both 110 V ac and internal batteries, thus affording a maximum of flexibility under differing conditions. The recorder features automatic recording-level control and automatic end-of-tape shutoff, which makes for almost hands-off operation. The ALC is a godsend when recording non-professional speakers who are not aware of the proper way to "play a microphone." Another necessity is a roll of what is called "gaffer's tape." It's just like ducting tape and is very valuable in attaching your mike to the PA mike and holding down mike lines so that you do not cause someone to trip over them. With the equipment described above, you can get some excellent recordings for an investment of about $175, the microphone being the most expensive investment.

Once Joe's presentation was concluded, he, his cousin, and I spent the rest of the day browsing around the convention itself. There was a plethora of new equipment to see, touch, and wish for. We spent the afternoon doing just that. It was when I arrived at the *Ham Radio Magazine* booth that I learned some very sad news. There on the counter were copies of a special edition of *HR Report* which told of the untimely passing of Jim Fisk W1HR, editor of *Ham Radio* and *Ham Radio Horizons*. This news just about knocked me off my feet. I cannot claim to have known Jim very well. I had met him on several occasions at hamfests, conventions, and other meetings, and I always felt that there was something very special about him. He was one of those rare people who had devoted himself to amateur radio and had become a very important part of the amateur radio community in the nation and the world. On the evening of April 18th, at about 8:00 pm, Jim suffered a heart attack from which he never recovered. He will be missed by many of us, and the mark he left on the amateur community will long be remembered. A short time later I located *HR*'s publisher, Skip Tenney, and ran the hardest interview I have ever been forced to do. I was almost in tears as I asked what had happened and recorded the answers. Sometimes covering the news is not a very easy job. Sometimes it really hits home.

Soon after, Joe and Bob caught up with me and told me they were heading back to the hotel. I told them I would meet them there later and went back out into the flea market with Noel, interviewing him and those who stopped us as we proceeded though the crowds, up one aisle and down another. I had parked my attache case containing my recording kit at the DSI booth with Dennis Romack WA6OYI, and at this point was using a smaller Craig pocket cassette machine more suited for field interviews. About 5:00 pm, Noel, Marilyn, and I took off for a quick trip to Xenia to take the baby to her grandparents who would be babysitting. We then went back to the hotel to get ready for the banquet.

The hotel we were staying at was directly across from the Dayton Convention Center where the banquet was to be held. We quickly changed into our formal attire and headed across the street in the hope of getting a good table. Joe and Wayne would be on the dais, but I needed to find a spot which would permit me to record from the house PA system, since there would be no way to run my own mike lines here. As it turned out, we were not the only 6th call district amateurs at the affair. Almost immediately we ran into Dave Bell W6AQ, who produces "Hams' Wide World," "Moving Up To Amateur Radio," and the newly-released "World of Amateur Radio." Dave was filming in Ohio that week and was able to slip away to get to the Hamvention and the banquet.

All I can say for the banquet was that the food was good, the awards ceremony beautifully done, and the entertainment excellent. The latter was provided by another old friend, Jean Shepherd K2ORS. I doubt if I have to say any more. Anyone who has ever heard "Shep" on the radio, on TV, or in person knows exactly where I am coming from. Jean is by far one of the nation's truly great humorists, and I have been a devoted fan of his since I first heard his program on WOR radio in New York many years ago. The last time I had spoken with him was on the WA2SUR repeater in New York back in 1971. It was both a pleasure and a thrill to get reacquainted again after all these years. Earlier in the day, we had spent about an hour or so talking about the old days back in NYC while standing around the Hamvention headquarters, but listening to him that evening really brought back the past. I closed my eyes, leaned back, and just listened. I was reliving many happy hours of long, long ago.

After the banquet, we adjourned to the DARA suite, at which time I excused myself for about an hour. I had my job to do at this point. On a bunch of tape cassettes was the story of the 1980 Dayton Hamvention. Somehow, I had to condense this material into a 2-minute story, write a script, choose my actuality material, and put it all together. I closed the connecting door and went to work. I had no way of editing tape on the fly, so all I could do was list the actuality cuts to be used and note the outcues, running times, and insert points for Bill Orenstein KH6IAF. I would be feeding the story to Bill over the phone so that he could get it on the upcoming Westlink newscast. Sixty minutes later, I was ready to record the "anchor track" and then feed Bill. I had asked Vic earlier if he would "voice" the story for me and he had agreed. However, when I cornered him, he told me he would be back shortly. He was, and with a rather big surprise. A few minutes after Vic returned, Jean joined us. It was then Vic told me that he had asked Jean if he would "voice" the report and that Jean had agreed to do it. At about 1:00 am Dayton time, we recorded the last track, and by 2:00 am the entire package had been fed to Bill via the phone. At that point, I went horizontal.

In the morning, this morning, which came all too soon, we packed our bags and checked out. Our flight back to LA would leave at about 4:30 that afternoon EDST, so along with our hosts, we headed back for a last few hours at the convention. Besides, I still had my own presentation to make about the Westlink Radio Network.

Our talk consisted of a 15-minute slide and sound presentation narrated on tape by Westlink anchorperson Jim Davis KA6IUH, followed by a 45-minute "question and answer" session. This was the first time I had used the slide show, and I am glad it was so well received. We will be presenting it again at the ARCH convention and will soon have it available on VHS videocassette for free loan to interested groups nationwide.

I recognize the terrain below. We have already made the stop in Kansas City and are about 30 minutes out of Los Angeles. It's been a whirlwind weekend and I have only one job left. That's transferring all these mental notes onto paper for you to read. It's been four years since my last Hamvention. A lot has happened in that time—some good, some bad. But for the past 72 hours it's been the thrill of a lifetime, and this very personal column is my way of saying thanks to a very wonderful bunch of people who put on one of amateur radio's greatest annual events. My thanks to DARA and especially to one Noel, his wife Marilyn, a Vic, a Larry, and two guys named Bob. Special thanks to Jean Shepherd K2ORS for becoming the Hamvention correspondent for Westlink and to everyone else who made this weekend happen. I will never forget any of you.

BOB, DAVE, AND RM-3618

You are about to read a request for rulemaking submitted to the FCC by Bob Thornburg WB6JPI and David Faraone WA6KOS. If you are a repeater user or owner, this rulemaking request will eventually have a profound effect on your day-to-day amateur operation. It was submitted because of a sequence of events that transpired over a year's time that perhaps began with a letter I sent to the FCC requesting a clarification of the rules and regulations in regard to a number of aspects of repeater operation.

You might remember the letter I speak of. We printed it in the column and have mentioned it from time to time. I have yet to receive an answer to it, even though a number of congressional leaders secured promises that an answer would be forthcoming. Early this year, the engineer in charge of the FCC's Long Beach, California, facilities announced that henceforth the licensee of a repeater would be held responsible for the content of communications over a repeater. This announcement was greeted with mixed emotions in the Los Angeles amateur community. Some amateurs felt that such action was long overdue, while many others were adamant in their opposition. Many amateurs, especially repeater owners, felt that such an interpretation of Part 97 might lead to an end of open repeater operation in this area. A large cross section of their userships echoed this sentiment.

Talking about a problem and acting on it are two entirely different things. While many talked a blue streak, two amateurs decided to take decisive action on the matter. Working together with input derived from both Part 97 and the local amateur community, Bob Thornburg and Dave Faraone prepared a formal request for rulemaking which asks a specific clarification of Part 97. It was assigned the designation RM-3618 and had a commentary cutoff date of April 30th.

Whether you agree or disagree with what follows is unimportant. The regulatory changes caused by it will affect you, and you should be aware of what might be coming in the future.

February 19, 1980

Federal Communications
Commission
Washington DC

We request the following changes to Part 97 of the Rules and Regulations of the Federal Communications Commission be considered:

We are proposing the rules be clarified to ensure that equity in responsibility be maintained clearly and unambiguously making the repeater owner to not be responsible (under certain conditions) for the subject content retransmitted by his repeater. The repeater owner/trustee will still be responsible for the technical operation of the repeater and be responsible in those areas where the repeater is the origin of a rules violation. But for those cases where a violation originates from stations other than the repeater station, the repeater licensee/trustee is not to be held responsible even if his repeater retransmits the violation.

We have been repeater owners and operators for several years and have endured numerous changes to those paragraphs of Part 97 that regulate and control repeaters. We have observed with enthusiasm the relaxation of those rules recognizing the stability and maturity of the repeater technology and its management. The concept of automatic repeaters which released the repeater owner from full-time control and monitoring was a significant meaningful advancement. This concept has been successful. The public service allowed by having 24-hour availability as well as the on-line emergency facilities has been documented in many thousands of examples.

The intent of automatic repeaters was to support the ongoing concept of deregulation by allowing the responsible amateur to "do his thing" without severe and restrictive rules and regulations. Clearly, the intent of the commission in this area of rulemaking was to relax the previous strict control and monitoring regulations. It has been successfully demonstrated that the privilege of repeaters was not abused and that the availability of automatic repeaters has better served the public.

Recently, the FCC enforcement branch here in Los Angeles (Long Beach) has stated that it will hold the repeater owner responsible for the subject content of signals retransmitted by automatic repeaters. We are not taking exception with his right to take this position, as Part 97 is quite ambiguous in this area. Nowhere could we find this subject addressed (either way) in Part 97. Therefore, we are not requesting a change, per se, to Part 97, but rather an unambiguous clarification to the repeater rules.

The clarification is justified by three distinct considerations.

First, the repeater owner cannot realistically control the subject content of repeater transmissions. It only takes one word or one note of music to have a violation. The technical control provisions of the repeater could not possibly respond to preclude retransmissions of these signals. It is not fair or equitable to impose responsibility in areas where control or prevention cannot exist or is impractical.

The second consideration is the very concept of automatic repeaters. The rules clearly release the repeater licensee/trustee from full-time control. This allowance states that the control does not have to be in "real time" and the implication is clear that the word-by-word content control is not required or intended. (See 97.85(e).)

The third consideration is a clear statement of intent of the FCC made in response to comments to Docket 21033. Quoting from page 7, paragraph 19:

> In Docket 21033, we proposed to take the next logical step and end the requirement for a separate license for repeaters. This was done in recognition that the original function of repeater licensing, namely, the stabilization of a new situation, had been served. However, the petitioners in this docket argued that a repeater license is still necessary and still serves a function. The expressed fear is that the situation will become chaotic if any amateur, Technician class or above, can set up a repeater. However, the state of affairs at present is that any amateur, Technician class or above, can set up a repeater simply by checking off the appropriate box on Form 610 and waiting for a repeater license. There is simply no longer any practical purpose being served by the licensing process. We should also note that some amateurs have also expressed the fear that without separate repeater licenses, amateurs that operate their primary stations as repeaters might place their primary station license in jeopardy for rule violations committed by users of the repeater. In this regard, the commission intends to treat the repeater users as being primarily liable for operational rule violations, and will look to the repeater licensee only to the extent that he fails to meet this obligation to provide adequate control of his repeater. As a practical matter, our enforcement efforts in the past have proceeded on this basis. In many instances, we have worked with repeater licensees in tracking down users who commit rule violations through the repeaters.

Additional concepts that may be considered are that in all cases the party originating the radio transmission is still responsible and that the request presented here specifically excludes any situation where the repeater itself is the originator of a violation. THERE IS ALWAYS A RESPONSIBLE PARTY FOR ALL RADIO TRANSMISSIONS. With this request, the responsibility for radio transmissions and any retransmissions, desired or not, become the sole responsibility of the originating operator.

Additionally, and in reverse argument, if the repeater is responsible for retransmission content, then the control operator must act as judge and jury on subjects such as what is profane or what consititutes broadcasting, etc. Most of these concepts are difficult for a court of law to interpret, much less the average repeater owner or control operator. The rationale that only continuing or severe or repeated "violations" would inflict action against the repeater owner is inappropriate, as a violation is a violation and quantity, time span, or intent do not make a violation. Either the first profane word is a violation or there is no violation even for the 100th profane word.

The specific change we are proposing is in two parts. First, we propose adding a paragraph to section 97.3 DEFINITIONS:

> Repeater User: The repeater user is defined as a radio operator utilizing a repeater for radio communications.

Secondly, we propose to add paragraph (f) to 97.85:

> (f) It is the responsibility of the repeater licensees to maintain technical standards as specified by the rules pertaining to automatic control or by control using a control operator. It is the responsibility of the repeater user to ensure that emissions originating at his station are in accordance with the rules as provided in 97.112 through 97.129 respectively. The content of a signal being automatically retransmitted by a repeater, in the automatic mode, is solely the responsibility of the originating station, not the repeater licensee.

This request for rulemaking is submitted by:

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Blue Jay CA 92317
(714)-629-5111, x-3738
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While it is too late for you to file comments on RM-3618, its authors definitely want to know your feelings on it, and they have, as you will note, provided addresses and telephone numbers where they may be contacted. If you do write to them, please send us a copy of your letter so that we may excerpt from it in future columns.

Also, if you are planning to submit a rulemaking request on any matter, the example shown herein is one of the best guides that you can use. It was well prepared and documented and is exactly the way such a request should be submitted. Whether or not you agree with RM-3618 is not the important issue. Far more important is that you be aware of it. I freely admit that I have certain reservations over some portions of it. However, if it helps clear away some of the ambiguity that now permeates the rules and regs, then it's definitely a positive step. We will keep you abreast of the progress of this RM as it wends its way through the Washington rulemaking mill.

Ham Help

I am presently in ACI in Florida and I have been having a little problem with trying to get any electronics/radio courses in here. I am very highly interested in amateur radio and am presently doing what I can to get my Novice ticket while here.

I am serving four years and I don't know when I will be granted parole, but I'm trying to do something with my life. I always have been interested in radio communications and I like to build and operate my own equipment. Up to late, my projects have been mostly flea-powered FM transmitters and such. I have built a few transmitters, receivers, preamps, and linears, and am awaiting the day when I have my ticket in hand before I will use this equipment.

But back to the story at hand. Since I am in prison, I have not been allowed to enjoy my hobby, and I sure do miss working with electronics. I tried to get permission to get an HF receiver, but they are afraid that such equipment would be hazardous to the security of the institution. They don't realize that the receiver would not be capable of receiving their police frequency of 45.520 MHz. I would just like to be able to monitor the activity on the amateur bands and learn in the process. I have also tried to get a code-practice oscillator—to no avail. They don't see how such a small device would be of any help to me. It is too bad there are no hams working here that I know of—maybe they could help convince the staff here of my good intentions.

If anyone out there can help me convince them of the good of amateur radio, please write to me. The only literature on the subject I have is my subscription to *73*. It is a lifesaver for me, as radio is my future. Thank you.

Norman R. Boyce, Jr.
PO Box 699, B-73
Sneads FL 32460

Contests

from page 22

erating time is 12 hours of the 13-hour period. Operating classes include: single- or multi-operator, single- or multi-band, and SWL. In the case of multi-operator, only one transmitter may be used at any time. There is a special section for mobile operators.

EXCHANGE:

RST, QSO number from 01, WAB area and county. Book numbers and districts may be requested, but are not mandatory as part of the exchange.

SCORING:

Score 5 points for each completed QSO. Stations may be worked on other bands for extra points.

Multipliers for UK contestants are each WAB area and each overseas country (DXCC list). In addition, Alderney, Guernsey, Jersey, and Sark count as separate countries. The remainder of G, GD, GI, GM, and GW count as one multiplier only.

Multipliers for overseas contestants are each WAB area, county, and each G prefix (G, GD, GM, and GW). Multipliers count on each band, i.e., a station worked on three bands = 3 multipliers.

For mobile entries, every contact made from a different area will count five points, but the multiplier counts once only (i.e., mobile station X from ten different areas: score is 10 times 5 points, but only one multiplier for the mobile station).

AWARDS:

Certificates for the leading contestant in each class or entry. For awards, each G prefix is separate. There will be certificates issued to the leading contestants from each DXCC country and also to SWLs. Certificates for 2nd and 3rd will be issued if there are 10 or 25 entries from a particular country or call area.

ENTRIES:

Logs must show the title of the contest, name and full postal address of contestant, QSO details, total points claimed, multipliers claimed, and the full details of all operators when multi-operator entry is submitted. Logs must be sent to the contest manager: R. L. Senter G4BFY, 27 Station Road, Thurnby, Leicester LE7 9PW, England.

Entries must be postmarked not later than one calendar month following the date of the contest and must be received by the contest manager not later than 40 days following the said contest. A signed declaration that the station was operated in accordance with the current licensing conditions must accompany all entries. It is a condition of entry that the decision of the WAB Contest Manager and the WAB Committee shall be absolute in the case of dispute. For SWLs, all stations logged must be participating in the contest and giving serial numbers which must be logged. The results will be notified to the RSGB and the Contest Manager will supply a detailed sheet on receipt of an SAE on or after November 1st.

SWOT QSO PARTY
Starts: 0000 GMT August 1
Ends: 2359 GMT August 7

Participants may use as much of the contest period as they wish during the third annual SWOT QSO Party. All licensed amateurs with operating privileges on two meters are eligible to participate. Contacts must be made on either CW or SSB. A station may be worked once on each mode for QSO score. You can count a portable or mobile station only once on each mode even though you may have worked him while he was in two or more geographic units. Contacts must be made direct without the aid of satellites, repeaters, or retransmissions of any kind. EME (moonbounce) contacts may be counted if they otherwise meet all requirements. All contacts must be made from one geographic unit. Portable or mobile stations operating from several geographic units may, however, claim the highest score made from a single unit.

EXCHANGE:

The following information must be exchanged to qualify for contact credit:

1. Callsigns.

2. Geographic designator (unit)—This will consist of a four- or five-digit number indicating the geographic location of the station in latitude and longitude rounded down to the next whole number. (Example: W7CKL located at 32 degrees 7 minutes north and 110 degrees 55 minutes west would send 32110.) Non-competing stations may be counted for contact and multiplier credit if they give their location with enough specificity that the competing station can determine the geographic designator.

3. SWOT suffix "X"—SWOT members will add the suffix "X" to the geographic designator to indicate SWOT membership; this will provide the additional multiplier as indicated under scoring.

SCORING:

The final score equals the sum of SWOT member and non-member credits computed as follows: The total SWOT member QSOs multiplied by the number of different geographic units they were located in multiplied by 2 equals the total SWOT member credit. The total non-SWOT member QSOs multiplied by the number of different geographic units they were in equals the non-SWOT member credit.

ENTRIES & AWARDS:

The person with the highest final score will receive the 1980 SWOT Trophy. Certificates will be awarded to the highest scorer in each ARRL section in which more than one entry is made. In the event of ties, the entry with the earliest postmark will be the winner. Winners will be announced in the *SWOT Bulletin* at the earliest possible date. Logs should not be submitted unless requested. Send a summary sheet postmarked not later than September 1st to: Val Taylor W7CKL, 3849 N. Houghton Road, Tucson AZ 85715. The summary sheet should include: name, callsign, address, ARRL section, SWOT membership number (if a member), # SWOT member stations worked and # geographic units they were in, total non-SWOT credit, final score.

ILLINOIS QSO PARTY
Starts: 1800 GMT August 2
Ends: 2300 GMT August 3

Sponsored by RAMS, the Radio Amateur Megacycle Society. Use all bands, CW and phone, with a rest period from 0500 GMT to 1200 GMT on August 3rd. The same station may be worked on each band and mode. No repeater contacts are allowed.

EXCHANGE:

RS(T) and state, province, country, or IL county.

FREQUENCIES:

Any frequency, but look for most activity: about 60 kHz from low end on CW; about 3975, 7275, 14275, 21375, and 28675 on phone; and about 25 kHz from the low end of each Novice band, especially on the hour and half hour.

SCORING:

One QSO point per contact or two points if the other station is a Novice or Technician in a Novice band. Illinois stations multiply QSO point total by the total number of states (50 max.), VE/VO call areas (10 max.), and no more than 5 non-W/K/VE/VO DX countries worked for a maximum of 65 multipliers. Additional DX contacts count for QSO points, but not for additional multipliers. Illinois portables or mobiles away from normal QTH may add 200 to final score for each county of operation from which 10 or more contacts were made. Non-Illinois stations multiply QSO points by the number of Illinois counties worked. Only Illinois stations may be counted for QSO points. Non-Illinois stations may also take extra bonus multipliers for each group of 8 QSOs with the same county.

AWARDS:

Certificates to the top 3 Illinois scorers in single-op, multi-op, multi-multi, portable out of home county, mobile, Novice, and CW Technician categories. For out-of-staters, awards go to top scorers in similar categories in each state, province, or country from which 2 valid entries are received. Club participation awards given per ARRL SS rules. Other awards may be given if deemed worthy and decisions of the contest committee are final.

ENTRIES:

Logs must be legible and be submitted along with a summary sheet listing all claimed multipliers and calculations of score. Operator(s) name, address, call, and operation category must be typed or printed clearly. Include a business-size stamped addressed envelope for return of results. Entries must be postmarked no later than September 15th and sent to: RAMS/K9CJU, 3620 N. Oleander Avenue, Chicago IL 60634.

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propagation

by

J. H. Nelson

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ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14A	14	14	7	14	21	21	21	21	21
AUSTRALIA	21	14	14	14	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	21	14A	14	14	7	7	14	21	21	21A	21A	21A
ENGLAND	14	14	7A	7	7	14	21	21	21	21	21	21
HAWAII	21	14	14	14	7B	7B	7	14	14	21	21	21
INDIA	14A	14	14	7B	7B	7B	14	14	14	14	14	14A
JAPAN	21	14	14	7B	7B	7B	7B	14B	14	14	14	14A
MEXICO	21	14A	14	14	7	7	7A	14	14	14	21	21
PHILIPPINES	14	14	14	7B	7B	7B	7B	14	14	14	14	14
PUERTO RICO	21	14	14	7	7	7	14	14	14	14	21	21
SOUTH AFRICA	7B	7B	7B	14	14	21	21	21	21A	21A	14	14
U. S. S. R.	14	14	7	7	7	7A	14	14	14	14A	14A	14
WEST COAST	21	14A	14	14	7	7	7A	14	14A	21	21	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7A	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14A	14	14	7	14	21	21	21	21	21
AUSTRALIA	21	21	14	14	14	7B	7	7	7	7B	14	14A
CANAL ZONE	21	14A	14	14	7	7	14	21	21	21A	21A	21A
ENGLAND	14	14	7	7	7	7	14	14	14	14A	14A	21
HAWAII	21	21	14	14	7	7	7	14	14	21	21	21
INDIA	14	14	14	7B	7B	7B	7B	14	14	14	14	14
JAPAN	21	14	14	14	7B	7B	7B	7B	14	14	14	14A
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	14	7B	7B	7B	14	14	14	14	14
PUERTO RICO	21	14A	14	14	7	7	14	14	14	14A	21	21
SOUTH AFRICA	7B	7B	7B	7B	7B	14B	14	21	21	21	14	14
U. S. S. R.	14	14	7	7	7	7	7A	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14A	14	14	7	7	14	21	21	21	21
AUSTRALIA	21	21A	21A	21	14	14	14	7	7	7B	14	21
CANAL ZONE	21	14A	14	14	7	7	14	14	21	21	21A	21A
ENGLAND	14	14	7	7	7	7	7	14	14	14	14	14A
HAWAII	21A	21A	21	14A	14	14	7A	14	14	21	21	21
INDIA	14	14	14	14	14B	7B	7B	7B	14	14	14	14
JAPAN	21	14A	14	14	14	14	7B	7B	14	14	14	14A
MEXICO	14A	14	14	7	7	7	7	14	14	14	14A	14A
PHILIPPINES	14A	14	14	14	14	14B	7B	14	14	14	14A	14A
PUERTO RICO	21	14A	14	14	7	7	14	14	14	14A	21	21
SOUTH AFRICA	7B	7B	7B	7B	7B	7B	14	14	14A	14A	14	14
U. S. S. R.	14	14	7	7	7	7	7	14	14	14	14	14
EAST COAST	21	14A	14	14	7	7	7A	14	14A	21	21	21

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

july

sun	mon	tue	wed	thu	fri	sat
		1 G	2 G	3 G	4 G	5 G
6 G	7 G	8 G	9 G	10 G	11 G	12 F
13 F	14 G	15 G	16 G	17 G	18 G	19 G
20 G/SF	21 P/SF	22 P/SF	23 F	24 G	25 G	26 G
27 G	28 F	29 F	30 G	31 G		

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Info

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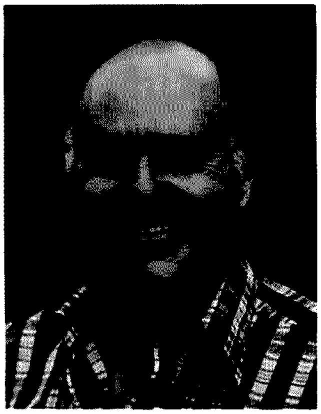
W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



A HAM CAREER?

Why not? I chose that avenue for enjoying both my hobby and my life and I've had so much fun "working" that it almost makes me feel guilty. The brand new Swan rig just arrived and we naturally have to check it out on the air to see how it works. That's work? Well, it's a bit more difficult to sit down and write up the results so the readers will know more about the rig and have a valuable second opinion . . . particularly when the ham shack offers comparison operating with the Icom 701, the Yaesu 901, and other late model rigs.

Just look over the last few issues of *73 Magazine* as compared with *QST* and I think you'll see why we're looking for people to help us put out our magazines and books. For example, if you'll count the pages of articles in the May and June issues of the two magazines, you'll find that *73* has 250% more pages of articles! That's two and a half times as many . . . and that means it takes us a lot more work to get *73* ready for printing.

Sure, amateur radio is in the doldrums these days, but with a good crew here at *73*, I think we can do a lot to help the hobby get moving again. Obviously I can't do all that alone . . . it takes dedicated hams working to edit and prepare articles for publication, to edit books for publication, to keep in touch with the manufacturers and dealers for ad sales and product promotions, to keep after firms who are giving hams shoddy treatment, and to keep abreast of what is going on in amateur radio all over the world.

I can help amateur radio best, I suspect, if I'm able to get away and help bring hams into hamfests with my talks . . . if I'm able to get to Washington to talk with the FCC people . . . to talk with Congress (I am and have been a registered lobbyist for amateur radio for years) . . . and have the time to visit lesser-developed countries to push for the development of amateur radio clubs which will benefit those countries.

We're looking for hams who are enthusiastic enough about amateur radio to make it their life . . . and who will be able to help select the articles we are to run, work with authors to get special articles, sell ads, keep track of new products, help with circulation efforts, and handle the dozens of other tasks which it takes to put out an interesting and valuable monthly ham magazine.

By now it should be no secret that we hire only non-smokers, so the air is sparklingly clean in our offices. And despite our size (130 people in all at last count), things are remarkably unstructured. This is a problem for some people and a blessing for others. It allows growth in just about any direction. One of our top ad sales people started in the shipping room. The Assistant Publisher arrived with nothing particular in mind and was started out editing books . . . now he almost runs the place. Others have come, put in as little of their 40 hours a week as possible, and have gone nowhere.

After visiting much of the world and most of our country, I can honestly say that there is no place that I've visited which I would trade for this small secluded corner of New England. The climate is fantastic . . . a bit cooler than New York, with pure clear air always, too little snow in the winter, and not too hot in the summer. It is a state where vacations are the major industry . . . with vacationists just about all the year around. Peterborough is protected from this by being in a little valley of its own. Housing is a difficult problem in Peterborough itself, but the surrounding towns, which use Peterborough as a shopping center, offer bargain housing as compared to most areas of the country.

One other thing . . . when you work in the ham business, you soon get to understand much more about the political aspects of amateur radio. You learn things about the ARRL that few

NO TAXES!

Looking for a job? *73* is currently seeking applicants for one of its top staff positions. In addition to being a non-smoker, the qualified candidate will be a ham with an outstanding knowledge of electronics, an excellent command of the English language, and experience as a working journalist. We offer a competitive salary, fine fringe benefits, and excellent working conditions—as well as the opportunity to live and work in beautiful, tax-free New Hampshire. Interested parties should respond with resumes to: Director of Personnel, *73 Magazine*, Elm Street, Peterborough NH 03458.

outside of their directors know. You learn who really are the bad guys and who are the good guys . . . and there are plenty of both.

If you're interested in making both amateur radio and publishing a career, drop me a line and tell me what you think you might be able to do for us . . . and what experience you've had which qualifies you.

What about our prospects? Well, with the ARRL admitting to serious losses and cutting down on their staff, with both *Ham Radio* and *Ham Radio Horizons* fading away rapidly, and with *CQ* uncertain at best, the field appears shaky. Despite the signs of disaster all around, *73* is doing very well . . . has more pages of ads than *QST* . . . and is growing in circulation. *73* is making money and is in healthy shape. I think, with some leadership from *73*, the hobby can get into a growth mode soon again.

There are some very exciting times coming up for amateur radio as we here at *73* push for amateur pioneering of new communications modes. These could well revolutionize the hobby as much as sideband did twenty years ago and repeaters did ten years ago. It's time for some new ideas and we have them. You can be a big part of this if you have the enthusiasm and the guts to make a big positive change in your life.

Salaries? They're adequate for the area and the responsibility undertaken. We don't have a need for inexperienced management in the higher brackets, so if you are in the over $20,000 range, you will have to have an incredible amount to offer. We much prefer to promote from within into the middle and higher management positions. One more thing . . . my job is available, if you can handle it.

ATTENTION, ENTREPRENEURS

If you've read much about nicad batteries, you know that while they are almost as remarkable an invention as Baggies, you also know that keeping them properly charged is almost impossible. Reading articles on nicads confuses matters more often than clarifies them.

My latest HT had nicad charging instructions with it. It seems that nicads have a memory and that to get them to keep their full capacity one must discharge them fully before charging. If one does not go through this routine, then the confounded battery will remember where you put it on recharge last time and stop working there. None of my chargers understand this problem.

After grumbling about this situation for a while, the light finally dawned. Why not make a smart nicad charger? Why not make a charger which will first discharge the nicads and then, when it senses that they are prostrate, slap in the approved charge rate to build them up so that I will get maximum life and pep out of them?

Shucks, it could even be made a little smarter than that. If there was a built-in tray for a group of AA nicads, the charger could be made to check each nicad separately and give it personal treatment. Now and then some of us (me) chance to leave a piece of equipment turned on . . . or it gets turned on by itself in a bag (my old Wilson HTs with the toggle switch on top were fantastic for that) . . . anyway, now and then a cell will go negative and need to be shorted out until it is totally dead . . . then it should be socked with a hard charge. A smart charger could do that.

Okay, there is your key to a million dollars. All you have to do is put the idea into a working model, go into production, and get it into every discount store in the country. And, hey, put me down for 2% of the gross for the idea. If you don't pony up with the royalty, I will stop giving you ideas and make things myself.

NARA?

The first I heard of the National Amateur Radio Alliance was when a chap who had been to Dayton talked with me at Wiesbaden in Germany during the hamfest there in early May. I'd been traveling in Europe since mid-April and apparently was a little out of touch.

He said that ten hams had put up $15,000 each to form a new national organization and that they were actively soliciting membership at Dayton. I was immediately suspicious. How could ten hams with that kind of money get together and decide to start something without getting in touch with me about it? And if they were doing it without any help or advice from me or *73 Magazine*, why? It wouldn't seem like an aboveboard operation if they were keeping it that secret.

Upon my return, I checked with our crew who had been at Dayton. They hadn't seen or heard of any NARA out there. Hmmm, more curious. There just aren't a lot of hams who could put up $15,000, and I've long been in touch with most of the hams who have taken any serious interest in the improvement of amateur radio. What was going on?

A letter, undated, was waiting for me . . . from a most interesting chap. He mentioned that he was one of the those involved in NARA, but he mentioned no one else. Since this chap was responsible for one of the bigger rip-offs in ham history, and the last I heard had screwed many amateurs . . . particularly in other countries . . . out of thousands of dollars, I started to worry. That scandal involved *QST* ads and happened several years ago. The chap now has a new location and a new call.

If NARA is legitimate, I'll be one of the first to want to try to help with what they are doing, but the secrecy, the emergence of one of the most rotten apples of hamdom with a deep involvement . . . I must ask for caution and suggest that we hear more before spending money with NARA.

THE MELTING POT

An idea has been percolating up through the withered remains of my grey matter. I'll try to put it into receivable shape.

It started a few weeks ago while I was in Europe. I was talking with a Frenchman and he was expressing some concern that microcomputers might bring damage to French culture. Hmmm. I mulled that one over, looking for a handle on it.

After a bit of mental gymnastics, I had the pieces in place. This chap was expressing concern, in his way, over the ubiquitous BASIC language, built into the ROM memory of microcomputers . . . in English. Sure, we can write the print statements in French . . . or German, etc., but the French *have* to come to grips with English if they are going to write any BASIC programs.

The French are not neutral about languages . . . nor about much else, for that matter. There really is only one language of significance for them and there

Continued on page 154

Looking West

Bill Pasternak WA6ITF
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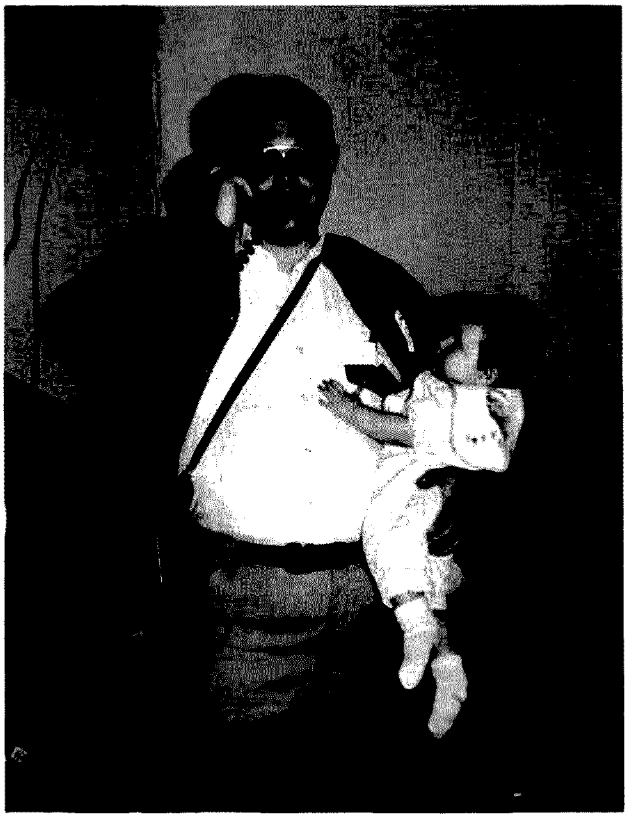
SELF-IMPOSED EXILE DEPARTMENT

Recently, after a long telephone discussion with Wayne, I took a break from most two-meter FM operation in Los Angeles. Why? There were a number of reasons, but the most important one was that I wanted to be sure that I was keeping objectivity in my reporting. It's no secret that when a person is emotionally involved in a given situation, he or she can gain a distorted view. For a writer/reporter this can be disastrous, and for this reason I packed away all equipment capable of hearing two-meter FM operation in the Los Angeles metro area. I spent a lot of time SWLing the outlying areas of this community and listening to FM operation in those areas. I did this both from my home and from the facilities of a mountaintop remote-base system.

During this same period, I did quite a bit of traveling to other cities. I had a chance to listen to the two-meter band in cities far removed from Los Angeles to see if they fare any better than we do. I also started to SWL the high-frequency bands—again, to gain some insight into the problem of malicious interference. The results of this combination of self-imposed exile and ongoing research surprised me.

First, and most important, I have learned that the problem of malicious interference is not limited to any one band or geographic area. Listening on the low bands was a real eye-opener. Forgetting the ongoing WESTCARS situation, which is a problem unto itself, I heard all sorts of regulatory violations. DXpeditions operating outside the US phone bands were being called on their frequency by stateside amateurs—or just being "commented on top of"—and stateside hams were getting a reply from other stateside amateurs . . . or getting "chewed out" by same.



Noel McKeown WB8QQC, General Chairman, had his hands full with more than the Hamvention.

Then there are those who feel they own a given frequency, and pity the poor soul who, by choice or chance, winds up on that special spot. As the CBers would say, "The hammer comes down." (The CB crowd also has a name for an operator who thinks he owns a frequency; such individuals are "channel hogs.")

Shall I go on? If there is any comfort in all this, maybe it's in knowing now that repeaters are not the only ones suffering. Some comfort!

For those of you who think that Los Angeles is the repeater jamming capital of the nation, I can tell you that we are not alone. In my travels, I have spoken with many amateurs and have learned that the problems of LA are the problems of other cities as well. Every area seems to have its share of kooks, and in general their act is the same.

Most of those I spoke with seem to agree on one point. The only way to beat a jammer is to beat him at his own game. If you look at a jammer as being someone demanding attention and recognition as a way of fulfilling ego needs, then denying the jammer such attention can be a formidable weapon. Ignore him!

Recently, the ARRL formed an Ad Hoc Committee on Malicious Interference. This was brought about at the urging of Los Angeles attorney Joseph Merdler N6AHU and ARRL Southwestern Division director Jay Holladay W6EJJ. Both men are vitally concerned with the future of the amateur service, and the committee actually was formed through a motion placed before the board of directors by Jay. How effective this committee will be remains to be seen. It's interesting to note that even though Joe is considered this nation's leading authority on both the causes of this problem and the methods to obtain help in combating it, he has yet to be asked to take official part in the committee's operation, even as an advisor. The ways of Newington are strange at times. Nonetheless, that committee is looking for input on the problem, so there is a definite avenue through which you can vent your frustrations.

If you do write, and I strongly advise that you do, be sure to include suggestions as to how you feel this problem can be combated effectively. Complaining about the problem is fine, but that privilege brings with it a responsibility to offer constructive advice as well. Also, if you do write, send a copy of your letter to Joe at PO Box 842, Northridge CA 91328; I know he will be interested in your views.

FLIGHT 72 DEPARTMENT: IS GETTING THERE REALLY HALF THE FUN?

A few months ago I told you about a "magic" nostalgia-filled trip via AMTRAK to Las Vegas; now I am going to describe an airborne nightmare.

I really enjoy traveling by air . . . usually. Once in a while, though, things happen that can really set you to wondering. The very early hours of Saturday, May 24th, brought me one of those experiences that one wants to go through only once.

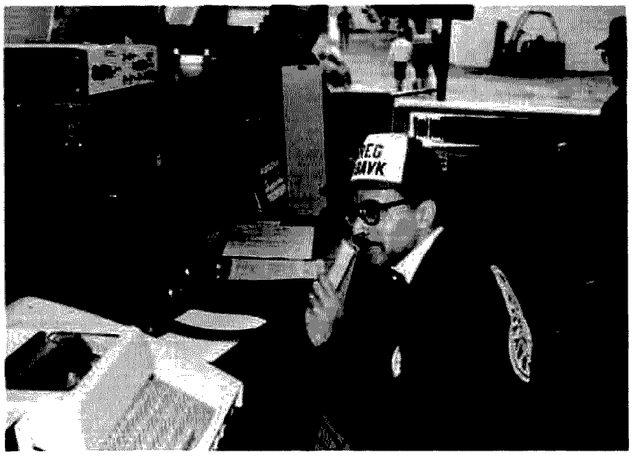
The Amateur Radio Computer Hobbyist Convention was being held in St. Louis, Missouri. Both Joe N6AHU and I were scheduled to speak, so we decided to travel together. Also in our entourage was Bill Orenstein KH6IAF, Westlink's Production Coordinator. We were to depart from Los Angeles International Airport (LAX) at 12:45 am on TWA Flight 72 nonstop, a 3½-hour trip.

We arrived at LAX well before flight time, checked in, and decided to grab a midnight bite at the coffee shop since we had about 1½ hours to kill. Little did we know how smart a move this was. Thirty minutes before the flight, we arrived at the gate figuring that the plane would be ready for boarding. No way. As it turned out, it was well after 1:00 am before we were airborne.

The aircraft was a Lockheed L-1011, usually one of the most luxurious planes in the sky. Not this one. In fact, after a while we began to feel as if we were part of an episode of the old TV program "Twilight Zone." For instance, while our overhead reading lights and air conditioner outlets worked fine on the ground, at altitude they stopped altogether, except for Joe's light, which kept blinking on and off at unscheduled intervals regardless of the position of the on-off switch.

Then there was the food.

The Spectrum Communications booth had to be cleared of a complimenting crowd before this shot could be taken.


DARA (Dayton Amateur Radio Association) thought of everything, including this specially-equipped mobile talk-in van.

What a gourmet treat! About 30 minutes after takeoff, the attendants distributed to each passenger a small cellophane wrapped box which contained two small breadsticks, two crackers, one small bag of pretzels, one granola bar, a small plastic container of cheese spread, a cheese-spreading utility tool (wood), one napkin, and airline promotional material.

That was it! Except for some beverages, that was the extent of the food service. None of the cute little miniature sandwiches such as were served on a United night coach flight four weeks earlier when we went to the Dayton Hamvention. No . . . just a goodies box that I could have filled from an airport vending machine. Now you understand why we were lucky to have grabbed a bite before getting on the plane. For those of you who find the foregoing hard to believe, Bill KH6IAF still has his box unopened. He's saving it as a souvenir!

Along about sunrise, the Captain got on the intercom to tell us that St. Louis was fogged in and that we would be sitting at 33,000 feet for a while in hope that the fog would clear. About 45 minutes later, he made an announcement that we would be going to Kansas City to await the reopening of the St. Louis airport. By this time, Bill and I were kind of hungry, and we figured any place with food would be welcome. So, 30 minutes later we landed in Kansas City, only to learn that while we could deplane, we could not leave the gate area. Why? No security people to recheck us through those crazy machines. Now, I grant you that in this day and age airline security is important, but this was just totally absurd! What were they afraid of? That I might smuggle a prune Danish on board?

We were on the ground in Kansas City about an hour and 45 minutes. Finally, it was announced that we would depart for St. Louis, and a few minutes later, I think we did. I say "think" because by this time I was so tired that I was out like a light as soon as I hit the seat. I remember neither the takeoff nor the landing. My plan had been to get to the hotel by 7:00 or 7:30 am and sleep till noon, but it was noon by the time we got our bags and reached the Sheraton.

Oh, yes, getting our bags . . . that was a trip in itself. The St. Louis airport has a unique baggage handling and claim system. Instead of each carrier having its own claim area, St. Louis uses a central baggage claim area, which is currently under reconstruction. Over a highly distorted public address system, they announce which baggage will be on which carousel, and, if you are lucky, you will get the message the third or fourth time it's announced. In our case, since our flight was a few hours late (as were many others), there was a short delay in obtaining our bags. They announced it would be 10 minutes. Then another 10 minutes, then another 10 minutes, and so on. About an hour later, our luggage followed us off the aircraft and met us in this baggage-pickup parlor. In all, a flight that was supposed to be 3½ hours was twice that. Creature comfort was nil and I will be writing TWA a strong letter about this one.

In closing this segment, just a note about the ARCH Convention: It was sensational.

DAYTON IN PICTURES DEPARTMENT

Last month, I told you about the personal side of my trip to Dayton's annual Hamvention and promised you a picture story this month.

Two of the nicest people I have ever met are Noel and Marilyn McKeown. They are two "together" people, and both devoted quite a bit of time to the Hamvention. Noel served as the General Chairman, and Marilyn was involved in a myriad of things. It was also a first for their 8-month-old daughter—her first Hamvention. As you can see from the photo, already she is very much involved.

The photo of the Spectrum Communications booth was not an easy shot to get. Spectrum's high-quality line of amateur and commercial repeaters drew large crowds, and I actually had to ask those in front to step away for a moment so that I could photograph it.

Our final photo was taken inside the DARA communications "mobile home." This is an installation you must see to believe. It's capable of operation on virtually any band in any mode, and can go just about anyplace it's needed. That's Greg WB8AVK doing his stint on the "hamvention talk-in station." If you get to the Hamvention next year, look for a silver mobile home with the DARA emblem on its side. It will be parked alongside the building adjoining the flea-market area.

Hamvention '80 was a true "blast." If you were among the 26,000 people who attended, then you know this firsthand. If you weren't, then I can suggest only that you try to get to Hamvention '81. If '80 was any indication of what is to come, then you are in for a treat.

DX

James D. Cain K1TN
306 Vernon Avenue
Vernon CT 06066

LISTS

No, not the kind where you sit on a frequency for days waiting your turn to call a station you don't even know you are waiting for. Who could get along these days without lists: groceries, resolutions, errands. Mr. Nixon had his Enemies List and the ARRL has its Entities List. Like it or not, other DXing awards notwithstanding, our DX corner of the hobby revolves around the ARRL DXCC Countries List, CD-216 in Leaguese. Let's look at it.

DXCC is a club, the DX Century Club. One hundred countries and you're in. No blackballing, no dues, no rituals—just a hundred QSL cards from different places listed on CD-216 and the DXing game begins in earnest. The second hundred are normally easier than the first, while the third hundred becomes real sport. After three hundred, the air gets pretty thin. DXCC has been sponsored by the ARRL since the 1930s. It was "started over" following WW II, on November 15, 1945, to be exact. In the succeeding three decades, DXCC has convoluted almost to the point of seeming alive at times.

But you know all this. There *are* other awards to be had while chasing DX, some sponsored by Americans and many more by other countries. Just like DXing itself, the awards are all political in nature and thus controversial. *73 Magazine* sponsors the "DX Country Club Award" for working 73 (or more) countries from *its* list during any calendar year. The *73* list has all the DXCC entities plus additional things like the African "homelands" and many spots which have been deleted from the DXCC list.

CQ Magazine has its "CQ DX Award," which is nearly identical to DXCC except they count *current* entities only. And not too long ago, *Worldradio* newspaper initiated a "Worked 100 Nations Award," which is summed up by their first rule: "W-100N virtually eliminates the need to work geographic areas heard only during DXpeditions. Almost all national entities have amateur stations consistently active on the air." Wishful thinking there, but they *have* knocked off the uninhabited rocks and reefs.

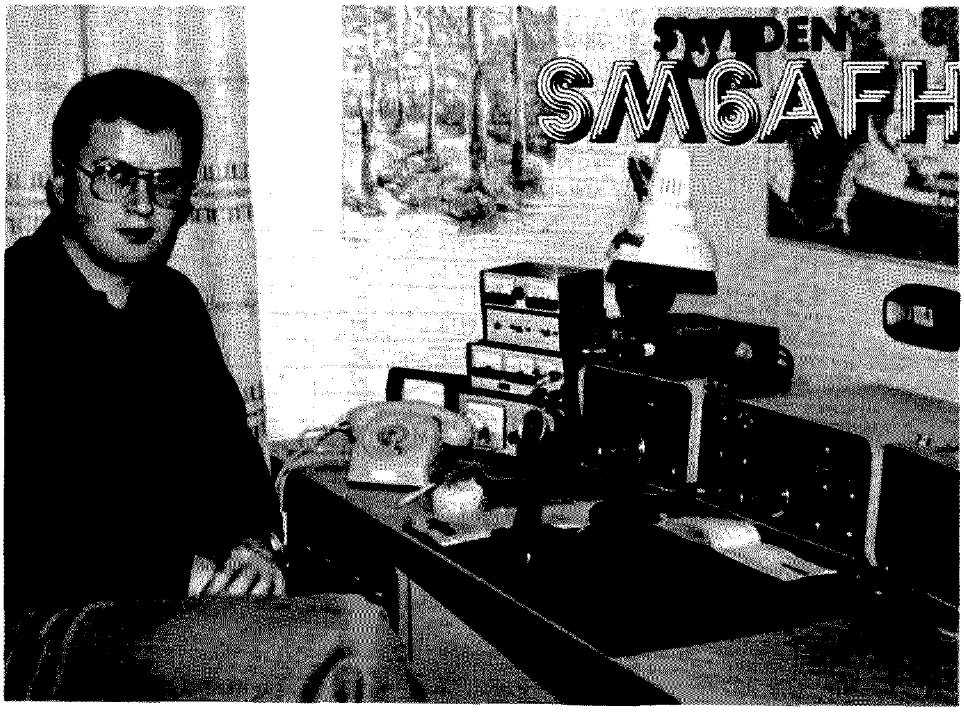
So by confirming a hundred countries or entities or rocks and reefs or buildings, you can probably use the hundred QSLs to qualify for not one, but actually four, handsome pieces of wallpaper. And if you're multimode, you should be able to paper an entire small room. DXCC isn't the only game in town, you see.

But DXCC *is* the main attraction. It has run a long time and generally has been administered with care and consistency. In the vernacular, we would call the other awards "spin-offs" of DXCC, tailored to meet other needs and wants of DXers. Now, if DXCC hasn't been sufficient for some, will it be able to adapt to the 1980s? (See this column last month.) The Volkswagen Beetle was marketable for forty years as updating matched safety regulations, advancements in automotive art, and changing consumer tastes, but finally the end came. Will DXCC change with the times, will it be replaced by something all new from ARRL, or will one of the spin-offs overtake DXCC? Let's consider some of the angles, keeping in mind that DXing would probably be very different from what we know it had DXCC never existed.

DXCC is an "operating achievement award," created in the 1930s to satisfy amateurs' competitive urge to excel. The challenge is different for all of us, with working the first hundred using two Watts tantamount to working them all with high power. For many, the real challenge comes above 300 countries, when the ones needed can be counted on the fingers and where patience and staying power count most. Between, say, 200 and 300, operating skill and staying informed make the difference. For some, the DXCC Honor Roll does not and will not hold the magnetism it has held for those of us who have spent decades approaching it. You must be able to do more than get on lists or check into "nets" to make the Honor Roll; expeditions as recently as the past month proved that and will continue to do so. Thus, those who do not develop operating prowess can forget the Honor Roll, but they probably do not have the necessary achievement orientation to make it anyway.

Until just a few years ago, if a US amateur moved over 175 miles, he was forced to start his DXCCing over from zero (unless he remained in the same call area). It was the mid-1970s before the ARRL recognized that people move and that working DXCC entities is more dependent on the operator and the availability of stations at the other end then on the operator's being in Iowa instead of Pennsylvania. "Rule 9" was then changed to state that contacts must be made from the same DXCC country.

Another problem which haunts serious DXers is the spectre of operating a DXpedition from an extremely rare entity when one does not have credit for that entity himself. In the past, it was not unusual to have a friend operate one's station in these cases; now that friend can (and often does) just sign the expeditioner's call from the friend's station to "put him in the log." Naturally, a moral question arises here which could be handled by merely rewriting DXCC rules to state that an expeditioner will receive DXCC credit for the rare entity from which he operates. Sound crazy? Well, the DX Advisory Committee of the ARRL thought so last year, when they voted down the proposition. But DXCC is just a game in which the greatest award is a plaque for "Number One of the Honor Roll," and for most of us it is



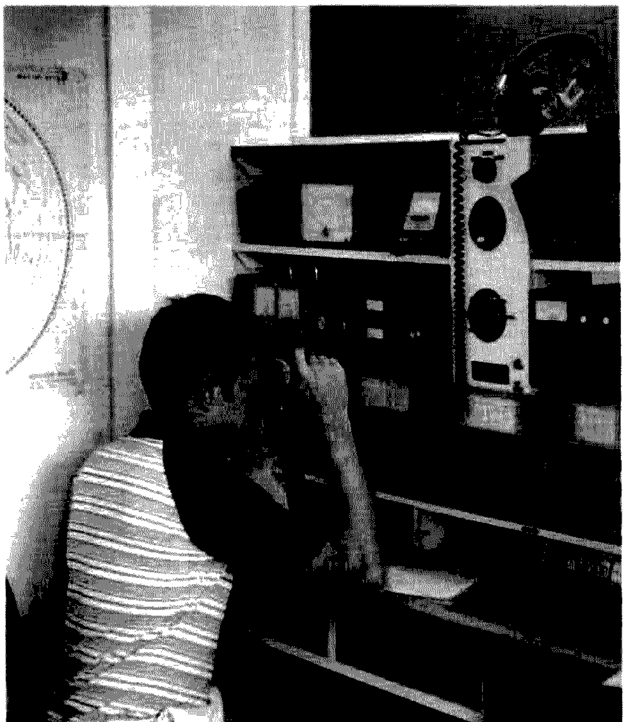
Tom Schell SM6AFH has a QSL worth swapping for. He's an active DXer with DXCC, WAS, and WAZ.

simply self-satisfaction and peer recognition. If we worked a new one to elevate us to the Honor Roll and were asked if the operator who risked life and limb to put it on the air should get credit himself, we'd reply "yes" in an instant. The Honor Roll could thereby come to represent not only achievement in sitting at home, ear glued to speaker, waiting for new ones, but also for being on the other end helping the stay-at-homes. It would turn out to be, for some, a recognition of both facets of DXing. Or don't you like apple pie, either?

Possibly the greatest mistake ever made in DXCC was recognizing phone as a distinct mode to be credited and awarded separately. For years and years, the two awards available were Mixed and Phone, because it was initially more difficult to work DX on phone due to lack of stations, weaker signals, etc. Offering a phone award may have encouraged operation on that mode for the first year or two, but it did little else. Then when things came full circle, as they tend to do, many forgot CW and working DX became easier on phone than on code, so the League bent under the pressure from the die-hards and instituted, in 1976, a CW DXCC. But it does not even require two-way! All you have to do is find the station you want, work him on phone, then send your callsign to him on CW; he comes back on phone to tell you you are "five nine nine," and, presto! another CW DXCC credit. The irony of this system is that the DX station does not even have to be able to copy the code.

There's more. The past few years have finally seen DXCC awarded for RTTY, 160 meters, and OSCAR, but there are no endorsements at levels after 100 countries (entities). SSTV and FM (possible on 10 meters) have not made the grade yet. With the DXCC operation at Headquarters always behind these days, why not simplify things by issuing endorsements only in the Mixed category, and just the basic club membership of 100 on all other modes? That wouldn't be as far-fetched as the League's trial balloon a year ago of starting the *entire* DXCC program over at zero for everyone. Oh, sure, those on the Phone and CW Honor Rolls would find the first solution repugnant (not to mention the second!), but they could be accommodated by having an all-time, final Honor Roll for the first-wave DXCC. A similar situation has come up in the contest program, where wholesale changes in contest times and point structures have altered scores to the point where comparison to past records is meaningless. In the case of a contest like the November Sweepstakes, which is as old as DXCC, the argument about "tradition" seems to have not held much weight at Headquarters.

A note: The latest blow to DXCC tradition came recently. Know those little cellophane stickers you endorse your DXCC certificate with (110, 120, 130)? Well, they're being phased out. We got stickers 260 through 290 the other day, and one was an oddball, opaque white instead of see-through cellophane. A guess would be that since the cellophane stickers were notorious for not adhering to the DXCC lapel pin, the decision was made to switch to a stronger glue sticker for both pin and certificate, rather than provide two different kinds of stickers (an added cost). But when you take your DXCC certificate (the certificate you've been adding to for years and years) out of the frame to add the latest endorsements and put that oddball sticker on, it's enough to make you cry. Start over with a brand-new certificate and all new matching stickers? And throw away the original from the 50s or 60s? Not a chance!



Larry Smith N1AAX along with Chris Emery K1RIF/VP2MFI operated VP2MFJ in April from the shack of VP2MF on the island of Montserrat. They made almost 2,000 contacts in about 32 hours. Photo by K1RIF.

ON THE BANDS

August. Is it the pits of HF DXing? Well, July and September have some support as being the best time to take the antennas down for refurbishing, too. All three months are nothing to compare to autumn and spring conditions. At least when it's August, October, probably the best overall HF month of the year, is only weeks away. August is a good time to clean up those states you need for five-band WAS on 10-meter sporadic-E and for weeding your garden. The All Asia CW Contest and the Worked All Europe Contest are August attractions and can be very interesting summertime activities; they can also witness horrible propagation. It's chancy.

May expeditions were plentiful in 1980, although the rarity was not up to the April show of TZ4AQS, Mali, K6LPL/Johnston, and Glorioso by FR0ACB and FR0ACC/G. Frank Turek, who operated ZA2RPS in 1971, operated in May from Madeira as DL7FT/CT3, using an Atlas 210X and TH3 Jr. beam. Frank spent much of his time on the air quashing rumors that he is going to Albania again soon. There is some hope along those lines, but not much.

A Dutch club, the Noviomagun DX Group, vacationed in Luxembourg in mid-May, eight of them signing "portable LX." QSL all of them to PA0KHS, Smaragdstratt 53, 6534WN Nijmegan, the Netherlands.

W5HF and K5GOE operated at the British Virgin Islands as VP2VEZ and VP2VEN respectively, both trying to complete DXCC with their VP2 callsigns.

Charles Jackson SV0AA put Crete on early in May, but his next stop at Rhodes (Dodecanese) was cancelled. His all-CW SV0AA/5 operating included regularly-scheduled forays into the US novice bands. QSL Box 722R, APO NY 09223.

Jerry Harley WA2TTI operated from Greenland the second week of May and was back again in June. His radio time is sandwiched between Air Force duties.

4Z4TT and another unidentified operator came on from the Tokelau Islands on May 10, operating ZM7AA for over a week but in a sporadic manner. Many Europeans went empty-handed in trying to work this one. There was no advance warning of the operation, either. Many *were* worked, however, and QSLs go to PO Box 22-572 for SSB and PO Box 22-800 for CW contacts.

During May, Eric Sjolund SM0AGD operated first from Swaziland as SM0AGD/3D6, followed by Botswana as A22GD, and then Rwanda as 9X5LE (an established station there). Most-

Continued on page 152

RTTY Loop

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Last month I began to examine commercial RTTY equipment, using first-hand information. Unfortunately, the particular piece of gear I was examining for this month's column developed a "fatal" malfunction. Rather than write about its failure, I have elected to return it to the manufacturer and delay a full review until later. It is my current impression that the particular review unit I received had been through the mill and that its faults were not representative of the line.

So, let's catch up on some reader input. Along the lines of receiving equipment, many of you are asking questions about the various "computerized" RTTY schemes. Tom Altman WA5JVH of Midland, Texas, writes, "Do you have any information on the Macrotronics M800 and M80 RTTY/CW interface?" Tom owns a Kenwood TS-180S and a Level II TRS-80 and would like to merge these two on RTTY. In a similar vein, Jerry Brantley N5ADJ of Crossett, Arkansas, has been bitten by the RTTY bug and has an Apple II in the shack along with his ham gear. Jerry outlined his choices as "1. Macrotronics—cheapest way; a. needs outside TU to work well; b. RFI? 2. Robot Model 800—a. new product, how reliable? b. How good is the built-in TU? 3. HAL—costs most."

Now, these are not easy questions to answer. My information indicates that the Macrotronics units themselves, for example, are not overly rf sensitive. However, the TRS-80, Apple II, or almost any other popular microcomputer may cause problems if operated in a typical amateur radio station. Call it a mixed marriage, if you will, between rf and digital electronics. The computers generate a good deal of hash, which may interfere with a broad band of frequencies on a receiver close by. The "bus-oriented" systems, especially S-100 ones, are notorious for putting out all kinds of radiation from signals traveling down the bus paths. My SWTPC 6800, for example, puts out birdies and whistles, which represent not only the system clock, but other assorted bus signals doing their own thing. Now, properly timed, this is great for playing the William Tell Overture on a nearby AM radio, but it can wreak havoc on RTTY signals. This problem is minimized both by shielding and through the use of a non-bus-oriented system, such as the TRS-80. Further, most computers do not respond nicely to rf floating around the shack and will either halt, crash, or make all kinds of messy errors. Nevertheless, operation of most systems is possible if you keep rf in the shack to a minimum and shield the computer to keep signals where they belong.

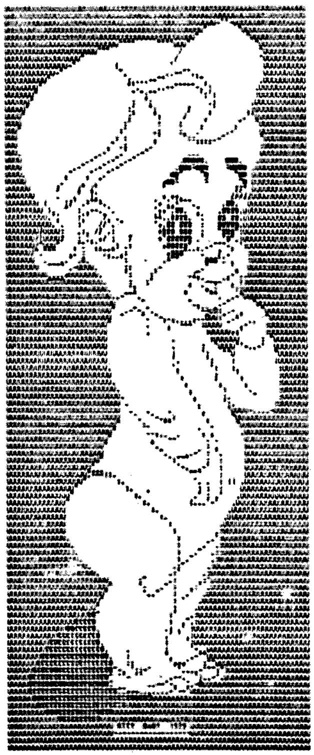
You don't have to go the commercial route, however, to put a microcomputer on RTTY. Programs have been published, here and in (shudder) other journals, which put most CPUs on RTTY. Although many of them require some minimal hardware for interfacing, the expense is certainly nominal, and this may well be the most cost-effective way for the ham with a computer to get on RTTY.

Now, many of these problems are solved through use of integrated units such as the HAL or Microlog series of RTTY terminals. Yes, they are expensive, but no more than the price of a computer, terminal, and interfacing. And, they do what they are designed to do very well. From information available to me, mostly on manufacturers' data sheets, any of the available "video RTTY" units should provide adequate service to the average ham. The various systems provide a variety of options and features which make operation on RTTY as it never was before! If you don't own, or are not contemplating owning, a microcomputer and you desire to enjoy silent RTTY, one of these is sure to satisfy you.

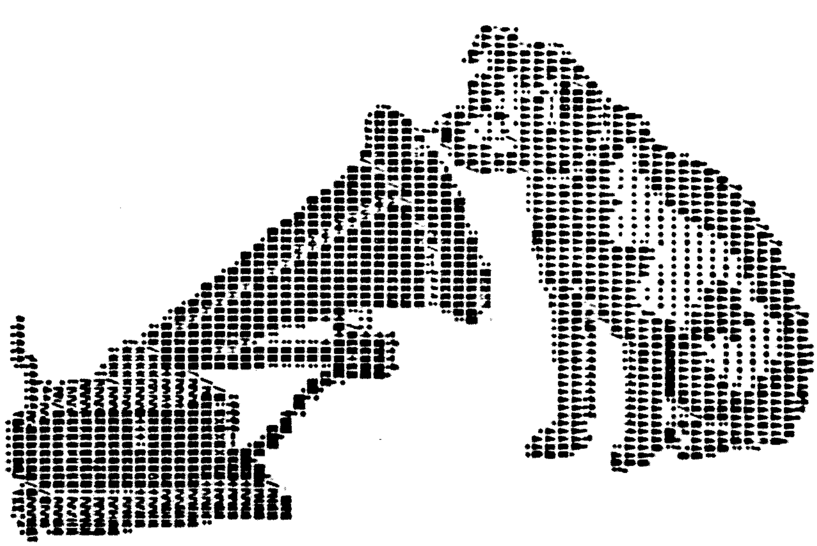
I am going to have to plead ignorance about the Robot system mentioned. I have no literature on it, nor can I recall any reviews. If any reader has experience with the Robot 800, he or she is invited to drop a line for future inclusion in this column.

Continuing along the lines of receiving, here is a tip passed along by Larry Clouse N0AAU of Gladstone, Missouri. One of Larry's requests is the passing along of useful modifications to commercial equipment that make our lives easier. Larry has the Flesher TR-128 speed converter and noted that the buffer will overflow if the speed control is turned down, so that data is coming in faster than it goes out. He suggests adding a diode from Terminal Board H going to pin 8 of IC1, a J-K flip-flop. He relates that, for example, when the buffer fills while transmitting at, say, 30 words per minute, this modification will open the speed control up to 60 until the buffer is almost empty. Then the flip will flop, and speed should resume at the previously set speed. Sounds interesting!

It seems like I end up mentioning this about once a year, but to respond to Robert Kerr KA3AAK, Rick Liftig WA1ISD, and the others who have written or called, *RTTY Journal* is, as far as I know, alive and being published regularly. Their address is: *RTTY Journal*, PO Box RY, Cardiff-by-the-Sea CA 92007. I know it seems like overkill, but when you write them, tell

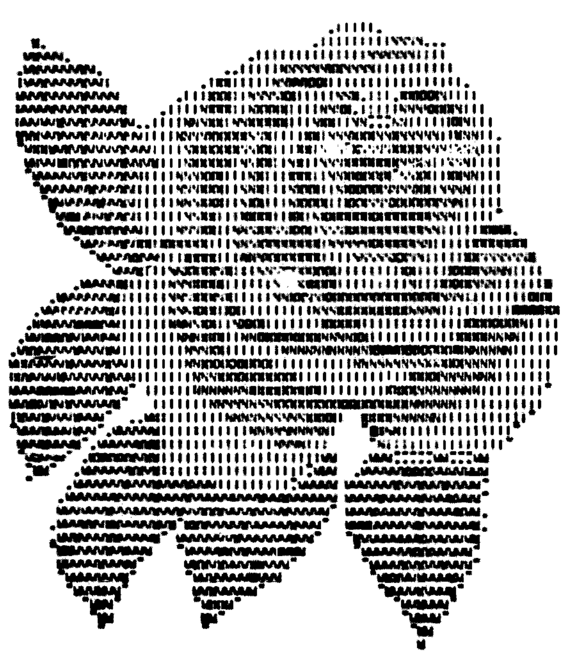


First place—WB6SHU's "RTTY Baby 1979."



Second place—AD4M's "His Master's Voice."

Third place—G3MEJ's "Old Gummy."



Honorable Mention—WB4VEU's "The Rose."

them you read about them here, in *73 Magazine*'s RTTY Loop. OK?

I always like to see new technology reach the air, and we are pleased to announce the arrival of the Maryland Mobileers Amateur Radio Club repeater, on 146.205/146.805 MHz, which runs AFSK in the Baltimore area. The data format is 170-Hz shift, 2125-Hz mark, and 45.45 baud Baudot. ASCII operation in the near future is anticipated.

Gonna close this month with a topic that I have not covered too much, but which interests most RTTY-philes: RTTY art. The Southern Counties Amateur Teleprinter Society (SCATS), of California vintage, completed judging for their 1979 Worldwide RTTY Art Contest. Ed Nally WB6HSU of Van Nuys, California, received first place in the contest for his entry, "RTTY Baby 1979." Second place went to Wendell Merk AD4M of Hollywood, Florida, who designed "His Master's Voice" after the old RCA logo. Paul Tew G3MEJ of Morden, Surrey, England, took third place for "Old Gummy." The fair sex took honorable mention as Sandi Clark WB4VEU of Hurt, Virginia, displayed "The Rose." These winning entries are reproduced here, although much reduced, and all look like winners to me.

Why not try your hand at entering the 1980 contest and win a large wood and brass plaque as WB6HSU did this year? Entries will be accepted after September 1, 1980, and SCATS will be publishing the rules in most ham publications. Who knows, maybe your picture will be printed here in RTTY Loop as one of next year's winners!

One final thought while we are on the subject of RTTY art. The situation reported in this column over the last several months involving Teleprinter Art, Ltd., is still quite active. I urge any hams who have had dealings with the firm in the last few years to forward a note to me, with details of your good or bad experience, at the above address. If you desire a reply, a self-addressed, stamped envelope is always appreciated.

Next month, a review of a book that guides you to new frequencies, more from the readership, and a lot more—in RTTY Loop.

Ham Help

I need a cathode ray tube for a Tektronix Model 549 memory scope. The tube is V859, Tektronix part number 154-0498-00 (description: T5490-202, CRT, standard phosphor). Scope is for hobby use—CRT need not be perfect but must be usable. Price must be very reasonable. Or does anyone know where I can get my old CRT repaired—filament open?

Curt Powell WB4WAA
Box 130, Powell Road
Rocky Mount NC 27801
(919)-446-3489

I need a schematic diagram and/or instruction manual for an RCA model 195(A) Voltohmyst VTVM. I will pay postage costs and/or copying costs or will borrow and return manual after copying myself. Thanks.

Stephen Olster K2MN
RD 1, Box 392B
W. Hurley NY 12491

I need information (operator's or repair manual) on a 2-to-5000-MHz dummy load, type AN/URM-58. The unit is listed as Federal Stock Number 6625-519-5488 and was manufactured by WacLine, Inc., Dayton OH, manufacturer's part number 22650. Adapters marked UG-1166/U and UG-1167/U are included. I would appreciate any help.

CPT Paul W. Morich, CAP
c/o Headquarters
New Jersey Wing
Civil Air Patrol
PO Box 16099
McGuire AFB NJ 08641

I am in need of full schematics for an FM two-way radio that was manufactured by DuMont Corporation. The only identifying name on the radio is "DUMONT FAIRCHILD TRANSICOM." Apparently there was a separate power supply which I do not have. Any help will be greatly appreciated.

Thomas A. Chambers
407 S. Williams St.
Denver CO 80209

I need a service manual or schematic for the Panasonic NV-3085 portable video tape recorder.

John S. Lee KA4EPR
17401 NW 20 Ave.
Miami FL 33055

I need a manual for a Hammarlund HQ-100 general coverage receiver. I will pay for an original or a copy.

Marvin Rosen KA3EUY
20 W. Madison St.
Baltimore MD 21201

LETTERS

HL9

Just thought I'd keep you up to date on the situation here in Korea. Since your visit to the Republic, there have been many changes in the HL9 environment. We now have an active radio club and club station (HL9TX).

Our club station is located on top of a small mountain inside the Yongsan military compound. The station is the fruit of much effort and is the only HL9 club station in the Republic of Korea. Inside the shack is a Collins KWM-2 which was rebuilt from scratch. The antenna is a Japanese C-218 tribander for 10, 15, and 40 meters. The antenna is located on the highest point on Yongsan, a water tank.

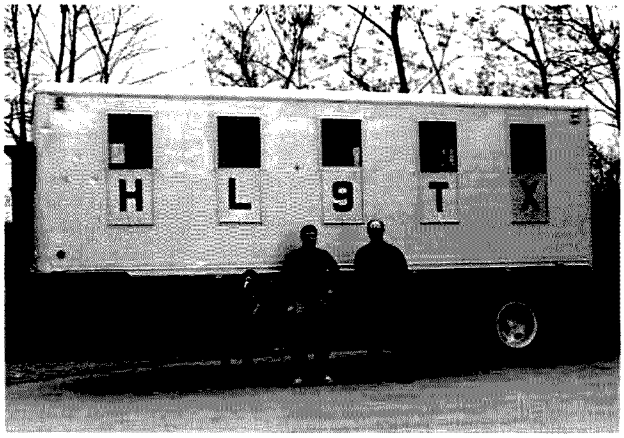
It is hoped that HL9TX will provide a new country for many stateside stations. I am pushing operations on 40 meters especially from this super location.

At this time, our proposed operating regulation is being studied by the Eighth Army staff. We are all anxiously waiting to see if it will be approved by the Korean government. If it is, it will allow licensing of Novice and Technician class stations for the first time in Korea. I have proposed several other changes which will prove very advantageous to the HL9 ham.

I will try to keep you informed as things come up. I hope you will disseminate as much information about HL9s as possible to the ham fraternity.

Thomas (Tom) L. Nickle HL9TN
APO San Francisco CA

You bet, Tom. You can also bet that the group of hams who will be with me in October on our tour of Asia will be looking forward to meeting you and the other HL/HM amateurs.—Wayne.



On the left is Thomas L. Nickle HL9TN, President of the American Amateur Radio Club of Korea; to the right is Gary M. Keller WB0ZEE.

LITTLE LIGHT?

Well, you really got carried away in the May issue of *73*. I subscribe to all of your periodicals, so I guess there'll be some repetition in *Kilobaud Microcomputing* and *80 Microcomputing*.

I generally agree with your opinions regarding the ARRL and the FCC. I would like to see a little less innuendo and a lot more fairly detailed facts printed regarding both. Your brush is usually much too broad to be really credible. Neither of those organizations is 100% bad.

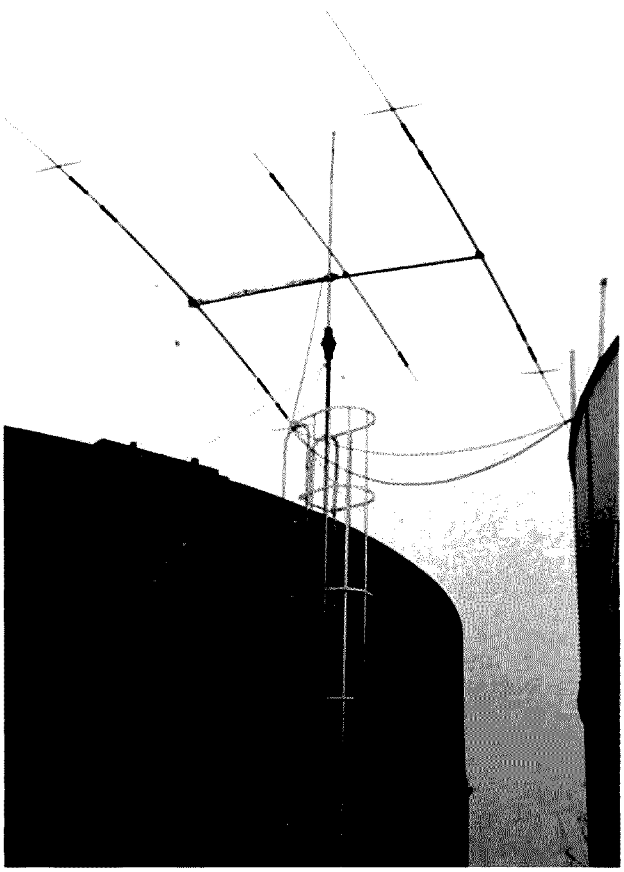
Now for the important stuff. The US did not "conquer" any countries in WWII other than Japan and part of Germany; true, we did not set up any long-range controls there, but we really have little problem with the Federal Republic and our problems with Japan in regard to trade practices are of our own making. We could effectively counter Japan's predatory trade practices without imposing import tariffs or anything like that. We only have to set up some bureaucratic regulations on imports from Japan and assign the development and administration of them to any one of a number of existing, well-qualified agencies, e.g., HEW, OSHA, HUD, etc. Japanese imports would slow up in a hurry, if not entirely dry up. Then maybe the Japanese would try regarding trade as a two-way street for a change.

Vietnam. Sure the military only fought there, and, as in Korea, fought under political constraints which made success impossible. We had absolutely no business in either place, but the blame has to be put on Roosevelt first for Korea and on the Irish kid for dabbling in Vietnam with his personal toy, the Special Forces. Not to forget, of course, the father of "The Great Society" who put a half million troops in Vietnam along with the "no win" policy.

Yep! I'm in favor of a viable CIA, too. But how can we have such a thing when classified information no longer exists for all intents and purposes? How would you like to risk your life in a "secret" operation knowing that a whole passel of congressmen are privy to that operation? You might as well have an oversight committee composed of AP, UPI, and all the major networks.

We're in pretty good shape other than Central and South America, Africa, and Asia? You're not sure about France? I am. In the case of France, charity begins and ends at home, particularly after they get all wrapped around the axle again and cry out for us to rescue them once more. Not that sure about Mexico and Canada either? Canada just turned rather decisively back toward

Continued on page 159



The C-218 antenna system for 10, 15, and 40 meters.

Contests

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

K0BM/9 KI

The Saint Charles Amateur Radio Club of St. Charles, Missouri, will be operating, for the 2nd time, a multi-rig station on historic Kaskaskia Island in the upcoming 18th Annual Illinois QSO Party. The dates will be from 1800Z August 2 to 2300Z August 3, 1980. The island dates back to the early 17th century when Joliet, the French explorer, and Father Marquette founded the church on the island. Kaskaskia Island houses the famed "Liberty Bell of the West." This is the only inhabited portion of Illinois that is on the Missouri side of the Mississippi River. The callsign will be K0BM/9 KI. A handsome 8 × 10 certificate will be available for all worked stations. Please send a 9 × 12 SASE for the certificate. Operating frequencies will be up 60 kHz on CW and up 25 kHz on the Novice bands. On SSB, the club plans to operate on 3975, 7275, 14275, 21375, and 28675. QSL to Mike McCrann WD0GSY, 25 Elm St., St. Peters, Missouri 63376; (314)-278-2578.

EUROPEAN DX CONTEST—CW
Starts: 0000 GMT
Saturday, August 9
Ends: 2400 GMT
Sunday, August 10

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operation out of the 48-hour period are permitted for single-operator stations. The 12 hours of non-operation may be taken at once or in not more than three periods at any time during the contest. Operating classes include: single-operator, all band and multi-operator, single transmitter. Multi-operator, single-transmitter stations are only allowed to change bands one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 MHz

through 28 MHz. A contest QSO can only be established between a non-European and a European station. Each station can be worked only once per band.

EXCHANGE:

Exchange the usual six-digit serial number consisting of RST and progressive QSO numbers starting with 001.

SCORING:

Each QSO counts 1 point. Each confirmed QTC (given or received) counts 1 point. The multiplier for non-European stations is determined by the number of European countries worked on each band. Europeans will use the last ARRL countries list. In addition, each call area in the following countries will be considered a multiplier: JA, PY, VE, VO, VK, W/K, ZL, UA90. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. The final score is the total QSO points plus QTC points multiplied by the sum total multipliers from all bands.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to a European station. It can only be sent from a non-European station to a European station. The general idea is that after a number of European stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported, i.e., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. Only a maximum of 10 QTCs to a station is permitted. You may work the same station several times to complete this quota, but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported. Europeans may keep the list of the received QTCs on a separate sheet if they clearly indicate the station who sent the QTCs.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the Contest Committee are final. It is suggested that the log sheets of the DARC or equivalent be used. Send a large SASE to get the wanted number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than September 15th. North American residents may send their ap-

Calendar

Aug 1-7	**SWOT QSO Party**
Aug 2-3	**ARRL UHF Contest**
Aug 2-3	**Illinois QSO Party**
Aug 9-10	**European DX Contest—CW**
Aug 16-18	**New Jersey QSO Party**
Aug 16-18	**Rhode Island QSO Party**
Aug 23-24	**All Asian DX Contest—CW**
Aug 31	**Worked All Britain Contest—VHF**
Sep 13-14	**European DX Contest—Phone**
Sep 13-14	**ARRL VHF Contest**
Sep 13-14	**Pennsylvania QSO Party**
Sep 13-14	**CAN-AM Contest—Phone**
Sep 13-15	**Washington State QSO Party**
Sep 14	**North American Sprint**
Sep 27	**DARC Corona 10-Meter RTTY Contest**
Sep 27-28	**Delta QSO Party**
Sep 27-28	**CAN-AM Contest—CW**
Sep 27-28	**EX-KZ5 Reunion**
Oct 4-5	**California QSO Party**
Oct 4-5	**ARRL Simulated Emergency Test**
Oct 11-12	**ARRL CD Party**
Nov 1-2	**ARRL Sweepstakes—CW**
Nov 8-9	**European DX Contest—RTTY**
Nov 8-9	**IPA Contest**
Nov 9	**International OK DX Contest**
Nov 15	**DARC Corona 10-Meter RTTY Contest**
Nov 15-16	**ARRL Sweepstakes—Phone**
Dec 6-7	**ARRL 160-Meter Contest**
Dec 13-14	**ARRL 10-Meter Contest**
Jan 18	**FRACAP Worldwide Contest**
Mar 7-8	**1981 SSTV Contest**

plications and logs to: Hartwin E. Weiss W3OG, PO Box 440, Halifax PA 17032 USA.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HB0, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1346, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, 9H1.

NEW JERSEY QSO PARTY
2000 GMT August 16 to
0700 GMT August 17
1300 GMT August 17 to
0200 GMT August 18

The Englewood ARA invites all amateurs worldwide to participate in the 21st annual NJ QSO Party. Phone and CW are considered the same contest. A station may be contacted once on each band; phone and CW are considered separate "bands," but CW contacts may not be made in phone band segments. NJ stations may work other NJ stations, and NJ stations are requested to identify themselves as "DE NJ."

EXCHANGE:

QSO number, RS(T), and ARRL section, country, or NJ county.

FREQUENCIES:

1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28610, 50-50.5, and 144-146.

Suggest phone activity on the even hours; 15 meters on the odd hours (1500 to 2100 GMT); 160 meters at 0500 GMT.

SCORING:

Out-of-state stations multiply the number of complete contacts with NJ stations times the number of NJ counties worked (21 maximum). NJ stations count 1 point per W/K/VE/VO QSO and 3 points per DX QSO. Multiply total QSO points by the number of ARRL sections (including NNJ and SNJ—maximum 74). KP4, KH6, KL7, etc., count as 3-point DX contacts and as section multipliers.

AWARDS:

Certificates will be awarded to the first-place station in each NJ county, ARRL section, and country. In addition, a second-place certificate will be awarded when 4 or more logs are received. Novice and Technician certificates will also be awarded.

ENTRIES:

Logs must show date/time in

Continued on page 150

Results

RESULTS OF THE 1980 SSTV CONTEST

What a blast! Enthusiasm and participation in the 1980 SSTV Contest was, to put it mildly, fantastic. Brooks Kendall W1JKF, Dave Ingram K4TWJ, and the complete gang at *73* would like to thank each and every contestant and invite you to do it again next year. This contest is rapidly gaining widespread popularity. If you haven't yet joined the ranks of SSTV operators, you best get cracking. This is, obviously, going to be one of the hottest modes of communication in the 80s.

During the weekend of March 8 and 9, 1980, practically all the designated frequencies were alive with the sound of SSTV. 10 meters was open like never before, with European video pounding into the US until mid-afternoon during both the contest days. 20 meters was also abound with SSTV, from approximately 14.225 to 14.240 MHz with several "levels" of SSTV signals. At one time during the contest, we noted a German slow scanner relating that in-shack efforts called for excessive work. The amateur said he was only making a few casual contacts and enjoying the "losing action." Down frequency from this operation, another SSTVer was busy making contacts while using felt-pen-lettered sheets placed under the camera during each QSO. We understand the paper menegene and hot lights soon choked the poor chap. One possible alternative to this situation is the new Robot super terminal or a house computer. Otherwise, we're open to alternate ideas. How about it, gang?

This year's contest resulted in a significant increase in the number of logs received, and, as evident by the comments received, most of you would like to see the schedule changed to stimulate more worldwide participation. Last year I conducted surveys during the Saturday SSTV network, and the suggestions received have been tabulated. We did not come to grips with this in time for this year's contest; however, next year will reflect a change in the schedule. If you wish to state your views, please let us know. The Saturday SSTV net that meets every Saturday at 1800 to 2000Z is a convenient way. Please call net control, W1JKF (handle is Brooks), on 14.230 MHz.

SSTV CONTEST SOAPBOX

"My first time in the contest, and it was terrific fun. It was enjoyed by all members of the family, and I even scored 2 new SSTV countries."—K0HT.

"Really had a ball, but where were the South Americans?" —WA4OAA.

"Had to take several intermissions, but kept plugging anyway."—K8EMI.

"KB9IG—you beat N6WQ—what's your secret?"—K4TWJ.

"Would like to see a divisor used that would divide power by same to determine score."—W0TUP.

"Really enjoyed contest and look forward to competing next year. My equipment is mostly homemade, with a modified SWTP computer—software by W8PVD and AA8D." —K8NTK.

"Enjoyed contest."—WA0LLQ.

"It was fun. My comments will follow."—W2GND.

"My first SSTV contest. Enjoyed same, but was severely limited by a stuck rotor."—WA1PEL.

"Best contest yet; good DX this year. Would like to see contest run 36 straight hours. Australia was just coming in when contest ended."—WB0RYP.

"Best regards on contest. Hope contest will continue and with more participation worldwide. Propagation is poor on 80 and 40 in Mexico. Would like schedule changed to take advantage of openings to JA and other countries. Big applause to 73 Magazine for sponsoring contest."—XE1AAK.

WINNERS

Congratulations to Dick Rush KB9IG, the winner of this year's contest. Dick's score was 306 points. He worked 23 countries in 4 continents plus 33 states and provinces. Dick will receive a year's subscription to *73* and a winner's certificate, plus a certificate for the most countries worked.

N6WQ will receive a certificate for the most states and provinces worked: a total of 34.

WB9QCD will receive a certificate for the most continents worked—all six.

Listed below are the scores of the contestants.

KB9IG	306	W0TUP	200	WB9ZBG	126
N6WQ	277	WA0LLQ	200	K8EMI	125
WB3APB	256	W2GND	196	WA1PEL	114
W1WS	214	WB3KOJ	160	WB0QCD	109
K0HT	212	W6WDL	156	XE1HT	102
WB9RYP	211	W3CJI	151	XE1AAK	34
KA1AQM	208	K8NTK	149	W7FEN	32
WA4OAA	204	K8HAB	127		

Thanks for participating in the contest, fellers. I guess this wraps it up for this year. See you in 1981, first full weekend in March. Read Dave's articles in *A5*; hope to see you on the SSTV net Saturday at 1800Z on 14.230 MHz. See you down the log.

Dave Ingram K4TWJ
Brooks Kendall W1JKF

Awards

Bill Gosney WB7BFK
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

It is hard to believe that almost one year has passed since our initial accouncement of the famous *73 Magazine* awards portfolio. During this period, we've seen the program grow significantly to become one of the most sought-after challenges facing amateurs today.

Consisting of six domestic incentives and five DX achievement programs, the awards portfolio has captured the interest of almost everyone on the band, whether a rag chewer or a big-time contester.

In the paragraphs to follow, I am listing the DX awards individually. Read through the rules with caution. The requirements are not as easy as one might first imagine. We want our award recipients to realize that they had to "earn" their recognition and therefore have designed each award to be somewhat of a challenge. Next month the domestic awards will be featured.

73 DX COUNTRY CLUB AWARD

1. Sponsored by the editors of *73 Magazine*, the *73* DX Country Club Award is available to licensed amateurs throughout the world.

2. To be valid, all contacts claimed must have been made in a *single calendar year* (January 1 through December 31), beginning on or after January 1, 1979.

3. This award is issued for All Phone, All CW, and Mixed Modes. Should you wish to recognize a single band or mixed band accomplishment, merely state your request when submitting your application.

4. To qualify for any of the *73* DX Country Club Awards, a minimum of 73 DX countries must be worked and confirmed from the *73 Magazine* WTW (Work the World) DX listing which appears elsewhere in this column. Once again, all contacts must be made in the same calendar year for which application is made.

5. Annual endorsement stickers are available for each succeeding year in which application is made.

6. To apply, prepare a list of claimed contacts in prefix order. Include each station's callsign, date and time in GMT, mode, and band of operation.

7. Do not send QSL cards! Have your list of contacts verified by two amateurs, a local club secretary, or a notary public.

8. The award fee is $3.00 or 8 IRCs for each award. Endorsements are granted for a fee of $1.50 each.

9. Send your verified list and award fee(s) to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

DX CAPITALS OF THE WORLD AWARD

1. Sponsored by the editors of *73 Magazine*, the DX Capitals of the World Award is made available to licensed amateurs the world over.

2. To be valid, all claimed contacts must have been made on or after January 1, 1979. There are no band or mode restrictions, although special recognition will be given for single band or mode accomplishments if requested in the application.

3. To qualify, you must work and confirm fifty (50) different national capital cities of the world. Only those countries which appear on the WTW DX listing qualify. Should a country with a national capital city not commonly known be contacted, you may list it on your application; the awards editor reserves the right to make a final determination as to its acceptance for award credit.

4. To apply, make a self-prepared list of contacts made in prefix order. Indicate the station callsign, date and time in GMT, band and mode of operation, name of the capital city, and DX country.

5. Do not send QSL cards! Have your list of contacts verified by two amateurs, a radio club secretary, or a notary public.

6. Send your application list and award fee of $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

TEN-METER DX DECADE AWARD

1. Sponsored by the editors of *73 Magazine*, the Ten Meter DX Decade Award is available to licensed amateurs worldwide.

2. All contacts must be made on the 10-meter band using only channelized converted Citizens Band equipment or similar commercial units operating a minimum of 15 Watts PEP output. External amplifiers may not be used.

3. To be eligible for this award, all contacts must have been made on or after October 1, 1978. Contacts may be claimed for all AM, SSB, CW, or FM. Mixed mode accomplishments are not valid for this award.

4. To qualify, you must work and confirm at least ten (10) DX countries from the WTW (Work the World) listing. Endorsements will be given for 25, 50, 75, and 100 countries confirmed.

5. To apply, make a self-prepared list of contacts claimed, giving the callsign of each station worked in prefix order. Include the date and time in GMT, band, mode, and a brief description of the equipment used in making each contact. Special recognition will be given for QRP mobile achievements.

6. Do not send QSL cards! Have your list of contacts verified by two amateurs, a local radio club secretary, or a notary public.

7. Send your application and award fee of $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

SPECIALTY COMMUNICATIONS ACHIEVEMENT AWARD CLASS A-1

1. Sponsored by the editors of *73 Magazine*, this award is dedicated to amateurs worldwide who take pride in active participation in the field of specialty communications.

2. To be eligible for this award, some very rigid requirements must be met. All contacts must have been made on or after January 1, 1980. Only communications via SSTV, RTTY, EME (Earth-moon-Earth), and/or OSCAR will be recognized for award credit. Contacts between stations on OSCAR and EME may be made using any mode authorized in your country, although applicants are cautioned that mixed mode contacts are not valid.

3. To qualify, applicants must work a minimum of 10 DX countries from the WTW DX listing. Special recognition will be made for those exceeding the 10 country minimum.

4. To apply, you must prepare a list of claimed contacts in callsign prefix order. Include the date and time in GMT, the band and mode of operation, and a signed declaration as to the type and description of equipment and antenna system utilized to make your contacts.

5. Do not send QSL cards! Have your list verified by two amateurs, a local club secretary, or a notary public.

6. Send your application and award fee of $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

WORK THE WORLD DX AWARD

To enhance the enjoyment of working DX, the editors of *73 Magazine* take special pleasure in presenting the most complex and probably the most sought-after award in existence today — the Work the World DX Award.

1. Sponsored by the editors of *73 Magazine*, the Work the World DX Award is available to licensed amateurs the world over.

2. To be valid, all contacts must have been made on or after January 1, 1979. There are no band or mode restrictions; however, applicants will be given recognition for single band or mode achievements upon their request. Only DX countries shown on the WTW (Work the World) DX listing qualify.

3. The Work the World program consists of six continental awards (North American, South American, European, Oceanic, Asian, and African), each of which is a worthy accomplishment in its own right. Once the applicant has made application for all six achievements, a seventh and ultimate award known as the Work the World DX Award will be issued automatically without charge. The operator who earns WTW recognition has truly "worked the world."

4. Requirements for the individual continental awards: North American award—work

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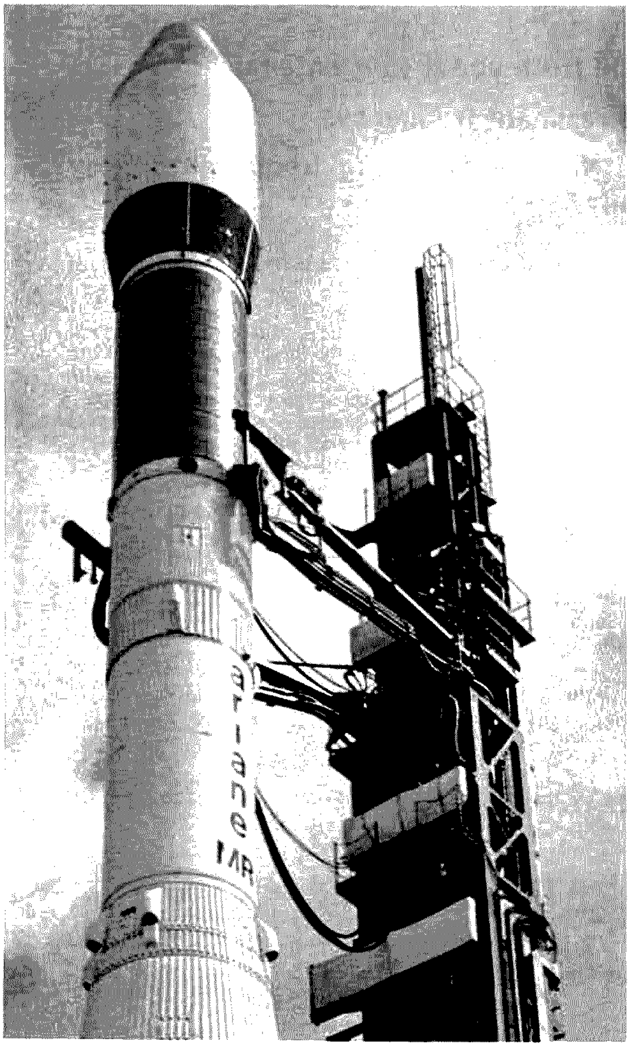
AMSAT

PHASE III TRAGEDY

The morning of May 23, 1980, began in hopeful anticipation and ended in devastating disappointment for radio amateurs throughout the world. This was the day of the long-awaited launch of hamdom's ninth OSCAR satellite, constructed by hams in several countries under the auspices of AMSAT, the Radio Amateur Satellite Corporation. As hundreds of amateurs tuned in to the AMSAT Launch Information Nets, a rocket motor failed in the first stage of the *Ariane* launch vehicle, causing the destruction of both the missile and its satellite payload.

The amateur satellite aboard the ill-fated mission was the first of the Phase III designs, created to operate from high elliptical orbits. Much more sophisticated than the previous amateur satellites, the Phase III bird would be available for long-distance communications for hours at a time. Development and construction of this first Phase III satellite (to become known as OSCAR 9 after successfully achieving orbit) took more than five years and cost a quarter million dollars.

The launch took place from the European Space Agency (ESA) complex at Kourou, French Guiana, on the northeast coast of South America. ESA had successfully tested its *Ariane* rocket last December by firing a mostly inert payload into space from Kourou. This time, *Ariane* carried the *Firewheel* scientific satellite as its primary payload, with the Phase III bird as secondary cargo.



Launch day was plagued by a series of annoying delays as controllers wrestled with several small problems, including a sticking valve, a computer error, and a rainstorm at the launch site. Then, shortly before 1430 UTC, everything seemed in order and the countdown reached its conclusion. On the AMSAT 40-meter net, Dr. Thomas A. Clark W3IWI, now president of AMSAT, kept amateurs informed. At first, everything looked good:

"9 . . . 8 . . . 7 . . . 6 . . . 5 . . . 4 . . . 3 . . . 2 . . . 1 . . . mark."

"Ignition comfirmed . . . liftoff confirmed."

"Flight is nominal."

"Everything is on track."

Then, a hint of trouble:

"We have the report that both transponders are off."

"We have a report there's a problem on one engine."

"The flight is not nominal. There's a problem on one engine."

And, finally:

"We just had the report: The launcher is going down. The launcher is going down."

"It appears that the launch was a failure."

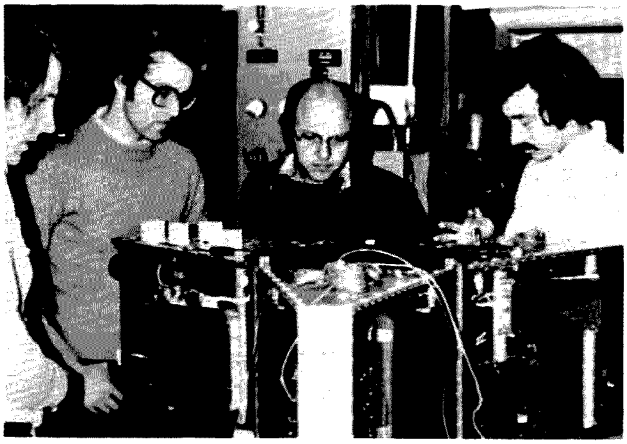
"The frustration level is extremely high . . ."

Telemetry signals from the *Ariane* showed that one of the four Viking-V engines in the first stage had begun losing thrust almost immediately after liftoff. The flight computer had attempted to compensate with the other three engines, but eventually lost the battle as the thrust from the failing engine continued to decline. As it began to go out of control, the *Ariane* rocket was destroyed, and with it, the Phase III satellite. It is small consolation that the amateur satellite worked perfectly, while the "professional" rocket failed.

Later on launch day, interested hams met on 75 meters to discuss the events of the day. With W3IWI as master of ceremonies, a large number of amateurs spoke up in support of the amateur satellite program. It was pointed out that two functioning satellites, OSCARs 7 and 8, remain in daily use by hundreds of hams. Also, AMSAT already has some of the major components of a second Phase III satellite, and it's estimated that the new bird could be made ready in about a year's time. A more difficult problem may be finding a suitable launch opportunity. With NASA launching very few payloads until the Space Shuttle is operational, space aboard launch vehicles is at a premium.

The AMSAT budget has been severely strained by the Phase III program. It was hoped that a successful OSCAR 9 launch would bring many new members into the organization, with the resulting infusion of badly needed funds. With the frustrating loss of the Phase III bird, AMSAT must count on the support of interested amateurs while a new satellite is prepared and launched.

If you are interested in learning more about the amateur satellite program, simply write AMSAT, PO Box 27, Washington DC 20044.



Pre-flight testing of the Phase III satellite was carried out by (left to right), among others, Jan King W3GEY, Ulrich Muller, Dtor. Karl Meinzer, and Clark Greene. The two in the center are from AMSAT Deutschland. (Photo courtesy of G. D. Moreno LU4EDS/W3)

New Products

HEATHKIT SA-2040 ANTENNA TUNER

Sometime around 1955, I had my first encounter with Heathkits when I purchased an AR-2 general coverage receiver. It was quite an undertaking. (I almost died when I thought of the apparent hoplessness of the bags and bags of screws, resistors, and other assorted parts that I had bought with the pain and agony of foregoing my lunch at school.) I was a real novice and really knew very little about what was what, but Heathkit apparently knew this and put things in such simple terms that I had little difficulty in "getting it together".

Several Heathkits and twenty-five years later, I found the need for a transmatch and, from what I could tell, the new Heathkit SA-2040 seemed to be just what I needed. Off to the Heathkit store I went. The salesman produced one from the back room while telling me how lucky I was to get one as they seemed to be selling so well. I told him that I thought I was lucky, too (and privately hoped that I was, since I hadn't received the bank confirmation of the automatic payroll deposit to cover the check I was writing).

When I got the SA-2040 kit home, I opened the box and found what looked like a hardware store. I was a bit disappointed to find that the packer back at the Heathkit factory had smashed one of the aluminum skirts on one of the knobs, but I considered it to be a minor setback and just hoped it wasn't an omen of things to come.

The instruction manual (Heathkit part #595-2327) was accompanied by an eight-page supplement of changes which bore the new Heath-Zenith logo. I quickly found out that the changes that were to be made to the "Illustration Booklet" couldn't be done, as they apparently forgot to pack it in the box. The absence of that booklet later proved to be a pain-in-the-neck to me and caused me to have to take a lot more time than would have really been necessary.

Instead of the usual "exact number" inventory that I'm used to with Heathkits, I found there was generally a surplus of the hardware items, but the 3/16" capacitor stator spacers were short by one piece. While that doesn't sound like much of a shortage, it proved to be quite a problem since the antenna capacitor just won't go together, Illustration Booklet or no Illustration Booklet, without all four 3/16" spacers. Fortunately, I had an extra 17/64" stator spacer, a small file, and some patience, so I was able to make a substitute part.

In spite of all the manual changes and my having to use my imagination in lieu of the Illustration Booklet, the kit went together with little difficulty. (The assembly very much reminded me of playing with an Erector Set as a kid!) Once Heathkit reprints the manual with the changes, and perhaps includes the Illustration Booklet, there should be no problem putting the kit together within the two-evening time frame mentioned in the new Heathkit catalog. Even with the problems that I had, I managed to get my first 1:1 match with the SA-2040 during the second after-dinner session.

Heathkit has really put together a nice transmatch kit. It comes with an attractive black and grey cabinet with a full-size face piece with a place to record your tuning settings. They've used the old reliable handbook-type circuit, complete with balun and continuously variable inductor.

My only criticism is that the kit is new and Heathkit just hasn't yet debugged the manual and box packing procedures. My guess is that they've simply gotten too anxious to get the SA-2040 into the hands of all those "lucky" buyers, but if I know Heathkit, that overeagerness will be taken care of by their customer service policy and corrections in future kits will be forthcoming in the immediate future.

The salesman who told me I was lucky to get an **SA**-2040 before they sold out was probably right, since they will likely go like hotcakes once the word gets around. Frankly, I've been in the market for a tuner for some time and have been shopping around quite a bit. Considering the cost of the various commercially manufactured tuners and parts for homebrew tuners, I consider the SA-2040 to be an excellent value.

For further information, contact *Heath Company, Benton Harbor MI 49022.* Reader Service number 482.

Tony Stalls K4KYO
Washington DC

CW STATION IDENTIFIER

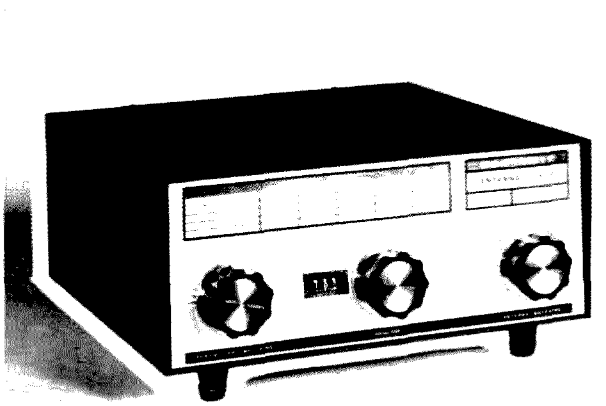
Spectrum's Model ID 1000 automatic Morse CW station identifier is a 1-2 channel, stored program unit designed to interface with any existing base station or repeater transmitter—either solid-state or tube. This new IDer features automatic identification of the station, either at completion of activity or at 15-30 minute intervals, built-in ac power supply, and optional provision for 12 V dc battery input with automatic switchover to special "Emergency Power ID". CW tone pitch, speed, level, and time are adjustable. The transmitted code signal is a pleasant sinusoidal note, and the unit has an output capacity of up to 6 V p-p into a 600-Ohm or greater load. A plug-in PMOM chip is used to store the memory.

For further information, contact *Spectrum Communications Corporation, 1055 W. Germantown Pike, Norristown PA 19401; (215)-631-1710.* Reader Service number 481.

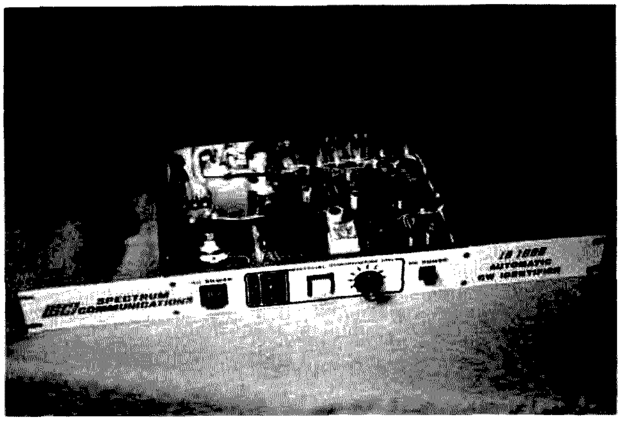
NEW TEN-TEC "DELTA" TRANSCEIVER

The new Ten-Tec "DELTA," in keeping with its name, offers a transceiver for the changing times. Covering 160 through 10 meters, the DELTA has the present 6 HF bands plus the new 10, 18, and 24.5 MHz segments (available when the bands open for use).

The wholly new design features a new low-noise double-conversion receiver with 0.3 uV sensitivity, 85-dB or better dynamic range plus switchable 20 dB attenuator, standard 8-pole monolithic SSB filter with 2.4-kHz bandwidth, optional 200-Hz and 500-Hz 6-pole CW filters, and standard 4-stage ac-



Heathkit's Model SA-2040 antenna tuner.



Spectrum's new ID 1000 CW station identifier.

Ten-Tec's new "DELTA" transceiver.

tive audio filter, built-in variable notch filter, offset tuning, new "hang" agc for smoother operation, optional noise blanker, WWV reception, and new digital readout featuring six 0.3" red LEDs.

For further information, contact *Ten-Tec, Inc., Highway 411 East, Sevierville TN 37862.*

AEA KT-1 KEYER TRAINER

Advanced Electronic Applications created a sensation among CW devotees with the introduction late last year of the MorseMatic, a superb microprocessor-controlled electronic memory keyer. Now comes AEA's KT-1 Keyer Trainer, a compact electronic keyer and Morse training device that incorporates many of the most popular features of the MorseMatic, but is available at a substantially lower price.

The Keyer

For someone familiar only with conventional electronic keyers, the lack of knobs and switches on the control panel of the KT-1 is surprising. In fact, only the on-off/volume control is immediately recognizable. Every other function, including speed, sidetone pitch, weighting, tune, and more, is programmable, using the 12-button keypad to address the microprocessor hidden inside the KT-1's black plastic case.

Don't let this talk of keypads and microprocessors make you nervous; AEA has provided a concise yet complete instruction manual that will have your fingers dancing merrily on the keys within a few minutes. For convenience, you'll probably commit the most often used commands to memory, but this will occur naturally after a few hours of use.

Keyer speed is variable from 1 to 99 words per minute. The command for changing speeds is typical of the keypad combinations used to control the unit. A new speed is selected by simply pressing the "*" and "6" keys, followed by the desired speed. A speed of 25 wpm requires the combination "*625", for instance. A newcomer might select "*607" to transmit at 7 wpm. Similar commands allow you to vary the pitch of the sidetone (there's a built-in speaker), change the weighting, turn the dot and dash memories on and off, send a continuous tone for transmitter tuning, and even set up the keyer for semi-automatic (bug) and straight key operation.

The Trainer

It's difficult to imagine a better gadget for helping someone learn Morse code or increase his speed. Stored inside the KT-1 is a sequence of 24,000 Morse code characters. For code practice, 10 different starting points are available, selected by the keypad digits. In the unlikely event that you happen to memorize the character sequence at one or more of the 10 starting points, a random starting point may also be chosen.

As with the keyer functions, almost every aspect of the trainer is controlled by the keypad. Especially noteworthy is the option of using the Farnsworth method of code training. In this method, the individual Morse characters are sent at a high rate of speed with longer-than-normal spaces between the letters. For many people, this leads to a rapid increase in code speed, since the ear becomes accustomed to the sound of the high-speed characters. As training progesses, the inter-character spaces are gradually shortened, while the character speed remains unchanged. The result is a steady increase in speed without the need to re-learn the sound of each character.

The KT-1 can be programmed to provide practice sessions up to an hour in length, with selectable starting and finishing speeds and five-character or random length code groups. Code class instructors, please note.

Conclusion

The KT-1 requires a source of 12 V dc for operation; an ordinary wall-plug transformer will do the job. The keying circuit is designed to handle most any ham transmitter or transceiver and is rated at −300 V and 30 mA or +300 V and 300 mA. One complaint about the KT-1: The hard plastic case tends to slide around on the operating desk. It really needs a set of rubber feet to prevent this.

For those who do not feel the need for the memory and beacon functions found in AEA's top-of-the-line MorseMatic keyer, the KT-1 Keyer Trainer seems an ideal choice.

For further information, contact *AEA, Inc., PO Box 2160, Lynnwood WA 98036.* Reader Service number 478.

Jeff DeTray WB8BTH
Assistant Publisher

HAMTRONICS' CONVERTERS AND AMPS

Hamtronics' transmitting converters and heavy-duty linear power amplifiers are now available as complete units, in eggshell-enameled aluminum cases, with BNC connectors for exciter and antenna connections. These units, which are compatible with virtually any ten-meter SSB, CW or FM exciter, provide an rf output of 30 to 45 W PEP with as little as 1 mW input. Models are available for 432-450 MHz, which includes operation on OSCAR, and for six meters and two meters. These units provide a versatile arrangement for getting on either satellite or terrestrial operation.

A complete new catalog on these and other VHF/UHF transmitting and receiving modules for FM and SSB is available from *Hamtronics, Inc., 65F Moul Rd., Hilton NY 14468.* Reader Service number 476.

THE COLLINS/ROCKWELL KWM-380

Continuing a tradition of high quality communications gear known and respected in amateur circles since the 1930s, Collins/Rockwell International recently introduced their latest high frequency transceiver – the KWM-380. Bearing a resemblance to its predecessors, the KWM-1 and KWM-2A, primarily in high caliber performance and advanced internal design, the KWM-380 is packaged in a heavy-duty cabinet which weighs in at close to 40 pounds.

Continued on page 161

One of Hamtronics' transmitting converters.

Don Wagner W2QFC
308 Parkdale Avenue
East Aurora NY 14052

The Soft Mount

—mobile mount enters the space age

"Ouch, that stuff smarts!" I said, half aloud, as I applied first aid to my skinned knuckles for what seemed to be the hundredth time.

It was a ritual I had not learned to live with and it was happening altogether too frequently. It seemed as though I managed to need some sort of first aid every time I took one of the mobile rigs out of the car, or when I put one in, or when I swapped the Argonaut low-band transceiver with the Amcomm two-meter rig, or vice versa.

The big problem was, of course, that the rigs are of vastly different dimensions (aren't they all?) and each presented its own mobile-mounting problems. I found myself constantly messing around with various lengths of straps, screws and bolts of varied types and sizes, nuts and wingnuts, all difficult to hold in place and most requiring that new holes be drilled in the automobile. And then I had to start all over again every time a new rig was to be mounted.

Consider the number of times you go through a similar ceremony, when, for example, you take the rig into the shack for fixed use or for adjustments, when you store it in the trunk for security, or whenever you decide to QSY from LF to VHF, etc. There must be a better way, I thought, as I hung the mike on its Velcro® fastener on the side of the rig. But so far none of the magazines or catalogs seemed to offer solutions.

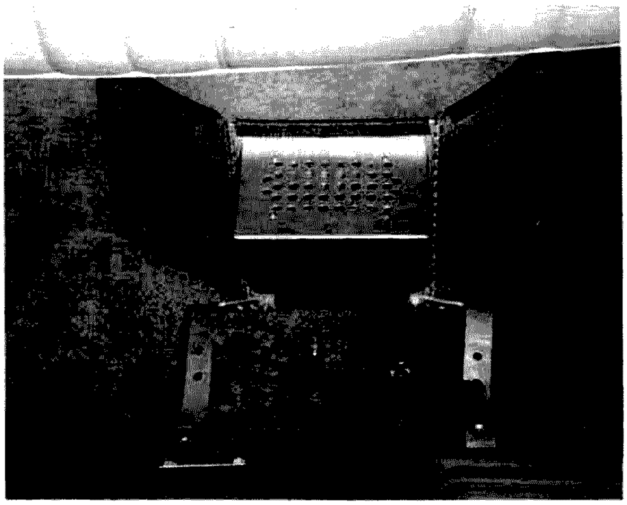


Photo A. The mount in position, covered with Velcro and some dust.

Wait a minute! *Velcro!* Why not? If a small piece of this fastener does such a great holding job for a mike, why not use lots more of it to hold a rig in place, especially rigs like the Arogonaut and Amcomm?

First, a trip to the local fabric emporium produced an abundant supply of Velcro tape on reels, in several widths and in several colors. I purchased a yard of the greatest width in stock, about an inch and one-half, and in black. The clerk gave me a leaflet about this material. It is a product of the Talon Division of Textron and is called a "self-gripping fastener." It consists of two pieces of fabric backing, one of which has tiny, firm nylon hooks and the other, soft nylon loops. These interlock when pressed together and hold with surprising strength, yet peel apart easily. If you have not used it, I imagine the lady in your house is familiar with it as a clothing fastener. If, however, you have had your blood pressure checked recently, the chances are that the arm cuff used Velcro fastener to hold it in place. And be sure to check your fly—for Velcro tape, I mean! Many men's and ladies' trousers use it there, too.

Next, a trip to the electronics emporium. It produced a great variety of types, sizes, and construction (metal and plastic) of hump floor mounts. I selected a rather heavy steel job that had a neatly sloping top and slants the radio dial and knobs at a good angle for viewing and handling from the driver's seat. The junk box produced a pair of sturdy aluminum straps that were bolted to the rim at the back of the mount and bent (contoured) upward and around the air-conditioning ducts. They are fastened to the underside of the dash rim and provide good stability for the mount.

The Velcro tape is glued to the top of the mount, laying the strips next to each other so that the top is completely covered, thus providing maximum versatility for any rig to be mounted on it. I used the "fuzzy" half of the Velcro tape on the mount and

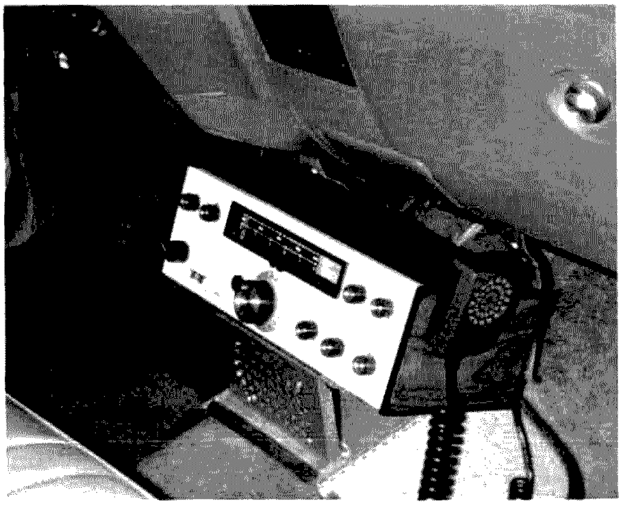


Photo B. The Argonaut in place.

Photo C. The Amcomm in place.

glued it with one of the newer "instant adhesives" or super glues. It has held the tape in place without problems for over a year, through six months of Arizona sun and through some severe western New York State winter weather, too.

The other half of the Velcro tape is glued to the bottom of the rigs, of course, placed carefully so that the rig will be in good position for you, making certain that none of the screws or the speaker grill is covered, hi. Leftover pieces make great cushions on the vertical straps to protect the cabinets, and for "hangers" for your mike, touchtone pad, mini frequency counter, and field-strength meter.

Having done this, you are ready for just about any rig of reasonable size—ready to go mobile without straps, holes to drill, screws and bolts, etc. All you need is more Velcro material! Your rigs will stay put; you will really be amazed at the holding power which this material provides while requiring only a "little pull to pull it off."■

Notes from Big Sky Country

—the further adventures of Dr. Hess

KGCX employees during the thirties included (L to R) Announcer Adolph Jystad, who obviously has just left his employment at the Westland service station to have his picture taken at the Westland radio station, Engineer George Bairey, later to become a consulting radio engineer in Washington, DC, and Engineer Eddie Richmond, who is now a practicing attorney in Portland, Oregon. The dog appeared out of nowhere, "adopted" KGCX, and filled the only position at the station for which he was qualified—Night Watchman.

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In the November, 1970, and June, 1979, issues of this magazine, Dr. Hess regaled our readers with stories of interesting and often hilarious incidents which occurred in the states of Montana and North Dakota when he was a young man living in that area, with special emphasis on the flamboyant early history of radio station KGCX. Here's more of the same, together with a few tales of the early days of radio and television in Los Angeles.—Ed.

The year was 1918. The terrible flu epidemic, which caused the deaths of millions of people that year, was raging full blast in my home town of Noonan, North Dakota, and in every other community in the world.

The Noonan Farmers Telephone Company, doing its bit to try to end this dreaded disease which was rapidly killing its customers, "sent away back east" for a supply of white celluloid discs, approximately three inches in diameter and about an eight of an inch thick. These discs contained the drug asafetida (also known as "devil's dung"), which was thought at that time to possess germicidal qualities. (In Noonanese, one never merely said that he had mailed an order to a firm in the eastern United States—one always said that he had "sent away back East." "East" was everywhere beyond Minneapolis.

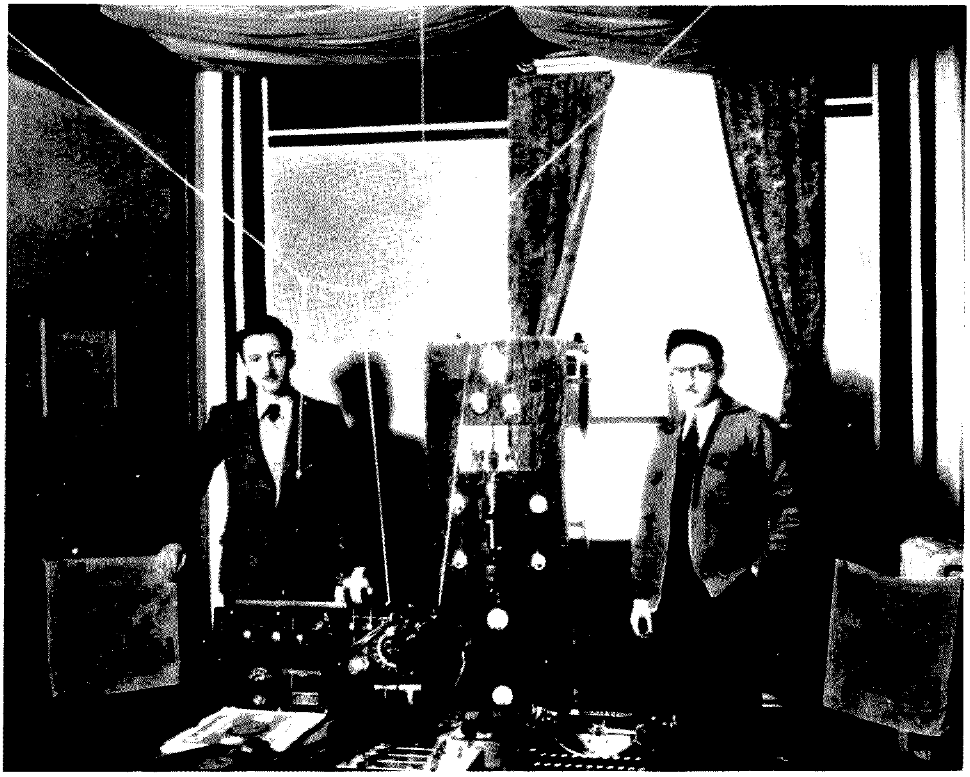
By unscrewing the hard-rubber mouthpiece of the single-button carbon microphone used in the hand cranked wall telephones then used at Noonan, one of these celluloid discs (which had a one-inch diameter hole in their centers) could be placed flat against the remaining portion of the "talk-into" part of the phone and held firmly in place by replacing the mouthpiece in its original position.

One thing these discs did for sure was keep people from depositing droplets of bacteria-laden moisture from their breath on their telephone mouthpieces, since the absolutely sickening odor of the asafetida made it very unpleasant in-

deed to stand too near the telephone.

My buddy, Pa Ness, was the lineman for the telephone company. He regularly patrolled the lines around Noonan, replacing broken or missing insulators on the poles (the cause of which was some mean kid equipped with a .22 rifle) and replacing the number-6 dry cells which powered each phone.

While driving up to a farm home, he noticed a cloth "Bull Durham" tobacco sack hanging from the iron telephone wire just before it entered the wall of the house. Upon inquiry as to the purpose of this sack, it developed that the farmer had observed the asafetida devices on the business phones in Noonan, and, wishing to take no chance of contracting the dreaded flu over the telephone, he had purchased some asafetida from the village druggist, placed it in the tobacco sack, and hung it *outside* his home. This gave the dreaded influenza bacteria no chance whatsoever of entering his home via the telephone! Even if he should receive a long-distance call from his relatives in Minneapolis where the flu was killing dozens of people every day, the germ coming over the phone wire would meet the medicine in the sack in a head-on collision and be given a double whammo. No dummy he, that would allow such a killer to come right into his home.



Pictured above is the author and the college radio station he built in 1932 for the North Dakota State School of Science. The 204A tube was mounted on the front of the transmitter as was the universal custom in those days. The antenna stretched from the steeple of four-story "Old Main" to a steel tower on another building. The older man is Mr. Linsky, a radio theory instructor at the college.

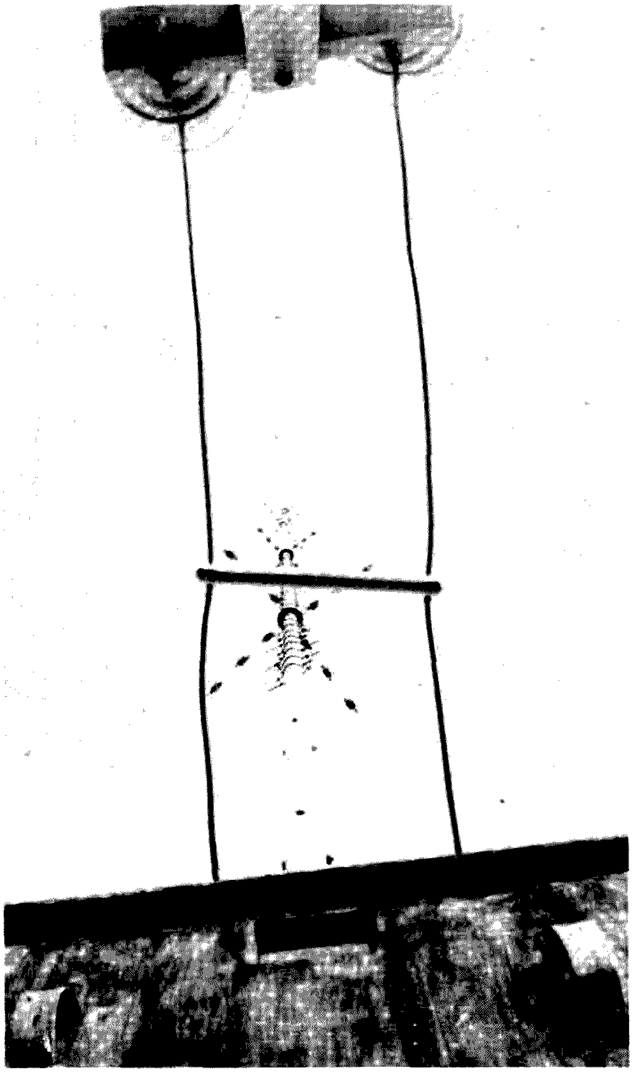
Another calamity hit the town about twelve years later, when the federal government licensed Pa Ness and myself as amateur radio operators and assigned us the callsigns of W9CHG and W9HHN, respectively. All that was necessary to secure an impressive-looking license (which was of the same important-looking size and the same bluish complexion as today's commercial operator licenses) was to visit a notary public (my father, in our case) and sign an affidavit stating that you could, indeed, send and receive ten words per minute in international Morse code and that there was very little, if anything, that you didn't know about radio theory. However, it did not state anywhere in the affidavit that the ten words could not be the same word, such as "it," repeated over and over.

We didn't interfere with the radio reception of the other residents of the town, provided their radios had two or more tuned radio frequency stages. Those unfortunates, such as the town postmaster, who owned cheap radios with a wide-open front end received us "sixty over" in several regrettable places on their radio dials, mostly on the very frequencies that the few stations which were receivable in that remote area of the United States were trying to broadcast on.

In fact, you didn't need a radio of any type to receive the 160-meter AM signal of W9CHG in certain locations. He and his wife, a registered nurse, operated the local hospital and lived in an apartment in the basement of the hospital. Employees in the hospital kitchen often became candidates for residency in Dr. Pierce's Sanitarium for the Trembling when the mere removal of a lid from a pot of food simmering on the hospital's electric stove and the laying of that lid down on an adjacent burner element of the stove caused CHG's booming voice to roar forth from the stove, with volume such as one might hear from a public address system at the county fair. Somewhere within the anatomy of the stove, dissimilar metals were rectifying the signal of W9CHG, and the pot lid, when placed on another burner element, served as sort of a speaker cone to reproduce the sound.

After daily radio conversations for several months with a couple of VE4s about sixty miles away in neighboring Canada, we thought it would be nice to have an eyeball contact with them. Over-the-air arrangements were made with them on a day in June, 1931, whereby we would visit them the following day.

We headed toward Canada the next morning about 8 am. Prohibition was



This view looks straight up the 200-foot antenna mast of KGCX at Wolf Point. Since it was impossible to climb it, the FCC waived the requirement that it be equipped with red lights and allowed it to be illuminated by floodlights on the ground. Still in use at Sidney where KGCX is now located, it gives one the impression of being apt-to-fall-down-at-any-minute, due to its crooked appearance. This was caused when vandals at the latter city cut one of its guy wires and the tower came down much faster than it was erected.

still in effect in the United States, so after reporting to Canadian Customs and Immigration at Estevan, Saskatchewan, we stopped at His Majesty's Government Liquor Store, where we bought a case of White Horse Ale, some bottles of Teacher's Cream Whiskey, and several gallon jugs of port wine (realizing that the store would likely be closed upon our return from our safari further into Canada). Purchases were restricted at these stores to Canadian citizens, so we signed the order form "Reginald Barrington-Smythe." How British can you get?

With preparations thus made for a liquor-smuggling trip back into the United States following our eyeball contact with our Canadian ham friends, we set a northeast course with CHG's Chevy and arrived at the home of one of the VE4s to find a somewhat less than deluxe ham radio installation. Our host immediately lit a homemade cigarette by holding a shovelful of red-hot coals from the kitchen range up to his face, burning off his eyebrows in the process. When we asked why he used this rather large cigarette lighter, he explained that he couldn't afford to buy matches.

His rig was a raw ac self-excited oscillator, capable, of course, of producing only CW signals. It was built in a wooden apple box. The dials were tomato can covers which he had soldered directly onto the brass shafts of the variable capacitors. His antenna was one of the iron wires of his mother's clothesline, suspended about five feet off the ground. On Mondays (wash day), his rig wouldn't load up, due to the wet (or frozen) laundered clothing and bed sheets draped over his clothesline antenna.

He turned on his receiver and we heard the beautiful 20-meter AM signal of W8CPC from Buffalo NY, who was calling CQ. The result was a QSO between that station and our VE4 friend, using his raw ac code signal.

During that era, *QST* used a few pages each month to describe and picture the Station of the Month. A few months later, W8CPC was featured as the Station of the Month. Its kilowatt-on-every-band operated by a prominent Buffalo doctor was described, and we were struck by the difference in value of the equipment used in the QSO. Our Canadian friend's gear was worth about \$5.00. The investment on the Buffalo end was more like \$5,000.

After being dinner guests of the other VE4, we headed for home about 5 pm. Shortly after crossing the international border, which is nine miles from Noonan, we noticed an automobile several miles away, coming toward us. Realizing that this car could mean trouble for us, in the form of Border Patrol officers, I focused the long telescope which CHG always carried in his car on the approaching vehicle. I could see that its occupants were wearing Smokey-the-Bear-type military hats, so we knew that the Border Patrol was indeed approaching. CHG brought the Chevy over to the extreme right-hand side of the narrow dirt road and continued driving slowly while I opened the car door a little and gently eased our entire cargo of liquor into the tall weeds which grew right up to the edge of the road.

We were stopped by the Border Patrol officers and our vehicle, including the trunk, was thoroughly searched. Of course, nothing illicit was found.

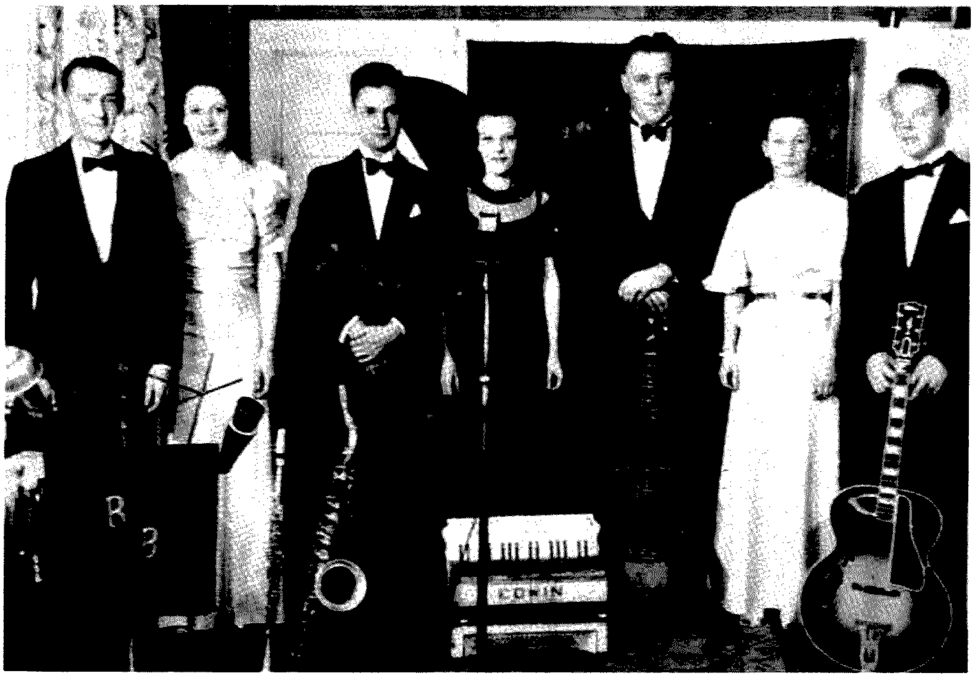
During the long days of June in North Dakota, it stays almost like daylight in the evenings until about 10 pm. A newspaper can, in fact, be read outdoors at that hour without benefit of any artificial light. We drove past the Chief Border Patrolman's home about 8 pm and saw, through his living room window, that he had settled down for the evening to read the *Minot Daily News* which had arrived on the 7 pm train. He had his pipe (which resembled a small saxophone) fired up full blast. We concluded that there would be no more border-patrolling done until the next day.

So, we went back toward the border. We had taken careful note of where we had hastily dumped our contraband, so it was easy to find.

Not a bottle or jug was broken. The smugglers had met the challenge and conquered it. *Note to the United States Attorney for the District of North Dakota:* You silly man, take those indictment forms charging Pa Ness and me with International Smuggling which you have been feverishly typing after reading thus far in this article out of your typewriter and throw them in your wastebasket. The Statute of Limitations on this terrible crime "ran out" forty years ago.

Pa Ness was a good carpenter, so his next project that summer of '31 was to build an eight-by-ten-foot playhouse for his little daughter, Patsy, on the hospital grounds. As soon as the paint was dry, she moved her dolls, her doll buggy, and her other playthings into this structure, which was wired for electricity. The dolls had iron weights attached behind their eyeballs so that they would "sleep" when laid horizontally and would "wake up" when set in a vertical postion. However, these dolls soon fell into a permanent horizontal coma when Patsy lost her lease on this building in less than twenty-four hours when a powerful thought crashed across the synaptic clefts of her father's brain with a blinding flash and ten kilovolts of nervous energy, carrying the following message: *"My God, what a great ham shack that playhouse would make!"*

The doll buggy was quickly wheeled to an undesirable corner of the playhouse and the other playthings were stacked on top of it. Pa needed room for a ham transmitter, a large table on which to set his Patterson PR-10 receiver, a homemade condenser mike (which was built into a leatherbound Thermos bottle), and other



The Rainbow Players, pictured above, performed daily on KGCX. Every day of the year, they left Wolf Point in two cars, towing luggage trailers to carry their instruments, for some town within a 150-mile radius of Wolf Point to stage a play, followed by a dance. Their association with KGCX was a symbiotic one, the radio station deriving free live entertainment each day and The Rainbow Players obtaining a lot of free advertising for their performance that evening in some Montana or North Dakota town.

items of radio equipment.

Every reader who was a ham during the thirties will probably remember that there were three classes of ham operator licenses in that era: the Class C or Conditional license, the Class B (corresponding to today's General Class license), and the Class A, equivalent to today's Advanced Class license.

About 1935, I secured an A license, which permitted me to conduct examinations sent out by mail by the FCC for the Conditional license. Among the many people whose examinations I supervised was a young man named Jim, who shortly thereafter enlisted in the Civilian Conservation Corps, a government, quasi-military-type agency created to provide employment for the myriads of young men who couldn't find jobs during the Great Depression. The enlistees wore khaki shirts and trousers for uniforms, and each camp was commanded by an army officer, usually a second lieutenant.

When the authorities at Jim's camp in Montana found that he possessed a radio operator's license, they immediately named him Camp Radio Officer and placed him in charge of communications. This indoor duty was, of course, much preferred over that assigned, for example, to the unskilled type of enlistees engaged in building the Timberline Lodge in the mountains east of Portland, Oregon, who had to work in the rain and mud, wrestling with the big rocks and huge timbers needed to build that impressive structure.

President Franklin Roosevelt, who never permitted his special presidential trains to travel more than thirty-five miles an hour, clickety-clacked it all the way from the White House to Portland to dedicate the Timberline Lodge project of the CCC when it was completed.

One Tuesday summer morning, Jim dashed in record time to the camp commander's office, bearing a message that he had just copied in Morse code on the receiver provided to the CCC by the government. After rendering a snappy salute, he excitedly handed the message to his boss. In essence, the message was a warning that Major General Jones would arrive on the forthcoming Friday to make a general inspection of the camp.

The commander and his troops had survived previous visits by second lieutenants, and even, on one occasion, by a traveling inspector who held the rank of First Lieutenant. An inspection by a Major General, however, was a horse of a different color. Even the words "Major General" in the text of the message struck terror into the heart of the camp commander each time he

Shown aboard the SS President Roosevelt *in Los Angeles harbor in 1970 are (L to R) Cal Smith W6BRD, retired long-time General Manager of KFAC, Los Angeles, the late Colonel Ben S. McGlashan W6GY, long-time owner of KGFJ, Los Angeles, and Colonel (Dr.) William C. Hess W6CK, author of this article. A few days later, the* Roosevelt *limped into Honolulu with a major boiler problem which required two weeks to repair. With free meals and free lodging provided aboard the ship, none of the passengers was heard to complain about being delayed for fourteen days in the lovely Hawaiian Islands on their voyage around the world. Today, the* Roosevelt *forlornly rusts away in Hong Kong harbor, awaiting a refurbishing which likely will never occur, and, perhaps, dreams of balmy evenings in exotic ports such as Papeete where, ablaze with lights from bow to stern, she awaits the return from shore of her affluent passengers.*

looked at it.

The world has never seen, before or since, such cleaning and sprucing-up activities as were carried on at that camp during the next three days in preparation for the visit by the two-star General. Scraps of paper, down to and including pinhead-sized ones, were hand picked from the entire campgrounds. Government trucks were used to haul 55 gallon barrels of water from a nearby river in an effort to "green up" the lawn in front of the commander's office. Each man's extra pair of khaki trousers was laundered, ironed to a razor sharp crease, and treated with so much starch that they were as stiff as a 1-by-10 board. They were then carefully hung away, to be worn on the big inspection day.

Friday came and went. No officer, not even a second lieutenant, showed up. Saturday, Sunday, and Monday passed with the same result.

Upon investigation, it developed that Jim, with his limited code-copying ability, had goofed. He had intercepted the subject message out of the air; it had not been addressed to the CCC camp at all, but rather to a huge army base a thousand miles away.

This incident had a happy ending, however, since after his CCC hitch Jim enlisted in the U.S. Navy. He spent twenty years as a radio operator and now can copy international Morse code at a high rate of speed—without error.

In previous issues of this magazine, I have related various incidents which occurred during the early history of radio station KGCX. That station was first operated as an unlicensed seven-and-one-half watter, near and in the tiny hamlet (population 25) of Vida, Montana, for a period of two years, beginning in 1924. In 1926, KGCX secured a license and continued to operate at Vida until 1929, when it was moved to nearby Wolf Point, Montana. Continuing its nomadic existence, it moved again in 1942 to Sidney, Montana, where it is now a very successful five-kilowatt operation, with auxiliary studios in Williston, North Dakota.

In addition to having been born in the smallest town in the United States ever to have a standard broadcast station and to being the second oldest station in Montana, KGCX also enjoys the distinction of being, no doubt, the only station ever to have operated with a completely nude crew.

One bitterly cold morning in 1935, KGCX's announcer and engineer overslept, having tarried too long the previous evening in one of the local bars.

Those readers old enough to remember how much *any* job (regardless of how lowly a job it was) was treasured during the Great Depression will understand completely the extreme alacrity with which KGCX's crew sprang into immediate action when they were awakened by station owner E.E. Krebsbach's telephone call with the terse message: *"Get on the air."*

As he had been sleeping nude in the warm basement of the KGCX building (the sleeping accommodations were part of their salaries), the engineer did not stop to put on any clothes, but ran upstairs, out the back door of the building, and through a snowbank, sans a stitch of clothing, to throw a switch on the antenna tower to the required position. He thus became the twentieth century's very first "streaker." The equally naked announcer started warming up the transmitter, a procedure which required that no less than eighteen switches be turned to the "on" position, some of which could be switched on immediately, while others required a delay of at least five minutes.

The engineer was working at KGCX without pay in order to have the "service time" on the back of his First Class operator's license endorsed by Mr. Krebsbach. He needed to prove that he had worked at a broadcast station during the five-year period for which his license was valid. Otherwise, he would have to take the very difficult First Class operator's exam all over again.

Since he had no funds whatsoever, one of the local restaurants gave him his meals "on the cuff," and he eventually repaid their trust. When he left Wolf Point, he went directly to Hollywood to be employed by the Columbia Broadcasting System. He is now retired after spending more than thirty years with CBS. He loves to reminisce about

the old days in Wolf Point.

One summer afternoon in 1935, the controversial Judge Rutherford, who was a radio personality at that time, was speaking over leased telephone wires all the way from Seattle to Wolf Point. He was making a half-hour broadcast over KGCX. Mr. Krebsbach, who was also the gasoline-pump jockey at the Westland Oil Company service station just across the street from the KGCX transmitter building, was propped on a chair outside the service station listening to the Judge. Krebsbach, who was a man of firm political convictions, could stand no more of the Judge's views, and after fifteen minutes of listening, shouted across the street to his technician at the radio station: *"Take him off!"*

When KGCX's power was increased in 1936, all of its 250-Watt equipment was given to nearby hams or junked. This control board was built for the new kilowatt operation by Engineer Harold Klimpel, using only a hand-operated drill and a file. With the new arrangement, station technicians faced toward the south and were able to see into the studio to "ride gain" on the performances of The Rainbow Players, Montana Pete, Stardust, the fortune-teller, and other live broadcasts.

The engineer, painfully aware that interruption of the Judge's speech would result in a forfeiture of the $80 fee (an amount of money valued very highly during the dark days of 1935) tried without success to reason with Krebsbach, and the Judge was cut off the air without a word of explanation.

About the same time, a fortune-teller named "Stardust" performed on KGCX. She always came on the air with a burst of the song of the same name. Stardust and her husband must have found Wolf Point a bit dull compared to their home town of Chicago, but they were probably consoled by the flood of dollar bills that arrived in each day's mail as a result of the lady's broadcasts.

She always arrived at the studio an hour before her broadcast began to set up a "threshing" operation in the main studio. This operation, separating the wheat from the chaff in her daily mail, consisted of holding each letter up to a strong light to see if it contained a dollar bill or a check. Those that did were stacked on the studio piano to be answered on the air during the broadcast. The letters which obviously did not contain a remittance were immediately discarded (unopened) into a big wastebasket.

Stardust's career at Wolf Point came to an abrupt end when the Communications Commission suddenly prohibited fortune-telling on every U.S. radio station. She and other female fortune-tellers (such as "Margo") moved their operations to the notorious Mexican border stations. Dr. Brinkley's famous power stations, located just over the Mexican border from Del Rio, Texas, beamed enough power northward into the United States to light up the street lights in Minneapolis.

Mr. Krebsbach was a sports enthusiast. On those nights when a Wolf Point High School basketball game was to be broadcast, he would telephone whichever technician happened to be on duty that evening at the transmitter and give him the following instructions: *"Lock all the doors and go with 250."*

KGCX was supposed to operate only 100 Watts at night in order to minimize interference to other stations. Krebsbach's instructions to illegally use 250 Watts were obviously designed to obtain the maximum possible coverage for the basketball broadcast, and, of course, the precaution of locking all the doors was taken to prevent a federal radio inspector from entering the building unexpectedly.

During the thirties, a man named Roy Ayers campaigned for election as governor of Montana. KGCX heavily plugged Mr. Ayers' candidacy in eastern Montana. Mr. Ayers was elected, in part because of KGCX's support.

As a reward for his efforts, Mr. Krebsbach woke up one morning and found himself the new State Railroad Commissioner of Montana. The appointment made it necessary for the Krebsbach family to move to Helena, the state capital, for the duration of his term as a state official.

While Krebsbach was absent from Wolf Point, a man who was not very well liked by KGCX's staff was appointed manager of the station. This man was actually about 99% an advertising salesman for the station and 1% manager. All decisions of any importance were made by Mr. Krebsbach in Helena via telephone or mail.

One day, the substitute manager decided to repair one of the station's extension cords which was broken in half. He needed this cord to operate the Christmas tree lights which he was stringing around the studio. He carefully scraped all the insulation from the ends of the four wires of the broken cord. He then proceeded to *twist all four bare wires together* and taped the resulting splice neatly. The other KGCX employees present watched the entire procedure silently and offered

If those readers old enough to remember movie comedian Ben Turpin thought he was cross-eyed, they should have seen the pilot of the Westland Oil Company's corporate airplane, shown above. He could see with both eyes, but not with both eyes at the same time. This visual defect caused him to look at the tail of the airplane when landing, a procedure not looked upon with favor by his passengers. The author saw one of his crashes as it happened. This Ryan monoplane, serial number 23, was constructed in an old fish cannery in San Diego by the Ryan Aircraft Company and was flown for practice by Charles A. Lindbergh while he was awaiting delivery in San Diego of his "Spirit of St. Louis," an exact duplicate of the above airplane, bearing serial number 29. Westland's airplane, with the huge letters "KGCX" painted on the underside of the wing, was the object of a long search by the North Dakota Historical Society and finally was found in an old barn in North Dakota in 1957 with its wings sawed off. The Society paid the owner nearly as much for it as it had cost way back in 1927. U.S. Air Force personnel at Minot, North Dakota, restored it to absolutely new condition.

no suggestions.

The next step, of course, was to test the cord to see if the repairs had been properly done, so he plugged the proper end of the cord into the nearest wall outlet. After the minor explosion, fire, and smoke which resulted had subsided, he plaintively asked the other employees: *"What did I do wrong?"*

In the early days of radio in Los Angeles, my late friend, Ben McGlashan W6GY, was illegally broadcasting phonograph record music with his ham rig. He was a close friend of the radio inspector in charge of the Los Angeles office. The RI didn't want to prosecute his good friend for the crime of operating a radio station without a license, so he completed the application (now the application is as thick as a small book, but in those days it consisted of only one page) for a standard broadcast station. He typed in Ben's name, address, and the other details, and asked Ben to sign it. This would make McGlashan's broadcasting legal and solve a nasty problem for the RI by avoiding the prosecution of a friend.

However, McGlashan refused to sign the document, stating that he didn't want to own a regular radio station. The argument between him and the RI continued for at least fifteen minutes before Ben signed the application. Signing this document made McGlashan at least two million dollars in later years. Upon receipt of the license, he established KGFJ in the Odd Fellows Temple in Los Angeles, paying the Los Angeles City Dye Works two hundred dollars for the 50-Watt transmitter which was already operating in that building.

The late Freeman Lang, a prominent Los Angeles ham in the early days, could imitate the loud noise created by a rotary spark-gap transmitter in operation more realistically than the machine itself. He was also a good friend of McGlashan's and was always the master of ceremonies and radio announcer at the live broadcasts of the premieres of new movies held at various theaters in Hollywood. Mr. Lang, dressed in a tuxedo and high silk hat, would greet and interview the movie stars of that era who arrived in chauffeur-driven Lincolns, Duesenburgs, Minervas, Rolls Royces, or sixteen-cylinder Cadillac limousines or town cars. In the latter-type vehicles, rarely seen today, the chauffeur sat exposed to the weather while the VIP passenger was seated in a deluxe compartment at the rear of the automobile and communicated with the driver via telephone.

Around 1928, KGFJ experimented with television broadcasting, using, of course, the scanning-disc type of transmitting and receiving equipment. A friend in Santa Barbara, California, had one of the very few television receivers then in existence. Telephone communication was maintained with him during the experimental telecasts. When one of the KGFJ engineers asked the viewer in Santa Barbara, "What am I doing now?", and the correct answer, *"You're putting your hand into the picture,"* came back, successful telecasting over the ninety miles to Santa Barbara had been confirmed.

About the same year, Kenneth Ormiston, a radio engineer well known for his close association with the famous and flamboyant evangelist Aimee Semple McPherson, was staging closed-circuit television demonstrations at the famous Coconut Grove nightclub, located in the Ambassador Hotel in Los Angeles. Due to voltage surges in the electricity at the hotel, the two separate motors which he used to whirl the transmitting and receiving discs would not operate at the same speed, and the picture would fall "out of sync" and, at times be hardly recognizable.

Ormiston took drastic action to solve this problem. He chopped a hole through the wall which separated

the transmitting and receiving equipment, ran a long steel shaft from one room to another, and operated this shaft with only *one* motor, giving the discs no alternative but to operate at the same speed.

Some years later, Lang moved to Honolulu, where he became a yacht broker. He and McGlashan maintained an autostart-teletype radio circuit between his office and McGlashan's posh home in Beverly Hills. This circuit was in operation twenty-four hours a day, so that each could leave the other a typed message whenever desired.

McGlashan once came within a hair's breadth of selling KGFJ for fifty thousand dollars. With pen in hand, he was ready to sign the bill of sale when a guardian angel must have hovered over his head and said: *"Don't do it."* This was extremely fortunate, as he retained this profitable station until 1964, when he was able to sell it for one and one-half million dollars.

The daily interest on $1,500,000.00 is a substantial sum, so as soon as he was handed a check for that amount in payment for his radio station, McGlashan hurried to his bank to deposit it so it would start drawing interest. A young teller gave him a receipt for the deposit. As he was leaving the bank, he suddenly reversed his direction and went back into the bank after noticing that the receipt was only for fifteen hundred dollars.

With its call letters now changed to KKTT, KGFJ was resold in 1979 for more than five million dollars.

A few weeks after the Japanese attack on Pearl Harbor, McGlashan enlisted in the Civil Air Patrol and flew his Stinson airplane to Brownsville, Texas, accompanied by 20th Century Fox's famous movie producer, Henry King, flying his Waco aircraft. Their planes, flying daily from Brownsville, with twenty-eight others under the Department of Defense, were used for anti-submarine patrol duty in the Gulf of Mexico, ranging as far south as Tampico, Mexico.

Each plane had a hundred-pound bomb suspended under its fuselage. The bomb release mechanism was triggered by the pilot, who jerked on a clothesline-type rope which ran to the cockpit of each airplane. These thirty planes sank two German submarines, scared hell out of a lot of others, and reported, via their two-way radios, the location of every enemy submarine which they spotted. The U.S. Navy followed up those leads with deadly results.

En route to Australia in 1972, I visited Freeman Lang KH6AX, who had a combination yacht broker's office and ham shack at a yacht harbor in Honolulu. He had a Morse telegraph sounder installed in a resonator box, which traditionally always had to have a Prince Albert tobacco can wedged behind it to amplify the clicking sound produced by the sounder. He had driven all over the island of Oahu trying to buy a can of that brand of tobacco, but without success. He finally wrote to the tobacco company on the mainland, telling them of his problem. They solved it by shipping him a whole case of empty Prince Albert cans at no charge.

He told me that he would buy me the best steak dinner available in Honolulu if I could "read" what he would send me on the sounder, which was connected to a Vibroplex. He added that he had maintained his ham shack at the yacht harbor for six years, and that no visitor to it had yet been able to read American Morse code well enough to decipher what he had sent to them.

I told him to go ahead and start sending, purposely failing to mention that I had been employed for a number of years as a railroad and Western Union telegrapher when I was a young man. To make it as difficult as possible for me to copy the sounder, he ripped off a long string of dots at about fifty words per minute. They translated into "Her Irish eyes cry cos she is so sorry," a statement which, in American Morse code, is composed entirely of dots without a single dash.

That evening at the nearby Ala Moana Hotel, I enjoyed the best steak dinner I have ever eaten, and KH6AX paid the bill.

The next day, my wife wanted to attend the "Hawaii Calls" program which is produced at a Honolulu restaurant. Not being particularly interested in the program being taped on an elevated stage before a large audience, I went to the long bank of audio equipment along one side of the stage to talk to the engineer in charge. We didn't exchange names but I did give him a glimpse of my First Phone card so that he would know that he was talking to someone who might be somewhat knowledgeable about what was going on.

Imagine my surprise when, after fifteen minutes of conversation, I discovered I was talking to Freeman Lang, Jr. Quite a coincidence to visit a well known ham and then accidentally meet his son the next day in a city with a population of a third of a million people.■

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Meet the Little Giant

—everyman's sheet-metal tool

The June, 1979, issue of *73* had an article by WØIHI on building custom-configured boxes. It was based upon the reasonable assumption that the average amateur does not have access to heavy-duty sheet-metal bending equipment. I recently came across a piece of equipment that made me see the situation from a different viewpoint, however, and this article is based on the use of this "light-duty" equipment that is within the reach of just about everyone.

The piece of gear I am referring to is the Little Giant Brake for forming and bending. Its name is fairly descriptive, and it really fills the bill for light-duty bending. It can make smooth bends to 90 degrees in metal up to 16 gauge (that's about .060"). It can handle material up to 18" wide, and the price is about $20.00. When a few hand tools that most of us already have are added, some really nice enclosures can be produced for a buck or two.

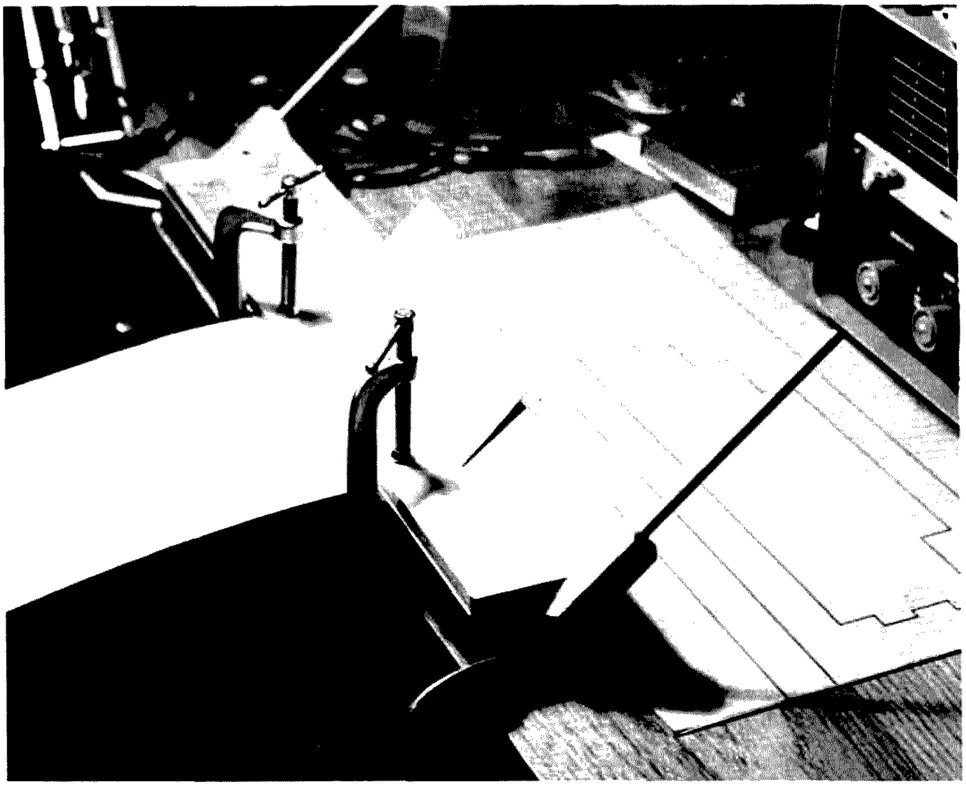

Photo A. The brake clamps to the workbench and the brake bar is clamped down over the sheet metal, here bent to 45 degrees for a keyboard top.

Mama is really a soft touch at times, so it took only some mild persuasion before I became the proud owner of this sheet-metal brake. Now, it doesn't make dutch bends, joggles, and other very exotic bends, but it can make a nice smooth bend that I have never been able to duplicate with a bending block and a hammer. The ability to make a nice crisp bend without waves or hammer marks can put your efforts in a class with commercial-quality cabinets.

I have bent a few boxes over the years, and, being one of the world's laziest hams, I have come up with a few shortcuts along the way. The Little Giant was the excuse I needed to try passing a few of them along, so here goes!

Most shortcuts start in the planning or design stage, and this is no exception. Your needs will dictate your design, and what goes inside will determine its size. If the unit inside is to be ac-powered, for example, the transformer will probably be placed near the back along with the fuse socket and power

cord. Controls will be at the front and the circuit board will occupy the major portion of the enclosure. (I am assuming that you will use either a PC board or perfboard for the majority of your circuits.) Once you know what's going inside, the shape and size is pretty well nailed down, but don't forget the front panel and controls. The front panel markings may very well demand the greatest amount of area, and this may dictate your final design and size.

I decided to try to illustrate my ideas by building an item that the shack has needed for a while: a keyboard enclosure. The shape is one that everyone will be familiar with, and I've found nothing commercially available that offers the room needed for expansion. It helps, of course, that its basic shape is easily perceived as the "clamshell."

I might point out that the brake will make bends slightly over 90 degrees, but we can tighten them up after we take them out of the brake. It's also worth remembering that every bend does not have to be 90 degrees. By opening or closing the bends, we can make some enclosures that look pretty exotic. You are limited only by your imagination when it comes to dressing up your enclosure.

Fig. 1 is a cross section of the tool itself showing the relationship of the sheet metal and the brake bar, but with clamps omitted for clarity. The left half of the tool (consisting of the brake bar and the fixed angle) and the sheet metal are held in place and do not move. The right half is movable and can force the metal up to about a 90 degree angle if you need it. It is possible to stop at any point between that flat and the full up position. Slight adjustments may be made in the angle after removing the metal from the brake.

Notice that in Fig. 2(a) the bends are a full 90 degrees, while in Fig. 2(b) one shallow bend has been added to slant the keyboard face both for better appearance and to aid in key identification if your skill in typing is more see than touch. The base also can be made to overlap the top by 1/8 to 1/4 inch, as in Fig. 2(c). This will provide a shadow effect that is very pleasing. Making the base a darker color than the top also adds to its appearance—it can sometimes make the difference between a box and an enclosure.

There's lots of truth in the old saying that "a coat of paint hides yesterday's mistakes." After painting, add a few well-placed lettering decals and your enclosure begins to look like a commercially-made unit.

Plan ahead, and put in enough room for the unexpected. Remember, the highest part inside doesn't always determine the size. Sometimes it's the front-panel lettering, but it could be the fan in back or a meter face that decides the finished size.

I like to start out with the front panel and place all of the parts in the positions they will occupy. One of the advantages of rolling your own is that you can change your mind at several points about layout or size without affecting your pocketbook. Another good point is that adding extra room costs little or nothing. This whole project cost me less than five dollars for material, with a lot left over.

After establishing size and shape, it's time to put plans on paper. One of the best shortcuts that I know of is to make the layout on paper that is glued directly to the metal to be worked with. This method offers several real advantages. It

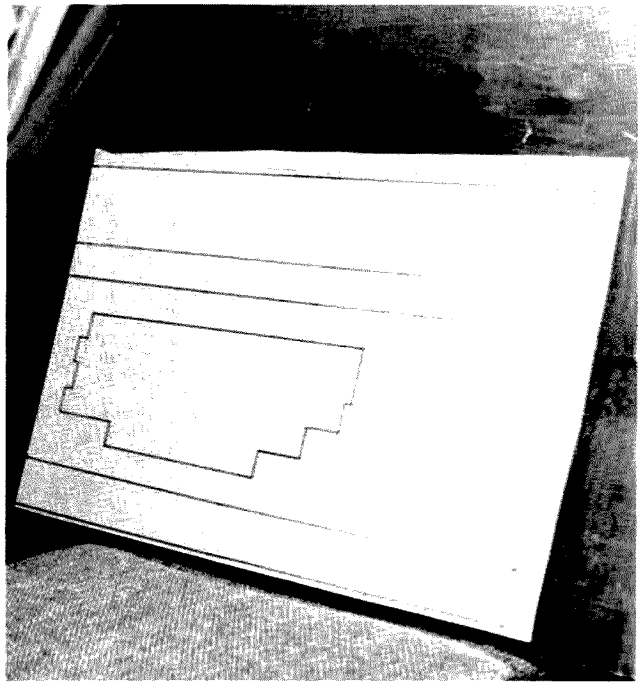

Photo B. The layout is glued to the sheet metal to guide cutting. It is glued flush left with the factory-straight left edge.

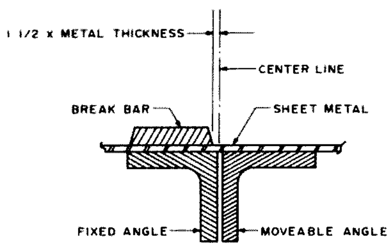

Fig. 1.

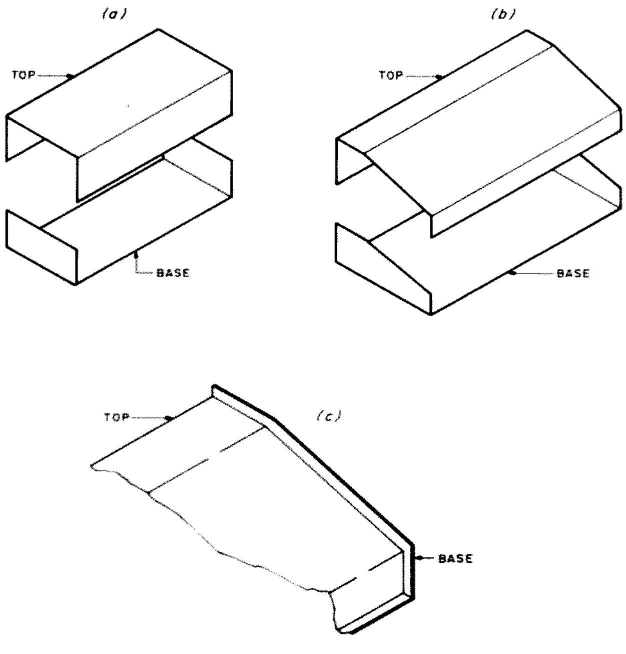

Fig. 2.

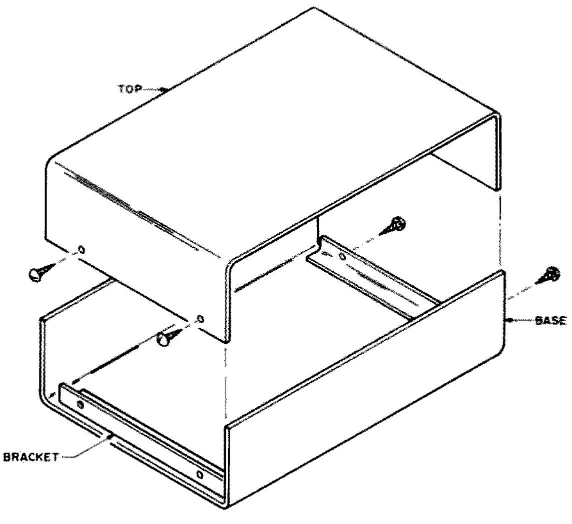

Fig. 3.

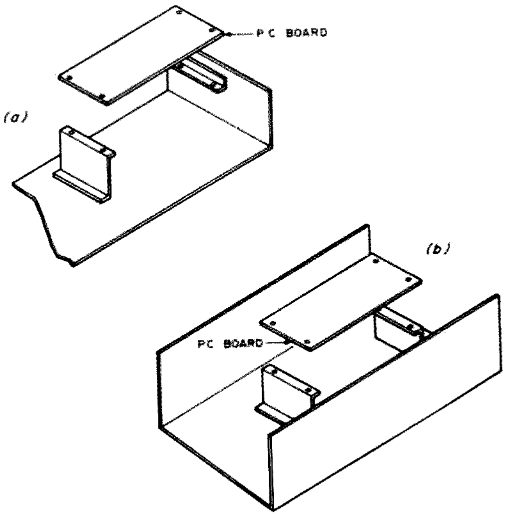

Fig. 4.

eliminates the errors that sometimes occur when transferring a layout from paper to metal; notes and how-to information can be added directly to the project so that they are always right in front of you; and, finally, when you are done, peeling the paper off reveals smooth, unblemished metal, free from scratches and nicks.

Let's assume that we have all of our hole centers, outlines, bend lines, and pertinent information on our layout. Gluing the paper to the metal takes only a few moments. (Rubber cement can be obtained anywhere, and a 4-oz. bottle will last through several projects.) Lay your paper layout on the metal with the outlines matching the edges of the metal where possible. This is assuming that you're working from a piece of metal with a couple of factory edges. If not, positioning should be done to save for the next job as much metal as possible.

Once in place, weight it down leaving one end loose. Spread the rubber cement on the metal after peeling back a corner. Cover the metal thoroughly, but not heavily, or you'll have lumps when you're done. Allow the paper to fall back on the metal, smooth it down by hand, and you are ready to glue the remainder of your layout. Remove the weights, apply cement to the rest of the metal, and smooth out the paper very carefully to prevent any wrinkles. Holding the far edge up with the opposite hand while working from the edge already glued is the best way to prevent it from sticking prematurely. Rubber cement acts like contact cement, so don't allow the paper to touch until it's in the right place; otherwise you may have to start over again. (If you have used heavy stock, like wrapping paper, you can peel it off without losing your layout, if you do goof.

At this point, it is a good idea to take all of your components, place them on the layout, and recheck clearances. It takes only a few minutes, and it is cheaper to catch a mistake here than after you start cutting and drilling.

We have one more design consideration to make, and that is how to hold the top and base together. The answer is fairly easy. Today, even airplanes are stuck together with glue, so we'll trust a tube of Super Glue to solve this problem. See Fig. 3. Cut small scraps of metal into strips about 2" by 1". Bend them into 1" by 1" by 1". Position these tabs on your cover, drill through top and angle at the same time, fasten together with sheet-metal screws, and you're ready to glue them to the base.

Put the top in place to make sure the tabs will position it correctly. Then remove the top, add one drop of adhesive to each tab, and place the top back into position. Press the tabs and base together for about 10 seconds, and you're done with that problem.

A couple of items worth remembering: Store the Super Glue in an upright position or it doesn't last long, and when using it, use one drop only at each position. (Any more and it doesn't work.) And it might be a good idea to have a bit of solvent on hand for "design changes"!

The same technique also can be used for mounting circuit boards, large capacitors, and even small transformers. No fancy measuring is required: Just bend up a couple of brackets as in Fig. 4, fasten them to the circuit board, position and glue. If you wish to mount a bulky item underneath the board, just make the brackets a little taller. You can even double stack your circuit boards by gluing brackets to existing brackets.

Fabrication is the next step. It is best to drill and cut every hole in the metal before bending. Centerpunch and drill every hole with an .060"-diameter bit before drilling larger holes. This prevents the larger bit from skipping out of a punch mark and marring the panel.

Large or irregularly-shaped holes can be cut with a nibbler or a saber saw. Clamp your metal to a thin piece of wood and saw the metal and the wood at the same time. This will keep the saw from ripping or bending the metal. A hole will be required for the saw blade or the nibbler. The nibbler will require a slightly larger hole than the saw blade.

It is easier to file away burrs before bending. One more check with the parts is worthwhile, and don't forget to double-check the direction of your bends. If everything fits and doesn't threaten to interfere after bending, we're ready to go.

For most enclosures to be built, bend allowance can be ignored. With the thickness of metal usually used, simple cabinets will come out OK without worrying too much about the stretching of the metal. If you start using metal more

than .030" thick, things may start happening, however. The brake can make a completely square bend, but the metal may fracture and/or the brake could be damaged by the heavier metal.

It is best to use a rule of thumb of 1½ times the metal thickness. To get the bend line in the center of the bend, it must be positioned with some accuracy. First, leave the bend line back from the pivot line of the brake by one metal thickness and the brake bar back from the bend line by half the metal thickness. The bend that results is the tightest I can get without the possibility of problems. Bend the metal too tightly and the outside of the bend stretches, possibly fracturing, while the inside compresses, with possible damage to the brake. The problem is worse with thicker materials and is more noticeable in aluminum than in steel.

Photo C. The keyboard is placed in the base and positioned so that the top fits over it correctly; it then is glued down.

The brake is made of aluminum, a fairly hard alloy, but it *is* a light-duty tool, so play it safe. Baby it a little. The people who make it say it's OK to use it on aluminum or steel up to .060", but make sure you use mild steel. I normally confine my use of steel to .030" or thinner as a hedge against damaging my brake. (Softer metals such as brass, copper and aluminum should be OK up to .060"; just don't force them.)

Setting up the Little Giant is simple. It has mounting holes in each end bracket for permanent mounting, or it may be clamped to the bench with C clamps. I use the clamps as the bench space is at a premium, and Mama doesn't like holes in the furniture. Photo A shows the brake in some detail. The fixed section is held to the bench with the large clamps and the brake bar is used to hold the work in place with smaller clamps. The movable section should be positioned away from you so that you can see the work as you bend it. It's a good idea to cut and bend a few test pieces to get a feel for what happens to the metal and how much you'll actually have to fudge with your bend lines. It will be quite educational and decidedly cheaper than making mistakes later.

Aluminum is easy to work with as long as you don't try to use one of the harder alloys. I generally prefer 2024T3 or T4. The 6061 alloy is harder, but will do in a pinch. The harder alloys are more difficult to work with and generally are unnecessary for our kind of application. The dead soft material, available in sheets at hardware stores and lumber yards, is OK for small enclosures, but will not be rigid enough for larger ones. It requires the addition of "stringers" (small angles to add rigidity) glued to the backside of larger unsupported panels.

Only a few hand tools are necessary. The drill can be an el cheapo. It should handle a step bit up to ½" in soft materials. The nibbler requires about 3/8" diameter holes to get the head through. Don't use the step bits on harder materials with a ¼" drill, or your drill won't last too long. If you intend to go to flush screw heads, you'll need a countersink, a set of taps, and the appropriate drill bits. They can be purchased in a handy little plastic kit which has the taps, the correct bits to match the taps, and a tap handle. The pieces can be purchased individually at some savings. (You may elect to use panhead sheet-metal screws and eliminate them entirely.)

A rat-tail file, a triangular-shaped one, and a half-round file will do nicely for cleaning up burrs and holes. A small Shur-Form plane is nice for corners and ragged edges, but the files will do the job just as well. They're just a little more work.

Aviation shears are best for cutting out your basic blank. They are available in left cut, right cut, and straight cut. It would be nice to have them all, but I get along with one set of straight cut. Most of the work is straight lines, and it's only unhandy, not impossible, to cut curves with the straight cut shears.

To summarize: With slight variations in shape, slope, and size, you can develop some real eye-catching ideas. The top can be made in several pieces to add to the accessibility. The rear apron can be made as a separate piece and glued to the base so that the power cord, fuses, and permanently-mounted items do not have to come off with the cover. The rear panel of the cover can be shortened or notched to clear those items.

Another approach, where

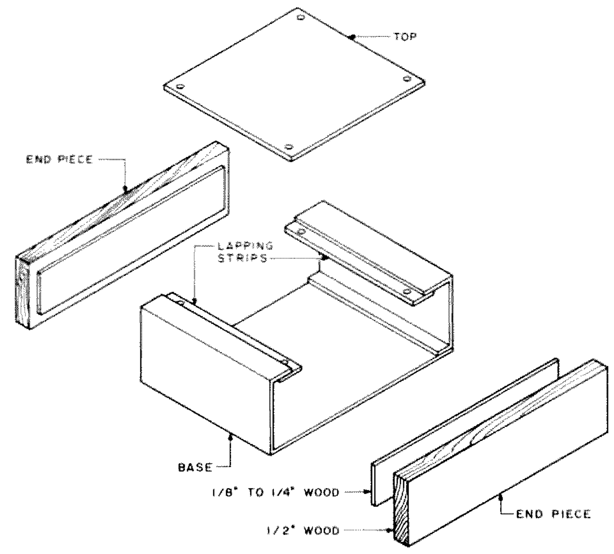

Fig. 5.

shielding is not a consideration, is to make the ends of wood. (See Fig. 5.) This allows us to make the front and rear as integral parts of the bottom. The top is then the removable piece. It can either overlap or be made as a flush joint. The flush joint is the more attractive of the two and only slightly more difficult to make. Strips are glued beneath the lips of both front and back panels. Set the top panel in place and align it to the front and back panels. When everything looks good, drill through both pieces and fasten together with sheet-metal screws. If you want to dress it up, this would be the place to use flat-head machine screws for a completely flush panel.

Don't skip painting the finished product. Many projects that look looked "ho-hum" before will look really nice when painted. If zinc chromate is available, use it as a base coat before adding color coats. It is easier to spray several light coats than risk runs from too much at one time. It is always disheartening to have a job almost done and then have to sand out a paint run or, even worse, have to strip it back to bare metal and start over. Runs are almost always a sign of impatience.

As for colors, a dark color for the bottom and a light color on top can be quite attractive. You might try one of the old favorites like black crinkle, and a light cream or blue on the top. The crinkle sprays just like any other paint, but wrinkles up in a random pattern as it dries.

Lettering is available from your local electronics store or art supply house in the form of decals or rub-on types. It would be a good idea to check prices at both places. You might be wise to buy some spray fixative from the art store to put a clear coat over the lettering to keep it from rubbing off.

Everyone runs short of ideas on occasion. If that should happen to you, try a little amateur espionage. Slip down to your local appliance or ham store and eyeball the other guy's solution to a similar problem. If you keep your cool, they'll never know that you are 007. ■

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On Ten FM

—home of the free, land of the brave

The word is out: 10-meter FM is definitely the place to be. Want to escape the "appliance operators" and the "twist two wires together, you're on the air" crowd? Well, up on 29.6 MHz you'll find a hearty breed, mostly experimenters and tinkerers who've converted, modified, and cajoled old commercial FM gear or hamband equipment into frequency modulating on 10 meters. The combination of channelized operation (convenient), noise-free FM reception (easy on the ears), and roller-coaster 10-meter propagation (fun!) is most intriguing—it's really a mix of HF and VHF operation—you can sometimes work coast-to-coast with QRP, and there are FM repeaters to play with, too.

To give you a sneak preview of our plans, we're going to start with two inexpensive, readily-available circuit boards (the guts of an 11-meter CB transceiver and an FM scanner), mix thoroughly, and recycle into a compact, 6-Watt, channelized FM transceiver for 10 meters, with all the usual amenities such as noise-operated squelch, PTT, repeater offsets, and even a scanner. Note that this will not be your usual CB-to-10 conversion!

At this point, you may logically ask: Where are we going to get the raw material for our project? Fortunately, we won't have to scout around for the right CB transceiver to convert. By "right" I mean that type of CB transceiver which can be converted to 10 meters most easily, with the fewest changes and modifications. Typically, the 3-crystal PLL type of CB fits the bill.

Now, the first unit that we're going to use in this project consists of the main circuit board of CB transceivers that were made for Hy-Gain, Midland, and other manufacturers and are of the latest 3-crystal, PLL, 40-channel type. These little gems are top quality boards which measure only about 5" × 6" and come complete except for some external, easily added items such as volume and squelch pots. The boards can be converted easily to 29.6 MHz (or any other part of the 10-meter band) with only one crystal change. You'll get about 6 Watts of rf output from them in FM service and have full receiver sensitivity to boot. The CB boards are available from several sources by mail, at a low price. Specify the CB circuit board with a 40-channel switch. The second board, which we'll use for FM reception, will be described in a later section.

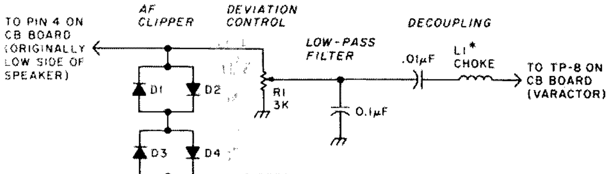

*Fig. 1. Improved FM modulator. *Choke value is not critical. 100 uH to 2.5 mH is suitable.*

Now, before you get the wrong idea about the complexity of this project, let me just say that I'm no electrical engineer—I probably couldn't design a circuit to save my life! What does appeal to the ham in me is to take already existing circuitry and equipment and blend them to get something new and different.

The first thing to do after ordering the CB circuit board is to send for the one crystal you'll need to get on 10 meters. There are, however, two questions that need to be answered: What frequencies are used for 10-meter FM operation and how does this relate to the crystal we'll need? There is a 10-meter FM band plan which is universally observed. The national simplex and calling frequency is at 29.60 MHz, with an alternate at 29.50 MHz. Repeater pairs are found at the following input/output frequencies: 29.52/29.62, .54/.64, .56/.66, and .58/.68 MHz.

The repeater output frequencies also are used sometimes for simplex operation on a non-interference basis—you'll always be able to tell if you're QRMing a repeater. Always avoid simplex operation on the repeater input frequencies for obvious reasons! At present, all 10-meter FM activity happens to be between 29.5 and 29.7 MHz, although narrowband (±5 kHz) simplex operation is allowed down to 29.0 MHz. In summary, then, what we'll need is at least 200 kHz of gap-free coverage, in 20-kHz steps, from 29.5 to 29.7 MHz.

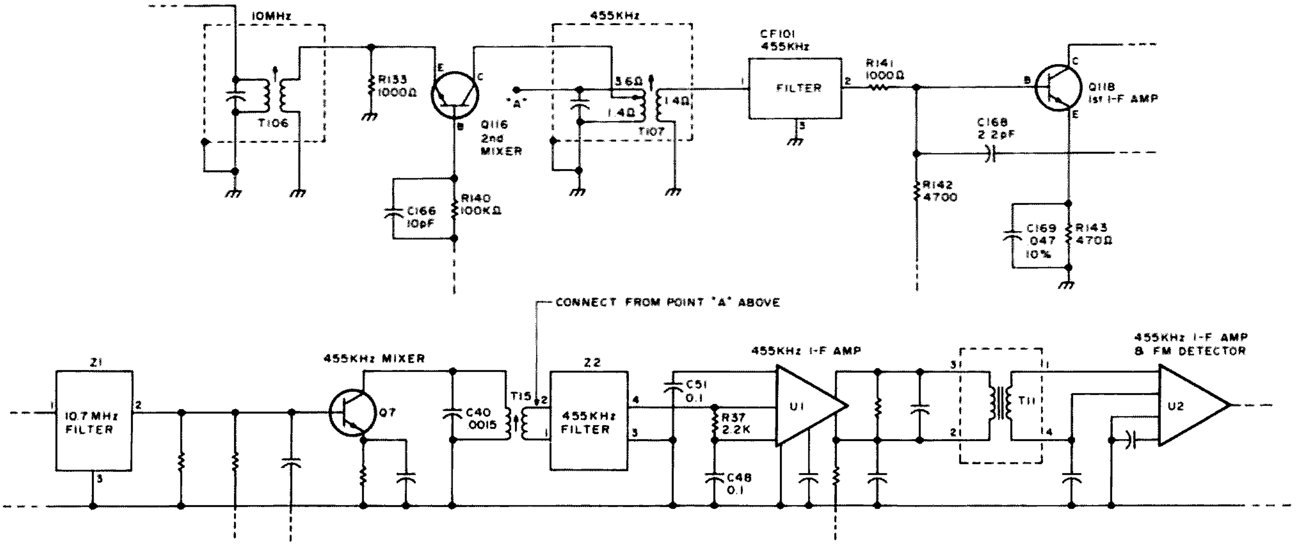

Fig. 2. Partial schematics, AM i-f strip (top) on CB board, and FM i-f strip on scanner board.

Since the 10-meter FM portion lies at the upper edge of the band, I wanted channel 40 to come out at 29.7 MHz to avoid wasting any channels. This ensures continuous coverage, in 10-kHz steps, down to 29.5 MHz, and channel 1 takes you all the way down to 29.26 MHz for any future simplex FM activity. Also, with this scheme, the channel frequencies are easy to figure out. Just take the channel number, add 30 and hang 29. in front of it. For example, channel 30: 30 + 30 = 60; placing 29. in front gives 29.60 MHz.

Some Improvements

A previously published article covers the theory of operation of these CB boards, selection of crystal frequency, and details of setting them up for FM operation.[1] In this article, I will describe a different approach to the conversion, particularly on the reception side, but you should refer to Reference 1 for the basic conversion information.

Firstly, crystal X101, originally 11.8066 MHz, should be changed to 12.5716 MHz to get channel 40 onto 29.7 MHz. Secondly, to improve the audio punch on transmit, I've modified the FM modulator circuit a bit and added a full-wave audio clipper and low-pass filter. See Fig. 1. The combination of two stacks of silicon diode clippers provided the right amount of clipping for my particular microphone/CB board combination, i.e., about 2 × 0.7 volts = 1.4-volt clipping level.

One stack of germanium diodes and one stack of silicon diodes would give a 0.3 V + 0.7 V = 1.0-volt clipping level, for example. The combination of R1, the deviation pot, and the 0.1-uF capacitor comprises a low-pass filter to eliminate some of the crud which is generated by the clipping. The clipper provides a very worthwhile improvement in average deviation level (analogous to average modulation percentage on AM). Also, I've used a choke instead of a resistor to feed audio to the varicap circuit to improve audio quality. Finally, for slightly more rf output, try jumping R131 (10 Ohms) on the CB board.

FM Reception: Plain or Fancy?

The previously referenced article describes an IC limiter/FM detector/noise-operated squelch circuit for FM reception in conjunction with the CB board. However, I chose a different route to FM reception. My path started many months ago at a hamfest where Science Workshop was running a display. One of their sale items was an E. F. Johnson Mono-Scan UHF-FM scanning monitor receiver board. These compact units come complete with front panel and all controls and lack only a speaker and case. They can be run on 12 V dc or 117 V ac if you add a step-down transformer, as the rectifier, filter, and regulator are built in. Its double-conversion FM i-f strip uses two filters and two ICs for hard-limiting and quadrature FM detection; the squelch circuit is noise-operated.

The Mono-Scan can run through eight UHF frequencies (it requires one crystal per frequency) and has the usual scan skip/lock-out switching arrangement and channel light indicators. The units measure about 6" × 7" × 2"; their frequency coverage in stock form is intended for the 450-MHz commercial FM band, but they can cover the 70-cm amateur FM frequencies, too. The scanner boards also are available by mail at very reasonable prices.[2]

What interested me even more, though, was the fact that the scanner's i-f frequencies, 10.7 MHz and 455 kHz, matched those of the CB board. This pointed toward the possiblity of mating the i-f strips of the two boards to provide FM reception: The CB board would be the tunable front end and first i-f amplifier and the scanner would provide further amplification, limiting, and FM detection. I felt that this combination would yield superior FM reception due to the use of proper i-f bandwidths in the receiver.

Briefly, a narrowband, ±5-kHz-deviated FM signal actually turns out to be about 13.6 kHz wide, because with FM signals you must consider at least the first *two* sets of sidebands. Contrast this with an AM signal where only one set of sidebands is even generated. This means that for optimum deviation acceptance of fully-modulated FM signals, least audio distortion, and greatest noise suppression during full deviation, your FM receiver

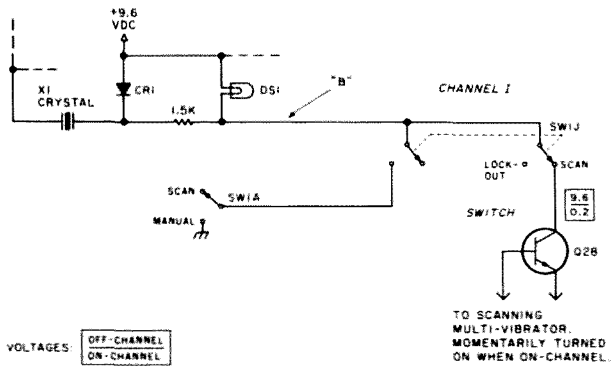

Fig. 3. One of the eight scanner board circuits.

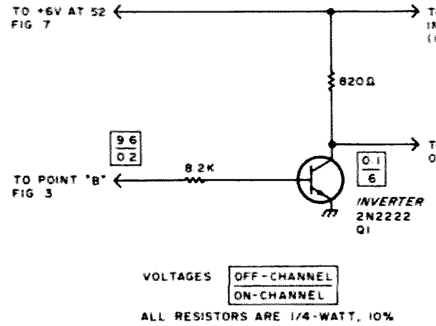

Fig. 4. One of the eight inverter circuits.

must be at least 13.6 kHz wide. The scanner has such an FM filter on board, so let's try it!

The next question is, of course, will it work? It was easy to find out—all it took was a short piece of coaxial cable running from one board to the other. Refer to Fig. 2 for partial schematics of the AM and FM i-f strips. For various reasons, I chose to "cross over" the signal at 455 kHz rather than 10.7 MHz. Incidentally, this sort of hybrid match will work with other receiver/i-f strip combinations as well, as long as they have an i-f frequency in common.[3]

Getting the scanner board up and running is no problem—you'll need only a speaker and 12 V dc. A schematic and parts location diagram is provided with each scanner. Plus 12 V dc from pin 20 on the CB board goes to the plus side of capacitor C79, a 1000-uF unit. The negative power lead can be applied anywhere along the underside rear edge of the board. The speaker goes from the negative side of capacitor C66, a 330-uF unit on the left side of the board, to the power supply negative lead. To temporarily interface the CB and scanner boards, simply run the inner conductor of a short piece of coaxial cable from terminal 1 of CF101 on the CB board to the high side of the secondary of transformer T15 on the scanner board. Ground the shield at both ends. In this way, you can temporarily run both the AM and FM i-f strips simultaneously to make sure that everything is perking OK. You will note that this combination is quite hot in the sensitivity department—the FM i-f strip has enough gain to limit on noise alone.

After you are satisfied that all is well, you may make a permanent connection as follows: To disable the AM i-f strip (we want all of the signal to go to the FM i-f strip), remove AM i-f filter CF101 from the CB board and move the coax connection to the high side of the primary of transformer T107 on the CB board. This is Point "A" as indicated on the schematic in Fig. 2 and was selected as providing the best impedance match to the FM i-f filter, Z2, on the scanner board. Cut the foil from the high side of the secondary of T15 to filter Z2 and remove the 11.186-MHz crystal, Y1, from the scanner board.

Receiver alignment isn't much different than before: Using a weak (noisy) signal, touch up L112, T106, and T107 on the CB board for maximum quieting and ditto for T111 on the scanner board. T112, the FM detector adjustment, should be set for maximum audio recovery consistent with minimum distortion. Keep the alignment signal as small as possible during adjustments. You can expect better than 0.5-uV quieting sensitivity and a steep quieting curve if you do a careful job on the alignment—spend some extra time here; it's worth it.

A few items will finish 'er up: You can increase the noise-operated squelch sensitivity by changing R66 (1k Ohm) to 150 Ohms and R65 (6.8k Ohms) to 620 Ohms.

Scan 10-Meter FM, Too? Yup!

All those blinking lights on the *scanner* intrigued me greatly—wouldn't it be neat to have a scanning FM receiver on 10 meters? By being able to listen to both simplex frequencies and all of the repeater outputs, it would be easy to spot band openings as well as to keep tabs on the gang. Also, it might be possible to select transmit frequencies from the scanner front panel with the push of a switch.

A look at the scanner schematic revealed that a multivibrator circuit drove a string of eight transistors, one for each channel, one at a time in sequence, to provide a stepping action from one channel to the next. Each of these "switching" transistors is set up to provide a ground for both the appropriate crystal and channel indicator light when momentarily "addressed" by the multivibrator. The presence of a signal unsquelches the receiver and stops the scanning action; when the squelch closes, scanning action resumes.

Putting a voltmeter across one of the transistor collectors showed that the voltage swung from +9.6 V dc when off channel to +0.2 V dc when on channel—the latter corresponds to a grounded condition, being close enough to zero volts. Any possibilities of interfacing the scanning circuit with the CB board would depend on the logic and voltage levels needed by the CB board's PLL frequency synthesizer circuit for channel selection; i.e., what polarity and voltage levels would be necessary?

Going back to the CB board schematic, the following information was gleaned: The PLL divider circuits require about +5 V dc on each divider gate to become activated (turned on) and less than +0.2 V dc (ground) or an open line to be deactivated (turned off). Looking back at the last paragraph, it's clear that not only are the logic levels backwards on the two boards, but the voltage levels are wrong, too. Therefore, some sort of interface circuit would have to be developed that would: a) invert the logic levels, and b) drop the voltages from 9.6 V dc to 5 V dc.

Fig. 3 shows just one of the scanner's eight identical switching circuits;

each one operates as a grounding switch when addressed, its collector swinging from 9.6 to 0.2 V dc. Fig. 4 is an inverter circuit which was figured out after some head scratching and pencil biting. This simple NPN transistor circuit has its base circuit hooked to the collector of the scanning switch transistor at point B of Fig. 3. As the scan transistor goes from 9.6 V (cut off) to 0.2 V (conduction), our inverter does just the opposite, swinging from 0.1 V (conduction) to 6 V (cut off), which, as we'll see later, is close enough to what the PLL needs. I used inexpensive 2N2222 transistors for the inverters, of which we'll need eight, one for each scan channel. Switch SW1A on the scanner board (Fig. 3) is the scan skip/lock-out for the first scanner channel, and SW1J is the Master Scan/Manual switch.

The next question is how we propose to get these now proper voltage and logic levels to the right combination of PLL divider gates on the CB board to select the channels we want. Like most digital circuits, the divide-by-N circuit in the PLL, which gives us different frequencies by varying the value of N, works using binary instead of decimal numbers. In other words, it operates using the number "2" as a base and powers thereof. For example, $2^0=1$, $2^1=2$, $2^2=4$, $2^3=8$, $2^4=16$, $2^5=32$, $2^6=64$, $2^7=128$, and $2^8=256$.

In order to select and divide by any particular value of N to get a certain frequency out of our PLL, we've got to energize the right combination of divider gates. For instance, if it takes N = 224 (channel 1 in our scheme) to give 29.26 MHz, then we would activate (by applying 5 V dc) divider gates 2^5, 2^6, and 2^7 because their values of 32 + 64 + 128 = 224 = N; the other divider lines would remain at ground, therefore deactivated.

F(MHz)	Ch #	N	2^8 ÷256	$2^5+2^6+2^7$ ÷224	2^4 ÷16	2^3 ÷8	2^2 ÷4	2^1 ÷2	2^0 ÷1	Gate Values
29.50	20	248		X	X	X				
.52	22	250		X	X	X		X		
.54	24	252		X	X	X	X			
.56	26	254		X	X	X	X	X		
.58	28	256	X							
.60	30	258	X					X		
.62	32	260	X				X			
.64	34	262	X				X	X		
.66	36	264	X			X				
.68	38	266	X			X		X		
.70	40	268	X			X	X			
			7	8,9,&10	11	12	13	14	15	PLL pin numbers

Notes:
1. "X" means divider gate energized by application of +5 V dc.
2. ÷1 gate not activated on even-numbered channels.
3. Gates for 2^5, 2^6, and 2^7 are tied together on circuit board to function as single ÷224 gate.

Table 1. PLL divider gate combinations.

In Table 1, the actual frequencies, channel numbers, values of N, and combinations of active divider gates are shown for frequencies from 29.5 to 29.7 MHz, in 20-kHz steps. Note that one divider line, the $2^0=1$, is never activated because it subtracts 10 kHz and all of our channels are on even frequencies. To digress just a bit, what the manual 40-channel selector switch does is select the right combination of divider gates for each channel to give the desired frequency. In it are seven SPST switches, one for each gate, actuated by a programmed mechanical cam; the correct combination of switches is selected by the cams as the switch shaft is turned to a particular channel. Essentially, the switch is a mechanical binary-coded decimal counter.

What we want is to have the scanner select the channels electronically, letting it do the knob twisting for us. As each scanner channel is addressed, a corresponding inverter transistor provides the necessary 6 V dc, which we will apply to the right combination of divider gates through a diode matrix. The matrix selects the right combination of gates for each particular frequency and the diodes provide isolation between the gates.

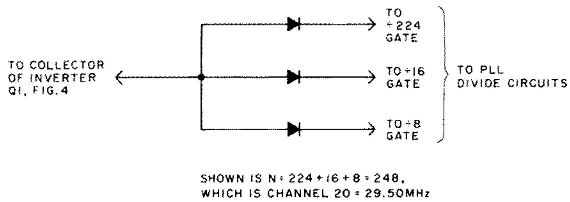

Fig. 5. Basic diode matrix.

Suppose, for example, that we wish to select 29.50 MHz as the first scanned channel. Table 1 shows that the ÷224, ÷16, and ÷8 gates must be activated, to give a total N value of 248, by the first inverter via a matrix. Note that the ÷224 gate is actually made up of the ÷32, ÷64, and ÷128 gates all tied together to act as a single ÷224 gate. Fig. 5 shows us the arrangement that the first inverter and diode matrix will use to give us 29.5 MHz. A second scanned frequency would require that a different combination of gates be activated, which would be done by a second inverter circuit (connected to point B of the scanner's second channel switching transistor) and diode matrix, and so on, for all eight scanner channels.

The full diode-matrix circuit can be found in Fig. 6. I built the matrix on a small perforated board (0.042" holes) along with the eight inverter transistors. A simple 6-V dc zener-diode regulator also was included to supply the inverters—see Fig. 7. A voltage level of 6 V dc was chosen to overcome a 0.7-volt drop through the diode matrix, giving about 5.3 V at the PLL divider gates. The switch, S2, in Fig. 7 selects either the scanning mode or manual channel selection via the 40-channel switch by routing 6 V dc to either the scan inverters or the manual selector switch. The matrix shown in Fig. 6 is wired to scan channels I through VIII as 29.50, .56, .58, .60, .62, .64, .66, and .68 MHz; any other frequencies can be programmed in by consulting Table 1 and rewiring the matrix accordingly.

It works like a charm.

Repeater Operation, Too?

Yes, Virginia, there are

10-meter FM repeaters, but no, they don't sound quite like the 2-meter machines! In my location (northern New Jersey), there are two 10-meter machines within ground-wave range plus many other machines heard via skip. Most of the repeaters are open machines, but some may require PL or tone-burst when the band is noisy, to prevent various non-signals from keying them up. They are all on in-low/out-high, 100-kHz splits.

My original "fast-fingers" method of working through the repeaters was to flip the manual channel selector rapidly from the input to the output frequencies on transmit and receive. Needless to say, this led to some strange and disjointed QSOs! A method had to be found of dropping the transmit frequency 100 kHz below the receive frequency when in the repeat mode.

There are two obvious possibilities for doing this: Either shift the transmit-offset oscillator, Q109, on transmit or else program the PLL to do the same. The first approach looks the easiest—you would need only a small SPDT reed relay to switch between the existing 10.695-MHz transmit-offset crystal and a new crystal at 10.795 MHz for repeater operation. The new crystal has to be higher in frequency to give us a downward shift because of the mixing scheme in the transmit mode. You would have to be careful of stray capacitance, though, so as not to pull the crystal frequency off. Also, this arrangement does not allow "reverse-split" repeater operation.

The second approach is even simpler. Set your scanner in its manual mode to the repeater output frequency and set the 40-channel manual selector to the repeater input frequency. Then wire up an SPDT reed relay to toggle 6 V dc between the scan inverter circuit on receive and the 40-channel switch on transmit. The plus side of the relay coil can go to the +12 V dc line on the CB board and the negative side can go, via S4, the simplex/repeat switch, to pin 13 on the CB board, which is brought to ground on transmit by the PTT switch. To provide reverse-split capability, simply wire a DPDT switch to interchange the 6 V dc lines per S3. See Fig. 8(a) for details.

I took this concept one step further to provide completely automatic repeater-offset operation, albeit with a more complex circuit, as shown in Fig. 8(b). An extra four inverter circuits, identical to the first eight, and a 4 × 6 diode matrix were constructed. The base circuits of each of the four new inverters were connected to each of the scanner transistor channels V through VIII in the same fashion as the original eight inverters; these channels are set on the repeater output frequencies, i.e., 29.62 to 29.68 MHz. The additional 4 × 6 diode matrix was wired to select the corresponding repeater input frequencies, i.e., 29.52 to 29.58 MHz, and connected, in parallel with the original 8 × 6 diode matrix, to each of the PLL gates. Now, the same SPDT reed relay is used to toggle 6 V dc between the original set of inverters on receive and the new set of inverters on transmit, thus selecting a repeater output frequency on receive and the corresponding repeater input frequency on transmit.

For example, with the matrix shown in Fig. 6, scan channel VI, the second repeater output frequency, is set for 29.64 MHz. The corresponding repeater input frequency would be 100 kHz below, at 29.54 MHz, so the second line of the new 4 × 6 matrix should be wired up to provide that frequency from the PLL; Table 1 tells you which PLL lines have to be activated for this frequency. This circuit is "goof-proof," too—if you accidentally select a non-repeater output frequency on the scanner and try transmitting while in the repeat mode, the transmitter will simply not key up.

As you can imagine, some rather interesting things can happen on these machines. For instance, how would a G4 to KV4 QSO via a WR2 grab you? Or how about two QSL cards for just one contact, such as when I had a QSO with a KL7, first via a WR6 machine and then, immediately following, a direct contact on the same frequency, with both of us running reverse split. I figure that the single QSO counted for two states worked! Of course, working from New Jersey to

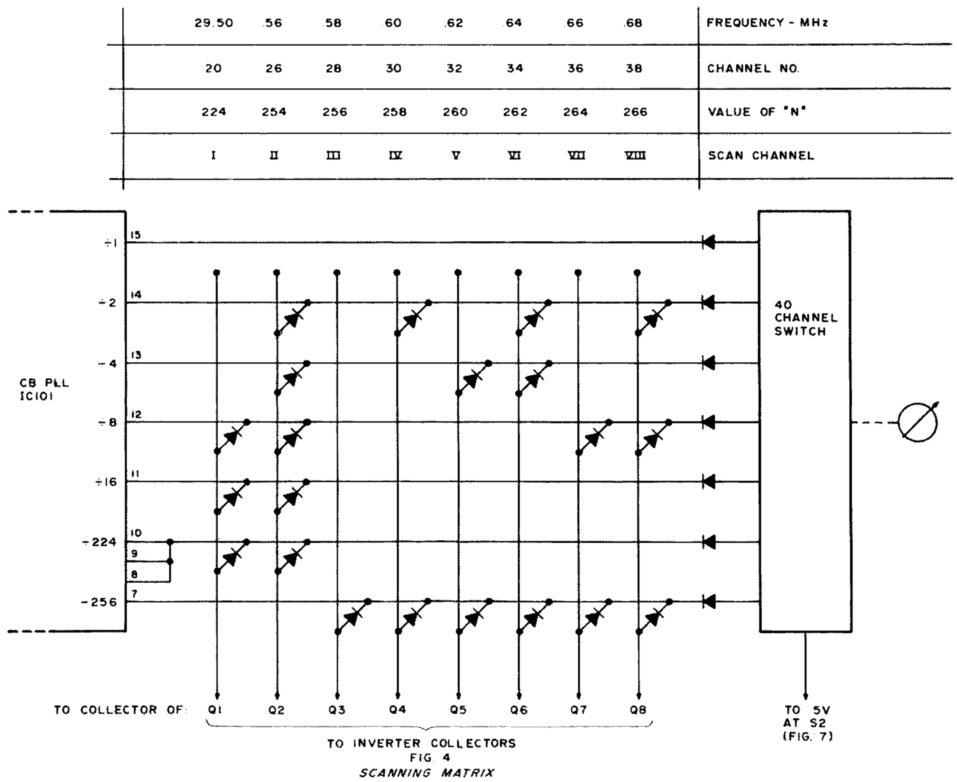

Fig. 6. Notes: All diodes are 1N914/1N4148. Seven diodes shown from 40-channel switch must be used to provide isolation from any matrix used. Pins 8, 9, and 10 of PLL are tied together to act as a single ÷ 224 gate.

Maryland via a repeater in Colorado might be called the hard way, but you do meet people that you'd never otherwise hear on 10 meters.

Deluxing It

To provide continuous subaudible tone encoding (PL) as well as tone-burst capability, the IC circuits in Reference 4 look like a good bet. In fact, at the moment I'm installing just that circuit in my 10-meter FM rig. The Exar chip is not cheap, but it's so simple when everything is in one IC package. A good place to inject the tone encoder's output into the FM modulator circuit, Fig. 1, would be between the 0.01-uF capacitor and the choke, L1. Since the PL tone is rather low in frequency, about 100 Hz, your coupling capacitor from the tone encoder would have to be larger in value, say about 0.05 uF. As of this writing, two machines in California require PL (107.2 Hz) and one machine in the state of Washington requires an 1800-Hz burst. However, you may find that on weekends the machines may be run on an open basis, depending on band conditions and QRN.

Since the scanner provides push-button selection of all necessary 10-meter FM frequencies, a digital readout is admittedly a frill. However, I'm presently working on paper to find a suitable circuit. The PLL divider lines are not set up on purely a sequential binary basis; i.e., you'll note from Table 1 that at 29.58, the ÷224 line is shut off, the ÷256 line is picked up, and the 2^1 through 2^4 lines start their count from zero again. And, of course, the number 224 is not your usual binary number.

What all this means is a decoding headache. My latest thought, therefore, is to use a programmable read-only memory (PROM) such as an 8223 or 74188. This type of PROM is easily programmable in the field without a fancy and complex programmer. It appears that only one 8223 would be needed to decode the PLL's line states to pure BCD form, in which case two 7448 BCD decoder/7-segment LED display drivers could drive a pair of common-cathode LED displays to read out the tens and hundreds of kHz of frequency, e.g., .62. Frankly, I don't have the digital expertise to put it all together without a lot of sweat, so I'd enjoy hearing from anyone who's done it.

One way to increase the output of these rigs is to run 'em through an amplifier. Since we're using FM, a Class C amplifier is fine because you don't need a "linear" amplifier for FM service. Incidentally, there are still more solid-state CB "afterburners" floating around. Some of these little monsters will put out 125 Watts dc, but I wouldn't say much about their linearity. Although supposedly linear, I wouldn't use them for anything but FM.

A word about operating practices seems in order here. Due to the delicate nature of FM (wide receiver i-fs), it is important that non-FM operation be kept to a minimum in the 29.5-to-29.7-MHz segment. SSB sigs really "tear up" an FM receiver. Also, due to the large number of users of 29.6 MHz, courtesy is an absolute must. Listen first to avoid chaos! QSY upward from 29.6 for ragchews and avoid simplex operation on repeater inputs.

All letters accompanied by an SASE will be answered. ■

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2. The E. F. Johnson "Mono-Scan" UHF-FM Scanner boards are available for $9.95 plus $1.00 postage from: Science Workshop, PO Box 393, Bethpage NY 11714. Specify Catalog No. 103B, "UHF Scanner Chassis, used."
3. "Providing a Tunable VHF-FM Receiver," *Hints & Kinks*, ARRL, 1978, p. 108.
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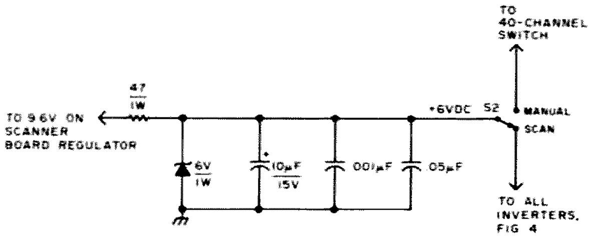

Fig. 7. +6 V dc regulator.

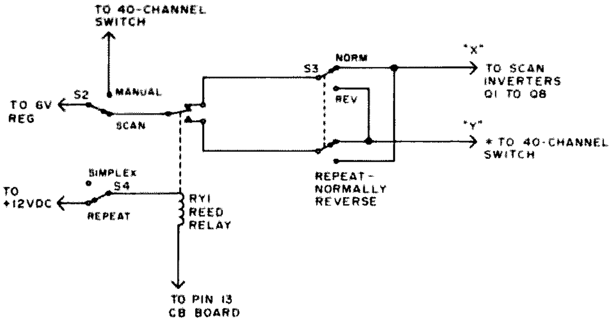

*Fig. 8(a). Repeater offset circuit. *When fully-automatic repeater offset circuit is used, this line goes to the extra four scan inverters and 4 × 6 diode matrix instead (See Fig. 8(b).).*

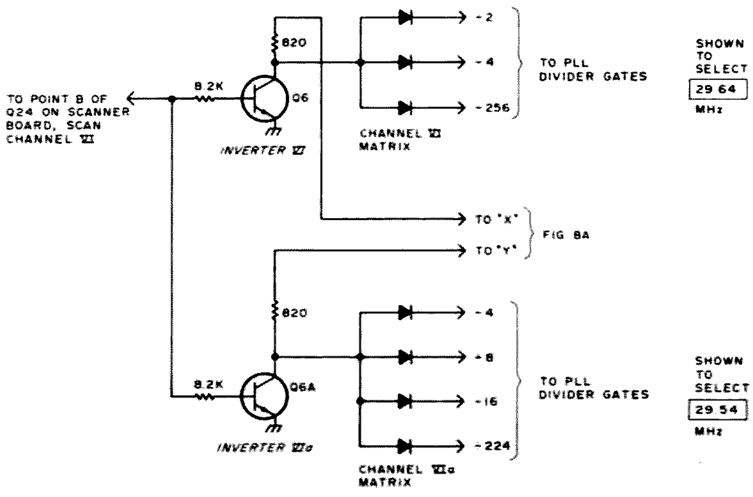

Fig. 8(b). Repeater offset circuit (one of four).

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The Rains of Morvi

—duty in disaster for Indian hams

Editor's Note: The author is president of the Federation of Amateur Radio Societies of India.

Disaster struck Morvi on the 11th of August in the afternoon. Due to incessant and unusually heavy rains, the earthen Macchu Dam No. 2 burst from both sides of the spillway and engulfed the entire city of 75,000 persons. A wave 7' or 8' high caused the initial damage which devastated 80% of the buildings and left an estimated 10,000 persons dead.

The water continued to rise to a maximum of 15 feet, and many were saved only by going to the third floors of buildings, where such existed. There is no dearth of stories of terror and heroism. After the flood waters receded, the streets and houses were under 14 feet of mud.

Communications and power supplies were completely wiped out at one stroke. Such was the devastation that word could not go out, and small towns within 10 or 15 km did not know of the tragedy for 24 hours. When word finally trickled out, the Home Guards were the first to reach the city, from Rajkot, 70 km away. They swung into action immediately, and their heroic efforts in extricating wounded persons from the debris, disposing of dead bodies and cattle, and organizing relief is a story by itself.

The Federation of Amateur Radio Societies held an emergency meeting along with the Radio and Electronics Society of India and noted that while relief of all sorts was being organized on a large scale by government and private agencies, there was bound to be need of communications.

Within two or three days, volunteers were mobilized, equipment collected, and antennas made. As we had no preparedness for such emergencies, we grabbed whatever equipment was available, namely the Atlas transceivers of Ishwer VU2AE and of Dr. Kirti Doshi, as well as my own FM and SSB 2-meter transceivers. Later, we added the FT-100 of Rayu VU2YY, Ahmedabad, and the KW-2000 of Dasan VU2AID at Rajkot.

The first team, consisting of Vasant VU2RX, Jimmy VU2IJ, and Chris VU2KIT, left for Rajkot (via Jamnagar, as no direct flight was available). They arrived at the Galaxy Hotel and, while discussions were going on as to where and how

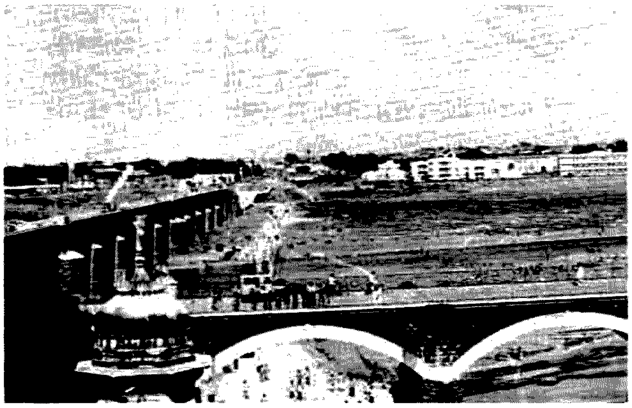

Photo A. The floodplain was swept bare, and part of the bridge destroyed, by the force of the water.

Photo B. The author (right) in front of the operations tent with (L to R) Chris VU2KIT, Jimmy VU2IJ, District Commandant Ushakant Mankad, and Jai VU2ED.

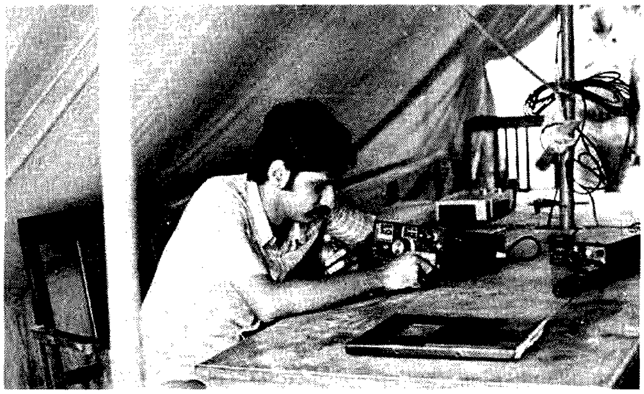

Photo C. In the tent, Chris VU2KIT uses the Atlas transceiver and IC-20 2m FM.

Photo D. The mobile jeep with operators and Home Guards. Author Saad Ali VU2ST is at upper left.

to operate, a station was set up in the hotel room itself. Operating as VU2RES, contacts were made with Bombay and others. Here they were joined by Deepak VU2DCD and Jivanbhai VU2JF.

Deepak VU2DCD, a local ham, immediately contacted the Home Guards and brought the District Commandant, Shri Ushakant Mankad, and Shri Pota to the hotel to see our facilities. They seemed quite bowled over by the facility offered and indicated that this was just what they desperately needed. Their own VHF was totally inadequate for the problems faced. Rajkot being the base station for the Home Guards for this rescue, a main station was immediately established in the office of the Commandant. A jeep was made available to us which soon was rigged up with HF mobile and 2-meter antennas. The team shifted to a hotel near the Home Guards office.

In Morvi, the Secretariat at Mani Mandir had been cleared of mud and activity was reviving. In the school compound nearby, a tent was provided for us where the equipment was installed, and contacts were made with Bombay, Ahmedabad, Baroda, and Rajkot, operating as VU2IJ. The aerial was a 20/40m dipole, while a twisted piece of wire round a bamboo pole provided for the 2m rig and did wonders.

The mobile jeep was out with the Home Guards during the day, in all the corners of Morvi, and conveyed information on 2m to the base at Morvi. This was relayed from the Morvi station to local persons and officials by messenger, or relayed to Ahmedabad, Baroda, and Bombay as required.

Most of the traffic concerned the Home Guards—deployment of personnel from the various districts, their transport and logistics, etc., as well as messages between the local officials and the District Commandant at Rajkot or the Commandant-General at Ahmedabad. Prior to our arrival at Morvi, a jeep had to make a trip of 70 km to Rajkot for the smallest item! Now a message could be conveyed at the press of a button! The frequencies used by us were 14150 kHz and 7050 kHz.

The equipment was jeeped back to Rajkot every night and taken to Morvi early every morning.

After a few days, Vasant VU2RX returned to Bombay and Jai VU2ED replaced him. Jayu VU2JAU was active in the Morvi/Rajkot operations and later at Ahmedabad.

No words can describe the dedication, hard work, acceptance of discomfort, and (initially) lack of food for many long hours with respect to the team operating in the Rajkot/Morvi area. The ingenuity shown in rigging up antennas (including mobile antennas on hand-held bamboo poles), and in making the equipment work under the most adverse conditions, deserves great praise. The average day was 14 hours; it sometimes was 24 hours. All operations in Morvi were on batteries, and these had to be carted to Rajkot for charging as there was absolutely no electricity in Morvi.

Equally deserving of praise were the hard-working teams in Ahmedabad, consisting of Pradeep VU2PCD (who was rushed off from Bombay at short notice) and Satish VU2CC, and the team of Jayant VU2JNT, Jayu VU2JAU, and Ramanbhai VU2MQ, who manned the club station, VU2GC, and relayed invaluable information to the government and Home Guards. Ahmedabad being the capital of Gujarat, communications with Rajkot/Morvi were vital.

Baroda was ably manned by Rayu VU2YY and Patil VU2XX. Rayu provided a rig at Ahmedabad and helped in many other ways. Arvind VU2XW also was operating.

At Bombay, prominent among those who monitored and relayed information were: Tipi VU2TP who was on the set almost 14 hours a day, Charlie VU2FP, Deryk VU2BEJ, Vasant VU2RX, Ishwer VU2AE, and myself. Jai VU2ED also was active until he went on to Rajkot.

The Atlas transceivers were a lifesaver. It is difficult to imagine how these operations would have succeeded but for this beautiful little piece, rugged, reliable, and easy to operate whether stationary or mobile. The 2-meter FM model IC-20 proved extremely useful and reliable and had a range of over 30 km, which was the maximum tried out.

This was invaluable when working parties went into mud-filled lanes and had to communicate with the base. The 2m SSB of Mizuho model SB2M is an equally reliable and useful piece of equipment, and with its shoulder strap and working on penlite cells, proved most useful in hand-held operations where even jeeps could not go.

The Chief Minister of Gujarat, Babubhai Patel, Home Minister Popatlal Vyas, and Commandant-General Udyan Chinubhai all visited the station and expressed deep appreciation of the facilities. Ushakant Mankad, District Commandant at Rajkot, who was directly in charge of the operations, was extremely appreciative of the work done.

The facilities also were used by the Red Cross, Ramakrishna Ashram Camp, Sadvichar Pariwar, RSS, St. Xavier's College Team, Ahmedabad, Lions Club Relief Kitchen, Giants Club, and many other relief agencies.

Financial help in travel, lodging, etc., was provided through the efforts of VU2RX by the Lions Club of Juhu; Rayu VU2YY rendered invaluable help with equipment, finance, and in every other way. Large donations were collected by Vasant VU2RX.

Hats off to the hams who put aside all work and for 18 days thought of nothing but providing emergency communications round the clock.

All praise to the manufacturers of the equipment which proved most reliable under adverse conditions.

Last, but not the least, all thanks to the Home Guards, who in spite of their preoccupations and round-the-clock work, looked after our lodging, food, transport, and every other requirement.

Gradually the position stabilized, and with the starting of telephones between Morvi and Rajkot, our usefulness diminished and operations were wound up on September 5th.

While we have the immense satisfaction of having done very useful work in an emergency and exposed amateur radio to hundreds of persons who had never heard of it, we also have realized how unprepared we were and how we lack suitable equipment and trained manpower. Hopefully, some urgent steps will be taken in this direction, and, hopefully, with some help from government and private agencies. ■

Those Fabulous Fifties

—an era in retrospect

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Of course, you remember *your* old rigs, but what was everybody else using 25 years ago? I have two different "dream" stations from 25 years ago. One was pictured on the cover of the 25¢ ARRL pamphlet, "How to Become a Radio Amateur." It showed a youth sitting in a room that was plastered with QSL cards. Apparently everything the kid needed in order to get those QSL cards was on the desk in front of him: A little home-built two-tube receiver and a one-tube home-built transmitter constructed on a wood chassis with an 80-meter coil wound of red and white bell wire. *That* was my dream station back in 1952. I stared at this cover photo for hours while I was studying the code and the questions for the Novice test.

I never saw a picture of my *other* dream station. I first heard of it in 1953, just after I got my General ticket. This hot-stuff dream rig was supposedly owned by a farmer someplace west of me in the state of Kansas. I never knew who this guy was, nor did I learn his name or call. (Today, I'm not sure he ever existed.) He had a *complete* Collins station: 75A-3 receiver, 32V-3 exciter, and KW-1 final. Remember, this equipment went for over $5000 in 1953. To top it all off, so the story went, the guy had a forest of telephone poles, with rhombics going off in eight directions.

As I recalled these thoughts recently, I figured that it would be interesting to find out what the average ham really used 25 years ago. So I dug out a bundle of QSL cards from 1953-55, my first three years on the air as a Novice and as a General class license holder. Some of you may be a little surprised, as was I, to discover which rigs were the most popular in 1953.

It was an interesting time for amateur radio. World War II was recent enough so that there was still lots of surplus gear around. The Novice class license was a new option and the market for ham gear was opening up, yet you could still go into radio outlets like Burstein-Applebee in Kansas City or Walter Ashe in St. Louis and buy single resistors and other small component parts. At Fort Orange Radio in Albany NY, they even sold rf cigars! At least their ads always showed "Uncle Dave" W2APF in his shack calling

Fig. 1. Viking II transmitter with Heathkit VF-1 vfo. Photo courtesy of W1FYM.

CQ with rf coming out of his stogie.

My first rig was a National SW-54 allband receiver and a home-brew single 807 transmitter using an end-fed Zepp antenna on 80 meters. It seems that I was not at all unusual in starting with a home-made transmitter and a commercially-built receiver. I entered ham radio long after the time when hams made their own condensers out of mason jars and foil, but home-built and surplus conversion rigs were very common.

I dug out a bundle of seventy cards, sent by hams from Maine to California to me in Grandview MO. I went through these and made a list of the rigs, antennas, and bands used by each. Let's look at the transmitters first. Eleven :ards described home-built :ransmitters of less than 100 Watts input and another ·leven home-brew jobs anged from 100 Watts to a :W. Four more rigs were BC ınd ARC Command series var surplus conversions, nd forty-four rigs were ·uilt from kits or were purhased ready-made.

Far and away the most opular transmitter I ·orked during the mid-950s was the Johnson *Vik-'g* series. Seventeen of the ·venty rigs listed in my ındle of cards were Vikgs, many of which were ›me-built. The Viking II ıd just come out; its pre-·cessor, Viking I, was very ›pular and the improved odel seemed to be every-ıere. It was available in : form only in 1953 and ·nt for $279.50, with a ir of 6146 finals modulat- by a pair of 807s. There › still a lot of Viking rigs ıse today, many of which · operating on the 27-łz Citizens Band. The :. Johnson company, like mmarlund, James Mil-, and many other radio companies, advertised its component parts at great length in the radio magazines, but Johnson really came into its own with the Viking series. Soon they added the Viking Ranger, along with regular and mobile vfo kits. Eventually, by the late 1950s, they had a whole line of transmitters, from the Adventurer (a small CW rig) to their kilowatt final console, which was built into a desk. The Johnson stuff was good gear. When I was at Stanford University, the EE department took a great many Viking kilowatt finals and converted them to 2-kW pulse amplifiers which were used all over the world during the IGY for HF radar backscatter experiments on 14, 21, and 28 MHz.

After the Viking I and II transmitters, the next most frequent model mentioned in my bundle of QSL cards was the Cadillac of ham gear, the Collins 32V series, of which I worked five examples. The 32V-3 cost $775, with its 4D32 tetrode final modulated by a pair of 807s. Seven of the seventy rigs were put out ready-made or in kit form by Leo Meyerson's World Radio Labs in Council Bluffs IA. Four of the seven were his big 400-Watt Globe King models, rigs designed to utilize a pair of wartime-produced final tubes, two V-70-Ds which were like 812s except they had 7.5-volt filaments. Leo also put out Globe Trotters, Scouts, Chiefs, and Champs, advertising "More workable Watts per dollar." The Globe King was a real boat anchor—the first several models were coil-changing types and one was in a Bud Company cabinet three racks tall.

Most popular among the little commercial rigs was the Harvey-Wells Bandmaster series (TBS-50 to 50D). Four of the seventy cards were from guys using Bandmasters. This little 807 rig was described optimistically as working from 80 meters clear down to 2 meters, with top band operation possible if you built up the capacitance and inductance in the 80-meter tank circuit. Now, the 807 tetrode was only designed to go up through 6 meters at full ratings, and the Bandmaster plate-current meter was useless at 2 meters, so you had to tune it using a flashlight bulb! Pretty primitive—but it didn't matter much, since the other guy on 2 was probably using a Gonset Communicator. Depending on whether you wanted the stripped down "Junior" or one of the more fancy models, the Bandmaster went for about $160 in kit form, including power supply. Included among the other rigs I worked were Heath (they came out with the AT-1 peanut whistle about 1954, then the DX-100), Meissner, Elmac, Tenar, and Sonar Engineering.

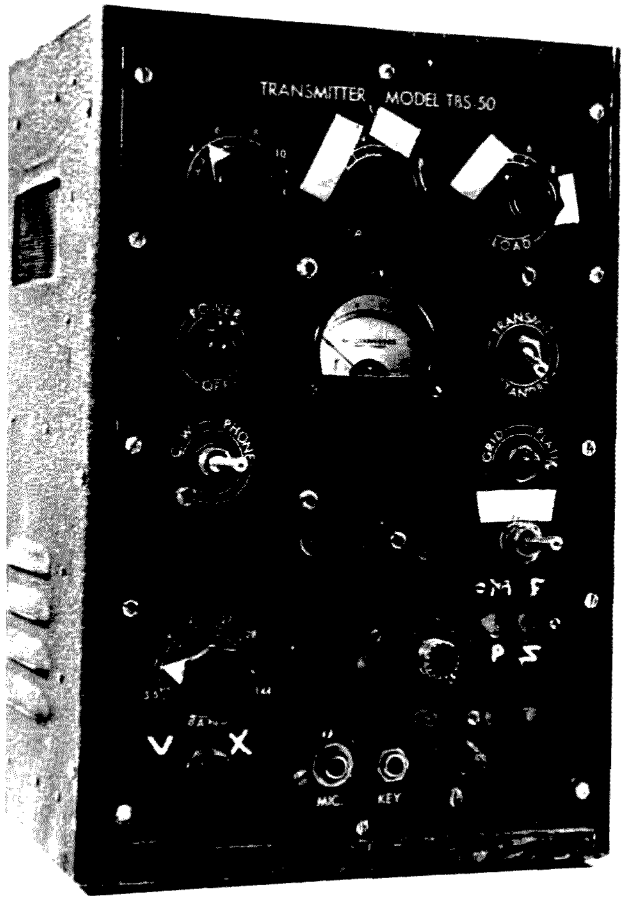

Fig. 2. Harvey-Wells Bandmaster transmitter. This example has been much modified over the years.

The home-brew rigs I worked went all the way from a 6AG7 oscillator/6L6 final running 12 Watts up to one guy using a pair of 250s at a full gallon. Overall, the home-builder seemed to choose a 6L6 final for low-power rigs and a single 807 or pair of 807s (or its 12-volt version 1625) for medium-power rigs. The bigger boys ran tubes like the 812, 813, or 250. As I remember, at least half the hams were rockbound. Vfos were outboard accessories for most rigs. All sorts of little outfits

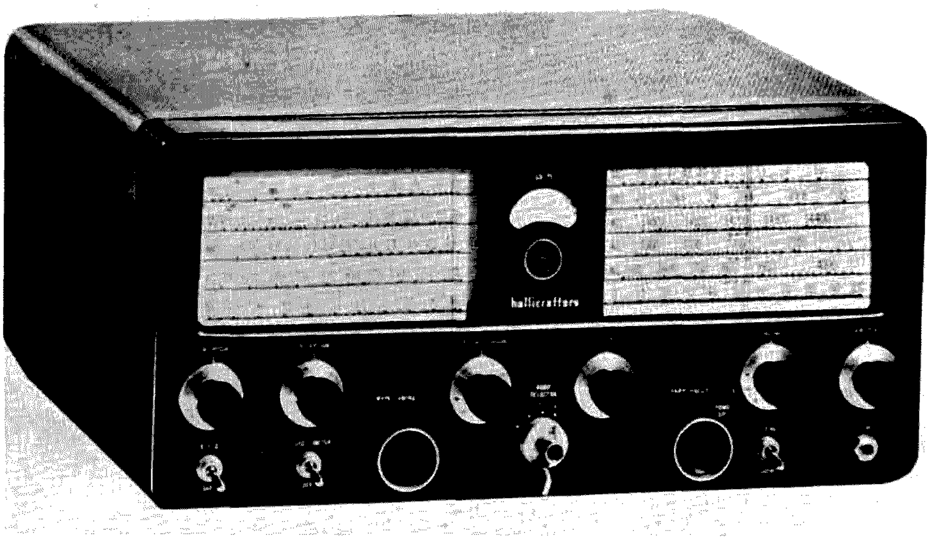

Fig. 3. Hallicrafters SX-71 receiver, introduced in 1950.

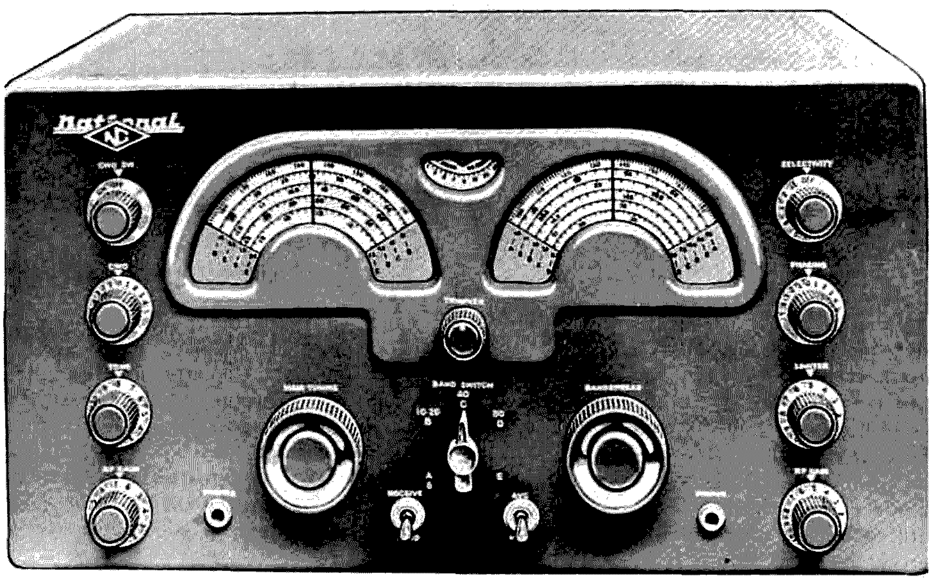

Fig. 4. National NC-183D receiver. This model was new in 1953, based on the NC-183, introduced in 1948. Photo courtesy of National Radio Company.

(between the Ozarks and Chicago) were sources of cheap crystals in FT-243 holders. We could adjust some of these by grinding them with toothpaste or grinding compound. The crystals cost less than $1.00 apiece, and if you ground one too unevenly, causing it to quit oscillating, it was no great hardship to throw it away.

Going back over those seventy QSL cards, I was surprised to find Hallicrafters so dominant among receivers. Almost half (thirty-four) of the receivers were Hallicrafters, including ten of the model SX-71s. The SX-71, at $225, was the cream of the "medium price class," as the Hallicrafters ads used to say. It was a double-conversion superhet with eleven tubes and a rectifier, covering the broadcast band up through 6 meters. Among the other Hallicrafters receivers worked were SX-99s, S-76s, S-43s, S-42s, quite a few S-40s, an S-28, S-24, S-20, S-17, and a couple of S-38s. I remember the S-38s well because I had their rival—National's SW-54. Each of these little table radios sold for a few cents under $50. National produced seventeen of the other receivers listed: the NC-183, -173, -125, -98, -88, -46, and the famous HRO series. The third most popular receiver manufacturer was Hammarlund, with nine examples including the HQ-129, the HQ-140, and the celebrated "Super Pro." I worked only a couple of guys with Collins 75A-series receivers. It was beautiful gear, but too expensive for most of us. In 1953, the 75A-3 cost about $670 with all accessories.

Of course, for commercial and military use, Hammarlund made the SP-600, Collins the 51J series, and Hallicrafters the SX-73. We only heard of these at military base ham and MARS stations because they ran all the way up to $1000 per receiver. Quite a few fellows used the surplus World War II receivers on 80 and 40 meters, or with converters for the higher frequencies.

Looking over the old cards for their choice of antennas, I divided the cards into low bands (80 and 40 meters) and high bands (20 through 10 meters). On the higher bands, everybody seemed either to have a beam or else merely a dipole. Some beams were all-grounded "plumber's delights." Telrex was *the* beam to own, although I often worked Mosley, Hy-Gain, and other beams. I don't remember working anybody who had anything other than a 2- or 3-elemen beam, although some o these were "mini-beams" and "tri-beams." Quad were not heard of (at leas not around my area) i those days. Eventually I go 3 elements on 20 meter and 3 elements on 10 me ters, and I turned them wit a chain-driven, prop-pitc motor or with a pip wrench (most of the time Lots of guys used pro pitch motors for bigger a rays and selsyn motors f smaller antennas. The se syns wouldn't always tu

since they had limited torque and they sometimes "hunted" for each other. That is, the selsyn in the shack and the selsyn on the tower would end up pointing in some mutually satisfactory direction unknown to the chief op.

As you might expect, the low bands turned up a larger list of antenna types, though most were wire antennas. Half of all antennas worked were dipoles, with the plain dipole or "doublet" in use more often than the popular folded dipole. This latter came into use after World War II when plastic-covered 300-Ohm line became readily available at TV stores. Only a few hams among those in my bundle of seventy QSL cards used verticals. It was still some time before the trap vertical was used as a popular antenna. Finally, there were a few off-center-fed wires which the operators usually called "Windom" antennas. Others used end-fed wires including a half-wave wire end-fed with ½- or ¼-wave 600-Ohm open-line feeders. This "Zepp"-type antenna had been developed for use on the German Zeppelin airships. In the mid-50s, 600-Ohm open-spaced line and 75-Ohm twisted-pair wire were still often used.

I have reported only on CW and AM contacts in my bundle of QSLs from 1953-1955. I did not get a chance to operate SSB until 1958, but one heard the "Sidewinders" or "Donald Ducks" on the phone bands 25 years ago. *The ARRL Handbook* introduced a chapter on SSB and also on DSB (double sideband) techniques. Everybody was learning how to tune in the stuff (rf gain down, af gain up, fiddle with the bfo . . .). Central Electronics of Chicago was selling SSB exciters and other companies quickly got on the bandwagon. As for AM rigs, most guys I talked with had high-level plate-modulated transmitters, although quite a few used the cheaper cathode- or grid-modulated approaches. I remember a radio handbook photo of a one-tube cathode modulator which plugged in the CW key jack.

Among these seventy QSLs from 25 years ago are four from YL operators. My mother thought I was driving the house crazy talking about ham radio, so, unknown to me, she went down and took her Novice test and passed. She drove up one spring day to where our high school track team was practicing and just showed me her Novice ticket. She later passed her Technician ticket and became WØTRC.

The Heath Company was beginning to expand their line of instrument kits, but most hams I knew didn't have much test equipment back in 1953. WWII surplus instruments usually amounted to signal generators and voltmeters. I knew one guy who had a Dumont three-inch scope and one other fellow who owned a

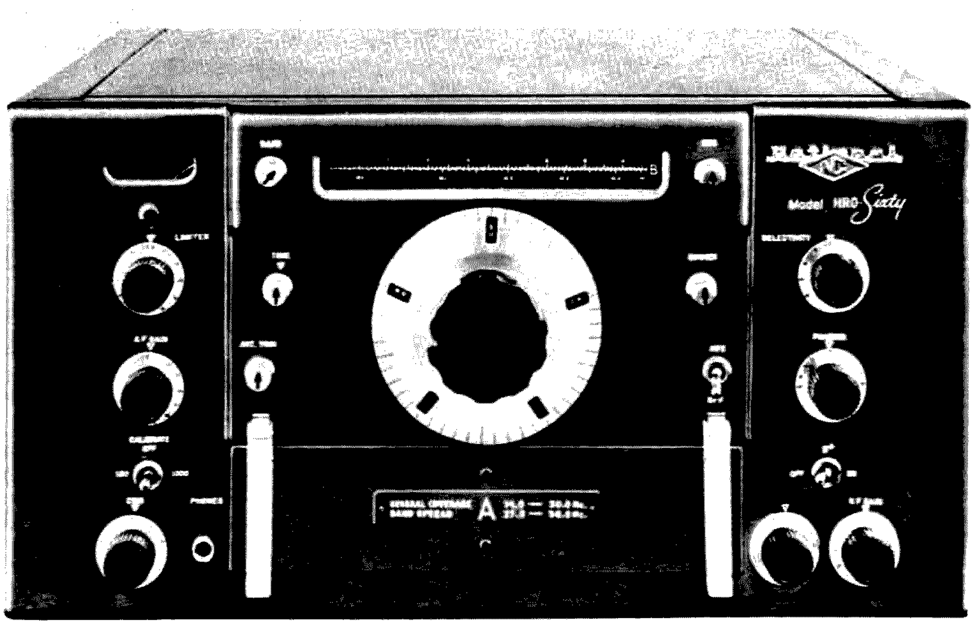

Fig. 5. The National HRO receiver. The first HRO, a 9-tube superhet, was introduced in 1934. All featured the famous "PW" HRO precision-ganged tuning condenser. The HRO-Sixty, shown here, came out in 1953. Photo courtesy of National Radio Company.

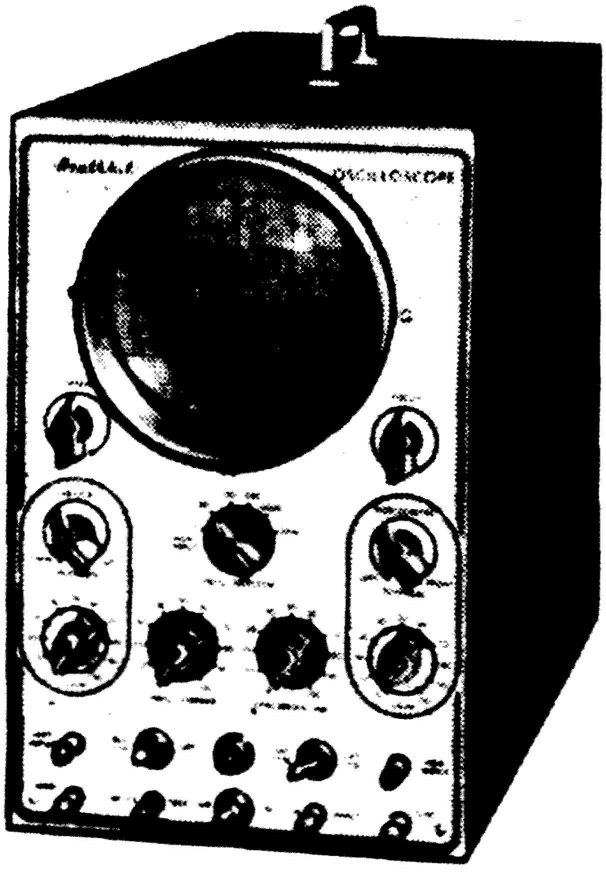

Fig. 6. Heathkit model "0-8" 5-inch oscilloscope, dc to 1 MHz, $43.50 in kit form in 1953. Drawing courtesy of Heath Company.

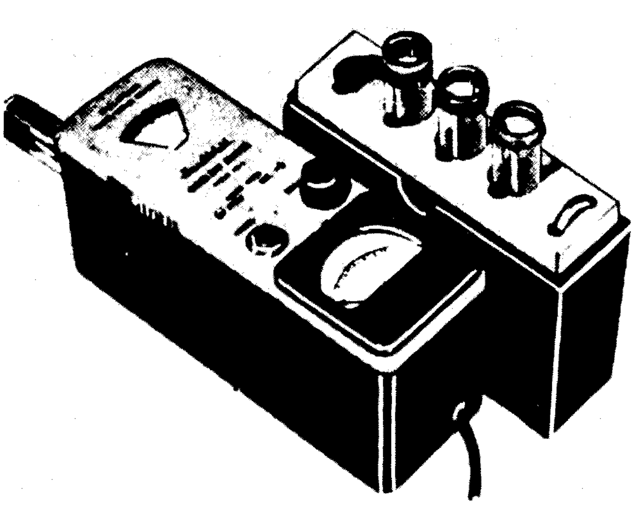

Fig. 7. Heathkit model "GD-1" grid-dip oscillator, 2 to 250 MHz, $19.50 in kit form. Drawing courtesy of Heath Company.

grid-dipper. Several hams that I knew owned VTVMs, but the vswr meter was rather rare around my neighborhood. The extent of my own test gear in the 1950s was an Eico multimeter kit which I built for $12.90. I also had a neon bulb for an rf indicator. At this time I was only a high-school kid and therefore not expected to own much test gear. But I really don't remember my older ham friends owning much test gear, either. What I *did* seem to covet were Greenlee metal chassis punches. They weren't cheap, but I managed to collect four or five, for octal sockets, miniature sockets, etc. Somehow, I always seemed to mangle the minibox I was working on, even when I was using a chassis punch.

My brief survey of some hams I worked 25 years ago doesn't pretend to be the last word in statistical sampling. If you chose to go back 30 years, you would not find many hams with commercial kit transmitters. If you go back only 20 years, you would find that SSB was really getting a major part of the market. For example, E. F. Johnson had several SSB exciters to go with their "Viking Kilowatt," Hallicrafters had the HT-32 SSB exciter and HT-33 kW amplifier, and Collins had their "S" line. Perhaps, if you had lived in a different region than me, your sample of cards would include hams who used Eldico, Gonset, Eico, B & W, RME, Tecraft, Central Electronics, or other gear.

All in all, most hams 25 years ago weren't appliance operators. Nearly everyone had a commercial receiver, but about ⅓ used home-brew transmitters with another ⅓ using commercial designs built from kits. If you worked one of my "average" hams in 1953, he probably used a dipole on the lower HF bands and a dipole or beam on 14 MHz and above. Most likely he was running an 807, a pair of 1625s home-brew, or a kit-built Viking II, and he was receiving you on an SX-71. Chances are one of you had a vfo and the other was rockbound.

What might you find today? Why not dig into your drawer and read *your* QSL cards! ■

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Trash All Your Worries

—Baron Von Rhonstead and the RFI caper

The big German Shepherd had five half-Doberman pups. Some 18-wheeler zooming by my wife's new car at 80 mph shattered a window. The water softener quit, belching salt water all over the place. The 100-pound Doberman, the Baron Von Rhonstead, ate all the patio plants. The ice-maker leaked water which froze in great globs all over the freezer compartment and I never even noticed.

When that UPS delivery van arrived a few weeks ago, I felt like a Third Avenue barfly on his first day as a paid whiskey tester.

I don't know how my wife Malinda WD5JZS ("Joe's Zany Sidekick") felt about that new TRS-80 because I didn't communicate with her for three weeks after it arrived, except when food was passed under the shack door. She said I grunted an occasional string of unintelligible noises familiar to Marines, bos'ns, and other denizens of the deep, but I don't recall.

For years, this guy Wayne Green has been yap, yap, yapping about computers and how any self-respecting ham had better get off his ROM and CLOAD the program.

But, you see, I was at a disadvantage. I was not an engineer. I knew only slightly more about electronics than did Attila the Hun and my experience with computer language was limited to that on Visa and Master Charge bills which elicited cries from Malinda each month: "What is Macrotronics?" or, "What does Long's sell?" or, "What do you make with Icoms?"

I knew even less about computers than I did about RTTY, but I couldn't wait to tear into that carton and stick wires on the Macrotronics M80 board and on the Flesher TU-170 which arrived at about the same time.

Since I had just mailed my log to the World Ecumenical Council for the WAC Award (you know the one—Worked All Churches) and because I was appealing to the ARRL for their coveted WAEB Certificate (Worked All Electric Blankets), I had briefly considered what might happen to the plastic-housed video monitor image with rf around. What I had not yet pondered, though, was how to explain to ol' WD5JZS about the RTTY "bug," late "nightitis," and frantic rushes home at noon to solder a connection or two.

Photo A. Unsuccessfully sniffing the shack of WA5TUM and WD5JZS for RFI are the "Royal Noses," quintuplet offspring of the Baron and Baroness Von Rhonstead. A ham can operate the TRS-80 microcomputer on RTTY within inches of equipment radiating the legal limit. The unique rf detectors, combining in a 50-50 mixture the intelligence of the German Shepherd and the tenacity of the Doberman Pinscher, were unable to catch even one wild electron.

WD5JZS thinks that RTTYers sleep in old hollow logs, have a shell on 'em kinda like an armadillo, and bay at the moon. What she didn't know was that RTTY-

ers don't sleep at all and that the immediate problem seen through my bloodshot eyes was the beautiful effect of Dentron MLA-2500 a la TRS-80. The CRT made fascinating patterns right after the program crashed, and I now wish that some of them had been "CSAVEd" for the RTTY pix freaks.

Even with limited knowledge of the esoterics of electromagnetic theory, it didn't take Tesla to tell me that "When everything is grounded and you still have a problem, then everything is not grounded," or at least the point that an electrical ground "ain't necessarily an rf ground."

I had, I thought, one of the better grounds around: some 150 feet of buried half-inch copper pipe running in two different directions, the tower base sticking below eight feet of concrete into three feet of deep earth, and all equipment tied within six feet of the buried pipe. It wasn't perfect, but this wasn't designed to be the 50,000-Watt "Voice of South Texas."

After grounding was checked, I bought an aluminum chassis box from the "doughnut shop" in Corpus Christi. That's the nearest ham store, Douglas Electronics, which specializes in top-name goodies, friendly service, coffee, doughnuts, and an outstanding reputation for keeping charge accounts stamped, "Top Secret." Wives see only select bills, and Bob Douglas W5GEL and crew keep an assortment of old oil-can cartons around, so the shiny new Icom or Kenwood goes home so covertly that the best KGB agent would never suspect.

The chassis box, about six inches by four by four, was ideal because with the M80 board inside and rubber feet on the bottom for height, the TRS-80 bus could be run through a slit, level with the CPU connector, leaving almost none of the wire exposed to nasty RFI.

Photo B. Wearily watching sunrise after chasing loose electrons all night, WA5TUM finally found keys to success in rounding up RFI for full power RTTY operation with the Radio Shack TRS-80 microcomputer system.

What a difference that grounded box made! It was particularly neat with RCA phono tip connectors mounted for hookup convenience, an off-on switch, and the two LEDs peeking through grommets for easy monitoring. I could then transmit up to 600 Watts on 20 meters without too much RFI, which was plenty of muscle for me.

I reached down, punched in the RM-2 microprocessor to call up 40 meters on the Icom-701, and Zaaaapp!!!

At anything more than 75 Watts, the video monitor information danced all over the screen, rolled, did back flips; it turned a muddy black at 200 Watts. RAM wasn't disturbed, though, so progress had been made.

Into the dry Drake dummy load, actually touching the video monitor and the TRS-80 terminal, the MLA-2500 kicked out enough stomp to peg the needle at 2,000 Watts, leaving image and program steadier than John Wayne's aim in *True Grit.*

That, at least, indicated a "clean" shack.

My friend, Guy Ford at the doughnut shop, again came through and sent a sack of ceramic disc capacitors—20 or so—and I attached them to everything. For security, I even carried a few around in my pockets. All eight wires of the CDE T2X "Tailtwister" through the caps found a trail to ground and so did all Flesher TU-170 connections. A couple of surplus military grade .001-uF 1,000-volt mica caps were placed on ac mains to ground at the primary circuit box, and even individual branches to the shack were similarly grounded.

Again, Zaaaapp!!! Everything was fine at 600 Watts or less on 10, 15, 20, and 75 meters, but on 40 it was only a hair better, with the video screen at more than 250 Watts looking like Wiley E. Coyote after a run-in with the Roadrunner.

I broke out the tape measure, ordered a winch truck to lower the 5,000-pound home-brew tower (constructed from 3" o.d. steel oil well drilling offset tubing, welded every four feet with massive 1/4" steel plates between tower legs), and measured the thing from base to beam.

I could have climbed the tower, but I wanted to make sure that the tower was as long as it was tall. You see, an engineer friend of mine, Joe Bethancourt, ex-WA7TUM and now WD5FYR, who graduated from Texas A&M University, told me there might be differences in height and length. Not being an Aggie or an engineer, and trusting a fellow TUM, I wanted to be sure, so I measured it standing and lying down. Both ways, it came to 66 feet, although when lying down I really had to stretch to read the tape.

A handbook printed by a well-known Eastern Establishment ham organization had a formula for wavelength, and when I divided their 468 by anything between 7.070 and 7.090 MHz, I came up with about 66 feet, or a shade more, depending on which pencil I used.

Aha! The shack, one-half wavelength on 40 meters directly below that beam,

put the TRS-80 video monitor right in the core of the ground field of the antenna. Long may my retinas live, Ralph Nader.

What next? Well, I crawled up in the attic, where in South Texas that space hovers at 180 degrees, rubbed in some fiberglass so the XYL would feel sorry for me, and dreamed of an air-conditioned Faraday shield up there. I thought I could perhaps build the shield in the garage and then carefully move it up to the attic and spread it out.

No, I thought, too much work and too uncomfortable. And one thing I had *not* yet done was to filter the ac line with rf chokes.

In a junk box, I found a couple of surplus chokes of no-telling-what value and built the thing into a small chassis box using appropriate ceramic caps. Since the shack and the 40-circuit breaker box for the house are adjacent, separated only by studs, insulation, and paneling, and because both were directly below the beam at 66 feet, I prayed that filtration would help.

And, it did! The rig could then transmit about 300 Watts on 40 meters before the image went into the "Twilight Zone."

The doughnut shop again tossed a lifeline. I decided that if my crude home-brew filter helped, then a custom-made-for-computer filter would work even better.

My bill at the doughnut shop is always competing for top spot with gasoline charges, and, "What the heck?" I thought, "Buy three of these little jewels—they're only $9.75 each." (With my soldering ability, I always get two spares.) I stuck one of these in with the home-brew filter and soldered them together. You know the reason: "If one works well, two will work better." I apply that same philosophy to medicine—especially hot toddies.

Two didn't work much better, even if one prescription did come from the experts who really know how to build filters.

Returning to the old law, "If you still have a problem, check the grounds," I drove in two new ground rods and bonded 'em to the tower and, just in case the electricians hadn't done their jobs, to the house circuit breakers.

That didn't help, except for peace of mind.

What should have been my first step turned out to be the last, but earlier I did not want to break seal on the video monitor while the thing was under warranty. By this point, however, warranty be damned! I got aluminum screen wire off a neighbor's window, about two feet by two, removed the back of the TRS-80 video monitor, and made a shield below, above, and all around the entire guts of the thing. (The neighbor donated the screen that the Baron tore, but that's another story.)

TRS-80 owners will notice that the slide-out video monitor chassis is attached by a ground wire on the left side. When the ground wire is removed, this allows the chassis to slip out.

I cut a piece of stiff poster paper to fit the bottom of the printed circuit board, which is mounted on an aluminum frame, and slipped it in for insulation in case the screen were ever to touch the PC board. A piece of screen was cut to that same size and used for shielding the chassis bottom.

The remaining screening was trimmed to size and placed on all sides of the chassis, extending up and around the CRT. It was fastened in place by sheet metal screws in holes conveniently provided on the flimsy aluminum frame holding the printed circuit board.

I was careful first to tape all bare connections around the CRT, its neck, and high voltage sections before stuffing the thing back in its case, with a capacitor running to external ground.

That completed the job. One thousand Watts to the antenna doesn't even wiggle the image on any band!

Whether this will heal everyone's TRS-80 RFI headaches, I don't know. I do print, though, a number of RTTYers complaining of TRS-80 RFI either from their transmitters or from the CPUs into their receivers.

Even though it was never a *significant* problem with the Icom-701 receiver, the slight bit of CPU-generated RFI seemed to vanish when the M80 and bus were shielded.

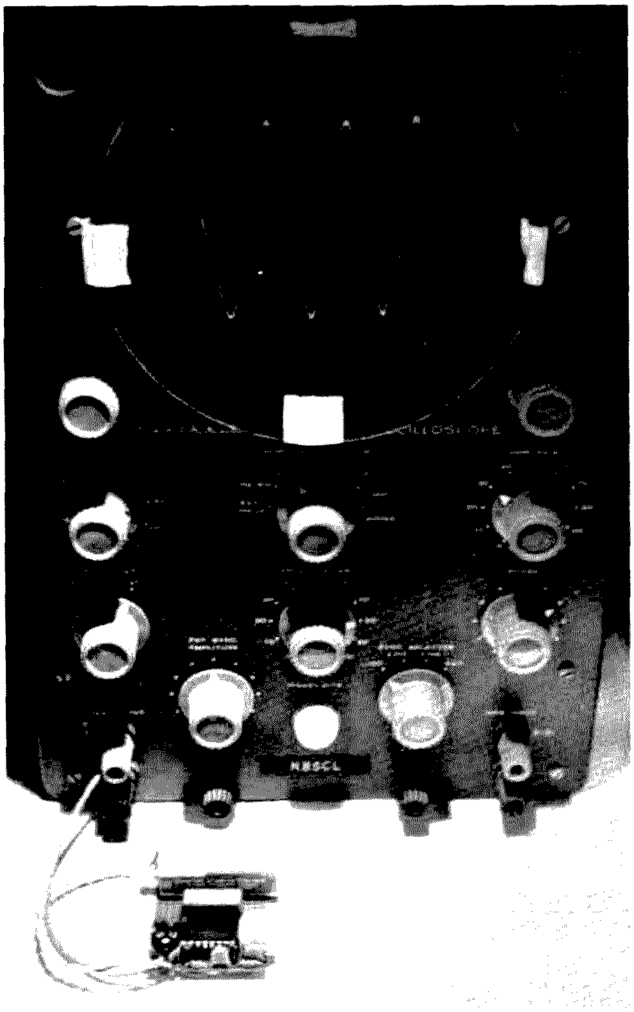
I finally realized that chasing capacitors, rf chokes, and grounding logbooks to beer cans, coupled with time spent learning something about Level II BASIC and RTTY, had all but totally curtailed communication with the most important ham in town, WD5JZS.

But, I also neutralized harmonic interference from the kitchen. A nice floral arrangement, delivered to her desk during the third week with a note expressing my appreciation for her understanding, prompted Malinda to CSAVE me, the shack, and the TRS-80.

It's like soldering capacitors to everything. Each step helps, but no effort by itself completes the job. Tonight I cooked dinner, and tomorrow I'll order the M800 stuff right after I do the laundry. ■

Two Dollars a Tone

—an inexpensive subaudible generator based on the S2559


The finished unit showing filtered output and its relative size compared to a 9-volt battery.

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Do you say you always wanted a Private Line—and more than one or two? (PL is a registered trade name of Motorola.) Then this circuit is just for you.

Being a traveling man, I have been looking for a circuit that would generate the PLs required in the areas I frequent.

Ohio and Michigan have used continuous tone-coded squelch systems (CTCSS) for a number of years. The CTCSS was designed for commercial two-way radio systems to allow many users on the same repeater or to allow adjacent repeaters to use the same frequency. Skip and other less mentionable things have made it advantageous to have this ability on an amateur radio repeater. Most of the time a PL is not required. It is only in the rare instances when problems exist that it is implemented.

It is at these times that I find myself needing the PL frequencies of 71.9 Hz for central Ohio, 100.0 Hz for Detroit and Toledo, and 110.9 for northeastern Ohio. They are not a bargain, for sure, at the price of commercial units. Then—Eureka!—the LSI (large-scale integration) boys did it again: a digital tone-generator chip with a price of under $5 each.

Design Objectives

The specifications that are important to the design of a CTCSS digital tone generator are: sine-wave output, stability (frequency, temperature, and level), and wide operating supply voltage. The sine-wave output with low distortion is to prevent harmonics from entering the 300-Hz to 3400-Hz receiver audio band and to have it stay subaudible as it should. Frequency stability and ac-

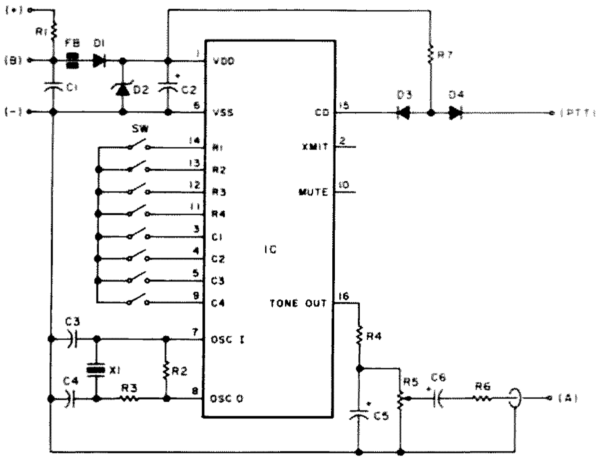


Fig. 1. Schematic diagram.

curacy must be ±2 Hz from center frequency to activate most decoders.

General Description

The American Microsystems S2559B/D digital tone generator was specifically designed to implement a dual-tone telephone dialing system. The device can interface directly with SPST switches. All necessary frequencies are derived from a crystal standard providing very high accuracy and stability. The required sinusoidal waveform for the individual tones is digitally synthesized on the chip. The waveform so generated has very low total harmonic distortion.

A voltage reference is generated on the chip which is stable over the operating voltage and temperature range and regulates the signal levels of the tones. The switches are arranged in a row/column format (4 rows x 4 columns). The active row input selects one of the four row frequencies, and the active column input selects one of the four column frequencies.

In standard dual-tone telephone systems, both tones are used. The frequency tolerance must be ±1.0%. However, the S2559 provides a better than 0.75% accuracy. The total harmonic distortion of the tone must be less than 10%. (The output filter provided by R4 and C5 improves this to about 2%.) The absolute amplitude of the tones must be within a controlled range. These requirements apply over the operating temperature range.

Features of the S2559:

- Wide operating supply voltage range: 3.5 to 13 volts (B), 2.75 to 10 volts (D), with outboard regulator, 3.5 to 18 volts. (See schematic.)
- Low power CMOS circuitry allows device power to be from small batteries, e.g., 9 V.
- Uses crystal standard to derive all frequencies, thus providing very high accuracy and stability.
- MUTE and transmitter drivers on-chip.
- Interfaces directly with switches.
- The total harmonic distortion is low.
- On-chip generation of a reference voltage to ensure amplitude stability of the tones over the operating voltage and temperature range.
- Dual-tone as well as single-tone capability.

Switch Position	EIA Tone	Actual Tone
R1 C1,2	—	52.6
R2 C1,2	—	57.6
R3 C1,2	—	63.7
R4 C1,2	71.9	71.3
C1 R1,2	91.5	91.4
C2 R1,2	100.0	100.1
C3 R1,2	110.9	110.7
C4 R1,2	123.0	123.7

X1 – fa = 269.14 kHz

Switch Position	EIA Tone	Actual Tone
R1 C1,2	—	54.2
R2 C1,2	—	59.5
R3 C1,2	67.0	65.8
R4 C1,2	74.4	73.6
C1 R1,2	94.8	94.4
C2 R1,2	103.5	103.4
C3 R1,2	114.8	114.3
C4 R1,2	127.3	127.7

X1 – fa = 277.98 kHz

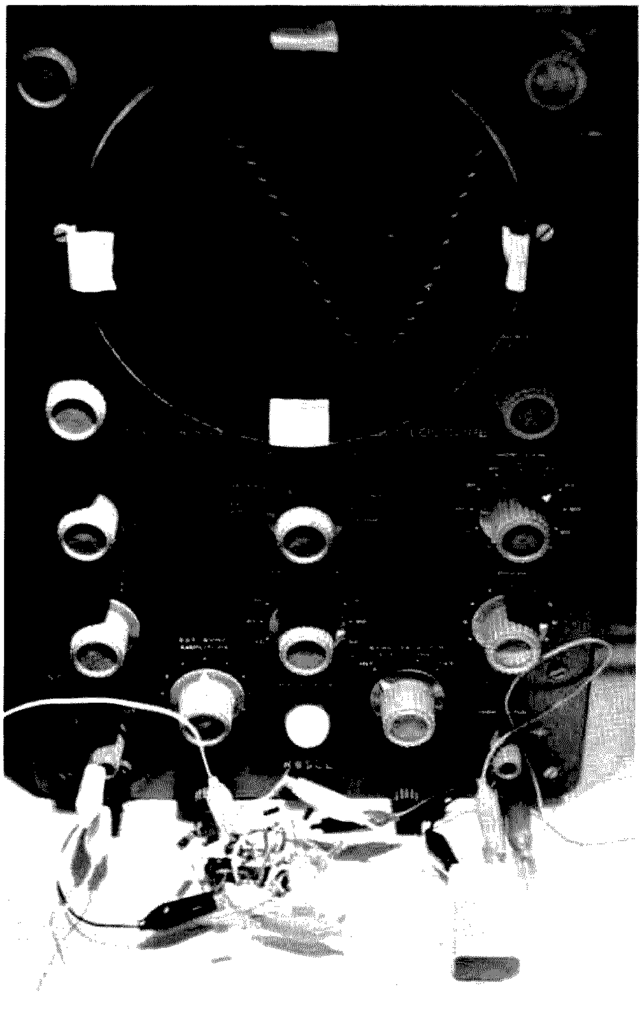
Switch Position	EIA Tone	Actual Tone
R1 C1,2	—	56.2
R2 C1,2	—	61.6
R3 C1,2	67.0	68.2
R4 C1,2	77.0	76.2
C1 R1,2	97.4	97.8
C2 R1,2	107.2	107.1
C3 R1,2	118.8	118.4
C4 R1,2	131.8	132.3

X1 – fa = 287.89 kHz

Switch Position	EIA Tone	Actual Tone
R1 C1,2	—	64.6
R2 C1,2	—	70.9
R3 C1,2	—	78.4
R4 C1,2	88.5	87.7
C1 R1,2	*	112.5
C2 R1,2	123.0	123.2
C3 R1,2	136.5	136.2
C4 R1,2	151.4	152.2

X1 – fa = 331.19 kHz

*Fig. 2. Frequency chart. fa = frequency anti-resonant; * = not EIA tone, but WR7ANP, Tucson, is listed using 112.7.*



The breadboard circuit showing the stairstep waveform.

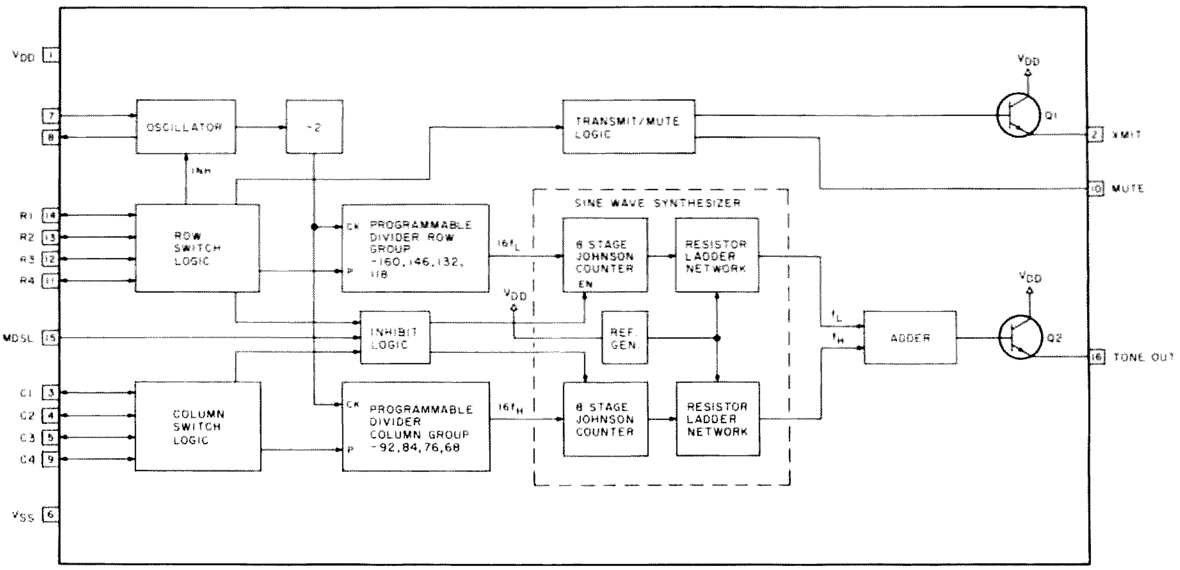
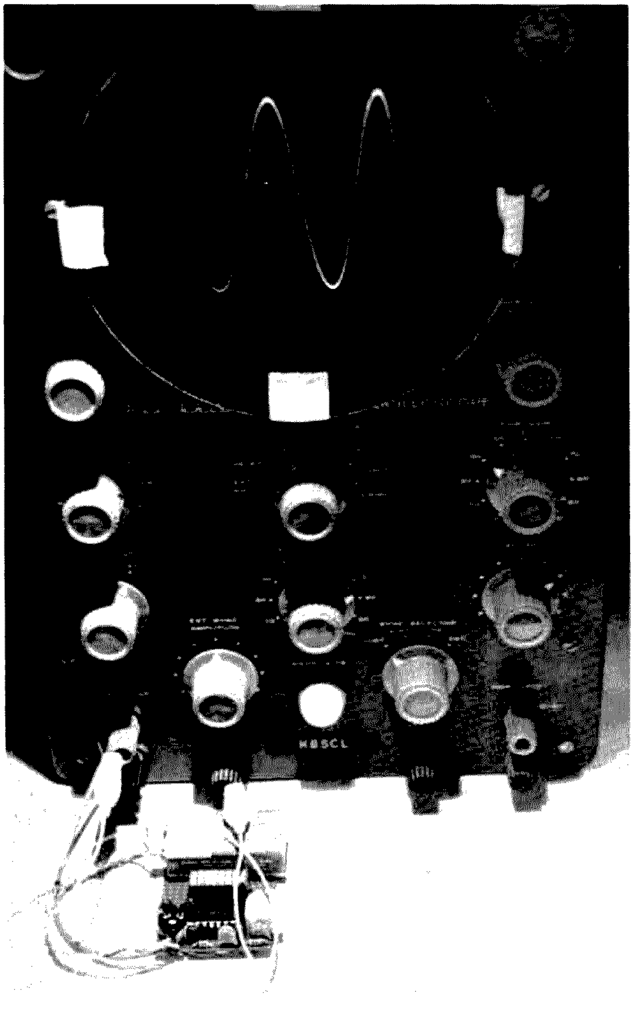


Fig. 3. Block diagram.

Oscillator

The device contains an oscillator circuit on-chip so that it is necessary only to connect a 10-megohm feedback resistor, the necessary capacitances, and a standard crystal across the OSCI and OSCO terminals to implement the oscillator function. (A ceramic resonator was used in place of the crystal to lower cost.) The oscillator operates whenever a row input is activated. The oscillator frequency is divided by 2 and then drives two sets of programmable dividers, the row group and the column group.



One-volt calibration level.

Switch Operation

The S2559 employs a calculator-type scanning circuitry to determine switch closures. When no switch is selected, active pulldown resistors are ON on the row inputs and active pullup resistors are ON on the column inputs. When a row switch is selected, a high level is seen on one of the row inputs, the oscillator starts, and the scan logic turns on. The active pullup or pulldown resistors are selectively switched on and off as the scan logic determines the row and the column inputs that are selected. The advantage is that an arrangement of SPST switches can be used, without the need for a common line.

Logic Interface

The S2559 can interface with CMOS logic outputs directly. Active high logic levels are required. Since the active pullup resistors present are 500-Ohm typical, diodes can be used to eliminate excessive sink current flowing into the logic outputs in their low state.

Tone Generation

When a valid switch closure is sensed, the row- and column-switch logic programs the row and group dividers with appropriate divider ratios so that the outputs of these dividers cycle at 16 times the desired frequencies. The outputs of the dividers drive two 8-stage Johnson counters. The symmetry of the clock input to the two divide-by-16 Johnson counters allows 32 equal time segments to be generated within each output cycle.

The 32 segments are used to digitally synthesize a stairstep waveform to approximate the sine-wave function (see Fig. 4). This is done by connecting a weighted resistor ladder

network between the outputs of the Johnson counter, V_{DD} and V_{ref}. V_{ref} closely tracks V_{DD} over the operating voltage and temperature range, and therefore the peak-to-peak amplitude V_p ($V_{DD} - V_{ref}$) of the stairstep function is fairly constant. V_{ref} is so chosen that V_p falls within the controlled range of tones.

The individual tones generated by the sine-wave synthesizer are then linearly added, and they drive a bipolar NPN transistor connected as an emitter-follower to allow proper impedance transformation, at the same time preserving the signal level. Amplitude depends upon the operating supply voltage as well as the load resistance connected on the tone output pin. The on-chip reference circuit is operational when the supply voltage equals or exceeds 5 volts, and, as a consequence, the tone amplitude is regulated in the supply voltage range above 5 volts.

The load resistor value also controls the amplitude. If R_L is low, the reflected impedance into the base of the output transistor is low and the tone output amplitude is lower. For R_L greater than 5k, the reflected impedance is sufficiently large and the highest amplitude is produced. For the values shown in the schematic (see Fig. 1), the output across R5 is adjustable to approximately 1.5 volts peak-to-peak. C6 and R6 provide dc isolation and impedance matching and should be selected for optimum performance with the connected radio.

Parts List

	Radio Shack Parts No.		
Capacitors			
C1—0.01-uF, 50 WV dc disc ceramic	272-131	2/.29	.15
C2—10-uF, 16 WV dc tantalum	272-1411		.49
C3—120-pF, 1000 WV dc disc ceramic, temperature-stable			.15
C4—330-pF, 1000 WV dc disc ceramic, temperature-stable			.15
C5—1-uF, 35 WV dc tantalum	272-1406		.39
C6—4.7-uF, 16 WV dc tantalum	272-1409		.49
Diodes			
D1—1N4001, 1 Amp, 50 V	276-1101	2/.39	.20
D2—1N4739, 9.1 V, 1 Watt	276-562	2/.89	.45
D3—1N914, signal diode	276-1122	10/.99	.10
D4—1N914, signal diode	276-1122	10/.99	.10
FB—Ferrite bead			.10
IC—AMI S2559B or S2559D, digital tone generator			4.65
Resistors			
R1—220, 1/2 W, 10%	271-015	2/.19	.10
R2—10 megs, 1/4 W, 5%	271-1365	5/.39	.08
R3—8.2k, 1/4 W 5%	271-1334	5/.39	.08
R4—470, 1/4 W, 5%	271-1317	5/.39	.08
R5—10k, 1/8 W, potentiometer	271-335		.39
R6—47k, 1/4 W, 5%	271-1342	5/.39	.08
R7—10k, 1/4 W, 5%	271-1335	5/.39	.08
SW—8 rocker DIP switch	275-1301		1.99
X1—Ceramic resonator (see frequency chart), Radio Materials Co., Chicago IL 60646, model CR15			1.50
Printed circuit board			2.50
IC socket, 16-pin dual inline (DIP)	276-1998	2/.89	.45
	Total		$14.75

Dual- and Single-Tone Modes

When one row and one column are selected, a dual-tone output consisting of respective tones is generated.

Single tones either in the row group or the column group can be generated as follows. A row tone can be generated by selecting the appropriate row input and two column inputs. A column tone can be generated by selecting the appropriate column input and two row inputs.

Chip Disable

The S2559B and S2559D have a chip-disable input at pin 15. The chip disable is active high. When the chip disable is active, the tone output goes to V_{SS}, the row and column inputs go into a high impedance state, the oscillator is inhibited, and the MUTE and XMIT outputs go into active states. The schematic in Fig. 1 provides R7, D3, and D4 so that the grounding point (PTT) will enable the chip. If this feature is not desired, omit R7, D3, and D4.

MUTE, XMIT Outputs

The S2559 has a CMOS buffer for the MUTE output and a bipolar NPN transistor for the XMIT output. With no switches selected, the MUTE output is low and the XMIT output is in the active state so that substantial current can be sourced to a load. When a switch is selected, the MUTE output goes high, while the XMIT output goes into a high-impedance state. When chip disable is high, the MUTE output is forced low and the XMIT output is in active state regardless of the state of the switch inputs.

Outboard Regulator

The outboard regulator is composed of R1, C1, FB, D1, D2, and C2. Resistor R1 is used to limit current and keep the voltage regulating zener diode, D2, within safe operating limits. Diode D1 provides reverse polarity protection as well as combining with D2 to make the regulator circuit inactive unless the input is greater than 9.8 volts. Capacitor C1 and ferrite bead FB are for RFI suppression; capacitor C2 is the filter capacitor. A voltage greater than 10 volts should be connected

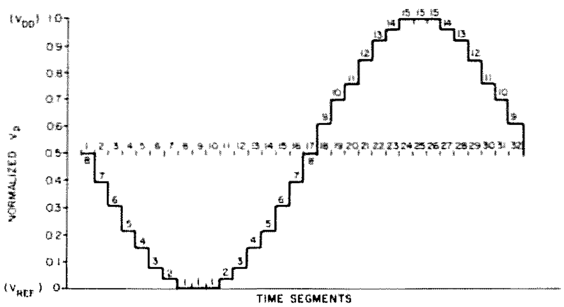


Fig. 4. Stairstep waveform of the digitally-synthesized sine wave.

67.0	97.4	127.3*	186.2
71.9*	98.1 N*	131.8*	188.0 N
74.4	100.0*	136.5*	192.8
77.0	103.5*	141.3*	203.5
79.7	107.2*	146.2	209.0
81.0 N	110.9*	151.4*	210.7
82.5	112.7 N*	156.7	218.1
85.4	114.8*	162.2	225.7
88.5*	118.8	167.9	233.6
90.0 N	121.0 N*	169.0 N	241.8
91.5	123.0	173.8	250.3
94.8	124.0 N	179.9	

*Fig. 5. EIA and other CTCSS tones. N = not EIA tone; * = tones listed in repeater directories.*

between points (+) and (−). A voltage less than 10 volts (i.e., from a 9-volt battery) should be connected between points (B) and (−).

Notes

The tone must be inserted after the modulator audio filter—most likely at the deviation control. (Be sure to match impedances.)

The audio level control, R5, should be adjusted to produce 0.5-kHz to 1.0-kHz deviation.

The encoder should be switched on or enabled only in the transmit mode. This can be done by applying power to (+) or (B). By utilizing the chip-disable feature, point PTT can be connected to the push-to-talk switch and power can remain constant while the radio is turned on.

CTCSS tone generators cause a problem in some synthesized transmitters. Consult the manufacturer for recommendations.

Printed circuit boards, available from R. A. Harold K8SCL, 1856 Cherrylawn Drive, Toledo OH 43614, are $2.50 each. Please send an SASE.

Frequency anti-resonant ceramic resonators have been purchased for fa = 269.14 kHz. Contact me for information regarding these. ■

References

"All About SCTS," John Franklin K6LUA, *73*, August, 1977.

"Should Repeaters Use Sub-Audible Tones?", Art Reis K9XI, *73*, July, 1978.

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COS/MOS Integrated Circuits Manual, RCA, Solid State Division, Somerville NJ 08876, 1972.

Repeater Atlas, *73*, 1977.

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The World Above 430

—part I: getting there is easier than you think

As amateur radio has progressed over the years and we amateurs have been evicted from the lower frequencies for one reason or another, we have continued to operate at the higher and higher assignments until a few years ago. I realize that many hams today have gone on to the microwave regions, but usually with laboratory or commercial equipment. Very nice gear is presently available commercially, even for 10 GHz, if one can afford it!

Even 2 meters was rather barren until a few years ago when the equipment drawn out of commercial service got the FM ball rolling. Then the multi-mode imports added the CW-AM-SSB language back to VHF, as it had been heard on the lower bands. There, all seems to have stopped again! Only the crowded conditions of 2 meters and the persistence of some ATVers seem to have "pushed" us into trying 450 MHz. As far as 1296 MHz goes, it is 90% forget-it. It is either limited activity with antique gear and modes or full-blown efforts at EME with gear straight from microwave laboratory environments. The following reasons sparked me recently to give it a whirl—one more time.

1) I was lucky enough to get on 1296 MHz over 10 years ago in an area of the country where it was then popular. Modulated APX-6 surplus military gear ruled the roost, and the biggest technical debate seemed to be, do I demodulate the received signal as AM or FM? The rig's characteristics were such that few hams really knew which they were sending, and even fewer of them cared! FM won, by the way.

2) Being familiar with the price versus quality (low vs. high) of the APX-6, and knowing that many were still around, led to my trying to overcome the contempt I formed of them 10 years ago. The contempt was mostly over the mechanical modifications required, and not over the electronics. At 1296 MHz, it is a "plumbing" world until someone comes up with a better idea. I am *not* a mechanical genius, and I have the disgust for mechanical things to show for it. In fact, in electronics I am only an expert (i.e., x = an unknown quantity; spurt = a drip under pressure!). With any attack I make on something I make or design, you can bet on an electronic approach.

3) Whatever I came up with had to be cheap—or at least inexpensive—so that I could interest others. This was from both an article standpoint and, equally important, so that I could get some local 1296-MHz population to talk with!

I believe that this article just might awaken an interest in trying out 432 and 1296 MHz, because it is based on sound and easily-proven facts. Those facts are:

- There is a fast-growing group of hams who own multi-mode or, at the least, FM 2-meter rigs in the 1-to 10-Watt category. That meets requirement one for my scheme.
- Many recent articles have been about small, light, high-gain antennas that can be built at home cheaply and effectively. Requirement two, that you need a good antenna, is met!
- A cheap means of getting from 2 meters to at least 432 MHz does exist, and in nearly ready-to-use shape. Don't panic for now about what tripling does to the modulation, OK? So much for requirement three.
- The APX-6 is an obvious answer to get from 432 to 1296, but the nearly ready-to-use item I chose turned out to be a commercial FM rig of the GE, RCA, or Motorola type, in my case, a Motorola T-44. Only the transmitter strip need be bought ($10 or less at hamfests), and then only the two box assemblies that are the 2C39 tripler (144 MHz to 432 MHz) and the 2C39 final are used. The latter is turned into a tripler itself in 1296-MHz use.
- Some scheme of modulation (beyond the obvious

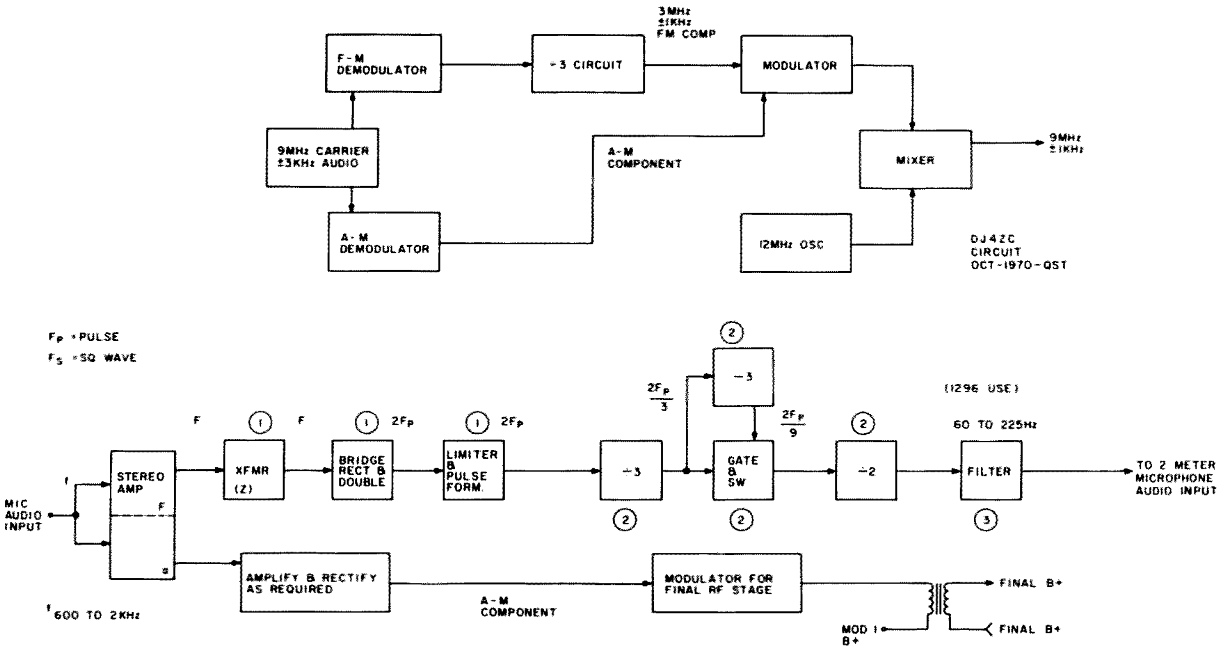

Fig. 1.

one of CW) which can be handled during frequency multiplication is required, and I'll cover that first.

In order to prove out my point on the modulation scheme, I refer you to an excellent construction article that seems to have slid right by present VHFers' notice. It is by Karl Meinzer DJ4ZC, and appeared in the October, 1970, *QST*. If you can imagine putting just old AM modulation on the original 2-meter signal and tripling twice to get to 1296 MHz, the results are understandably horrendous. If I may, I will quote from Karl's article one full paragraph that says it all better than I could.

"It is well-known that conventional frequency multiplication results in distortion of an amplitude modulated signal." (That's for SSB as well—author.) "Frequency multipliers are usually class C amplifiers, which have a non-linear relationship between the input and output voltages. The third harmonic of an amateur AM signal may be readable enough, though somewhat distorted, but the complex nature of sideband (which is really AM of sorts) makes the signal unintelligible after multiplication in conventional stages."

The author goes on to describe a quite workable system that begins by modulating a 9-MHz carrier, then demodulating the FM and AM portions in separate channels, dividing the FM channel by 3, combining the AM component back in through the use of the new 3-MHz carrier frequency, and then mixing against a 12-MHz signal to get back to 9 MHz. What he has, as his diagram in Fig. 1 shows, is (FM/3) + AM at 9 MHz. Anywhere that this is again tripled (as in the transmitter class C tripler), the original modulating tones or audio reappear.

I had been working on a scheme for two years when this appeared, but for quite different reasons. My moonbounce interest goes back further than that even, and I had concluded that I would have to run CW or come up with a narrowband (very narrowband) voice system in order to run very narrow bandwidths in the receiver and reduce the system noise problem. I thought, with all the TTL ICs just then appearing, that this would be my method. I would divide down the voice (only at baseband audio, in my case) so that a 300-to-3000-Hz voice band, when divided by 10, would become a 30-to-300-Hz band. The problems arose when I tried to figure out a way to reverse what I had done to straighten it out on the receive end. It should all work at baseband audio, so that no station equipment modifications would be required.

Karl's article really sparked the way to go for me. By taking the speaker audio (original audio frequencies divided by 10, sent, and received) and using it to modulate a 50-kHz carrier (using old surplus receiver coils such as are used in some Q-multiplying operations) and multiplying in an i-f with class C stages up to 500 kHz (modified 455-kHz cans), the original audio was back. In short, it worked—great!

I got sidetracked due to new job traveling at that point and could never quite settle the legal aspect of whether this might be thought by the FCC as being encrypted (illegal) transmission on the amateur bands. An STA from them was never sought. All work was noted, filed, and forgotten until recently. I even discussed at the time whether or not just tripling twice, sending it at baseband (but using class C finals), and dividing it down at the receive end would be a valid idea except that the bandwidth (at 1296 MHz) would be wide (i.e., 3 kHz is 3 x 3 x 3, or 27 kHz wide at the frequency of transmission, assuming 2 triplers in class C operation).

My recent work on just getting a carrier on 1296 MHz for a bit of fun this winter reawakened the modulation ideas. Sure enough, it all seems to work on QRP, VLF, test-bench setups, and on paper.

Fig. 1 shows Karl's scheme and also mine. The ideas are similar, but just a little different approach is taken. The system is not hi-fi or without bugs, but I will point out where they are and where I think the system is now totally sound. In Fig. 2, the audio system is

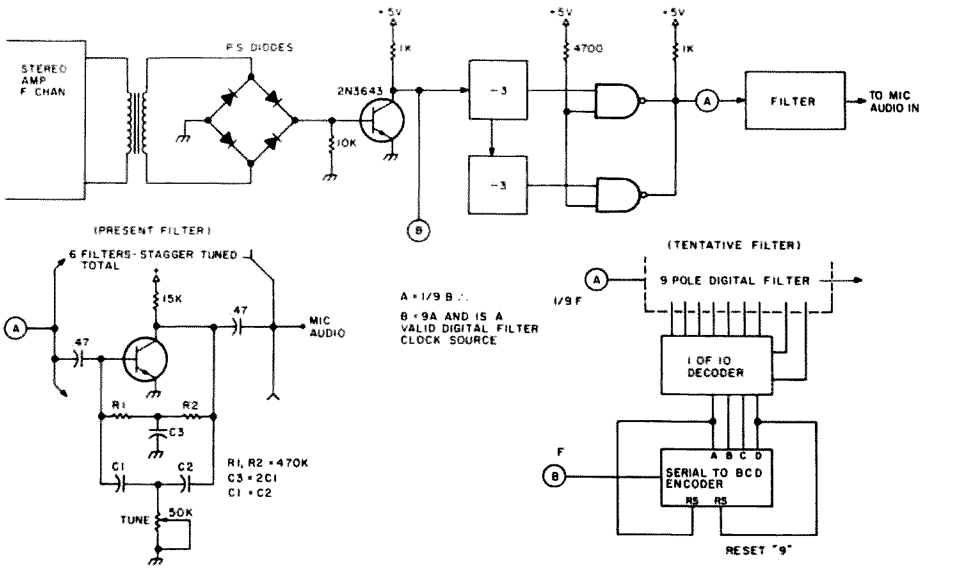

Fig. 2.

efficient and can be made quite inexpensively by using available components. Audio amplification is handled by a small, 1-Watt stereo amplifier. It uses transformers to match the outputs of the amplifiers used, and the split controls allow you some degree of alignment or adjustment.

The gain of the FM channel should be set to produce square waves or hard-limited sine waves at the amplifier output over the range of 300-to-3000-Hz single-tone inputs. The AM channel gain control becomes an AM gain, or modulation level, adjust. It should be set to produce a dc output level that is proportional to the amplitude of the tone input and at sufficient level to re-modulate the AM component back onto the constant-amplitude divided audio at the last audio stage.

The only item which needs more testing in the audio circuits before attempting on-the-air tests is the low-pass filter after the FM divider. Since reams of literature are available in all the amateur magazines and handbooks on "divide-by" circuits for TTL, some CMOS, etc., I have shown the entire scheme as a block diagram and provided details where needed. The low-pass filter is now a group of 6 "twin-T" single transistor filters which are somewhat broadbanded and overlap over the new voice bandwidth (600 Hz to 2000 Hz reduced to approximately 60 to 220 Hz). This is not very expensive, but there must be a better way!

LC filters are not a good choice as they ring too much. Digital filters may be the answer as they have a nice variable bandwidth and a frequency set by a factor of the filter poles and the clock input frequency. Some thought is being given to using a digital filter having 9 poles and the original amplified, rectified, but not filtered FM component frequency as the clock. We are still working on that one, but, meanwhile, the "T's" do work.

The above produces audio divided down in such a way that the output is a square wave (filtered to sine wave) at one-third or one-ninth of the original frequency. If this is applied to a 2-meter transmitter just as microphone audio would be, the result would be a 2-meter signal with divided-audio modulation on it. Unfortunately, using TTL dividers to divide by 3 or 9 results in an unsymmetrical output—not a square wave, but this is easily overcome using some simple power supply theory.

The output of the audio amplifier module encounters a matching transformer. In both of my channels, I used 500-Ohm-to-16-Ohm output transformers installed backwards (16-Ohm side to the amplifier output), and they worked fine. Feel free to try what you have before you go buying anything.

The transformer then connects to a full-wave bridge, which is the quickest and easiest way to double an input frequency that I know of, and it yields just the waveform that is needed for the next stage. The next stage is just an inverter, but it uses the "off" period of the transistor to produce a fairly narrow pulse whose width is equal to the short time the transistor is off. By putting the transistor collector reference up to +5 volts, a TTL-compatible pulse is also produced.

A pair of divide-by-2 ICs follows next, but they are rigged to divide by 3. This is the take-off point to feed the last divide-by-2 stage if you are going from 2 meters to 432 MHz. Otherwise, the signal goes on to another divide-by-3, and on to the divide-by-2 for 1296-MHz work. The whole idea is shown by the following example using a single 2700-Hz tone and 432-MHz end frequency: Double the 2700 Hz in the full-wave bridge to 5400 Hz, divide by 3, which produces 1800 Hz in the divide-by-3 circuit, then divide by 2 to 900 Hz. The result is 2700 Hz divided by 3, but the output is a square wave.

Try the same example for a 1296-MHz end frequency: The 5400 Hz achieved from the doubling action is divided by 3 to 1800 Hz, divided again by 3 to 600 Hz, and sent through the final divide-by-2 to produce 300 Hz. The result is 2700 Hz divided by 9, but with a square-wave output!

When this modulation is applied to a 2-meter signal, the new signal is a 2-meter carrier with modulation consisting of divided-by-3 audio (for 432-MHz use) or divided-by-9 audio (for 1296-MHz use). The 2-meter signal is then multiplied in a class C amplifier tuned to 432 MHz in the output and a 432-MHz signal with the original audio (using divide-by-3 audio in) results; triple again to get 1296 MHz plus or minus the original audio (when the divide-by-9 audio is applied to the 2-meter starting point).

What all of this means is that class C amplifiers (used as multipliers) can be run from 2 meters on up. Varactors can be used to multiply up to 432 MHz or 1296 MHz, if you are stuck on using solid state. Varactors are efficient and no extra parts or power supplies (regulated-type screen supply, etc.) are required to operate on UHF, where everything gets hard to tame or work with.

Since the length of this article kept growing, due to

the construction of the audio portion and explaining what may be a whole new modulation scheme, and there are yet the T-44 transmitter and APX-6 to deal with, I have decided to break the article into two parts. Part 2 covers the T-44 and APX-6 modifications (which are not as complicated as the original APX-6 articles) and a few band plans and idiosyncrasies of this system—such as FM use. In the meanwhile, you can build the audio portion and even completely check it out by using single tones in place of voice.

If the point marked "voice audio out" is fed to an audio amplifier and a 2700-Hz tone is fed to the stereo amplifier, a clean 300-Hz tone should result out of the speaker (divide-by-9 mode). By varying the AM channel gain, you should be able to find a point where the output level is clearly proportional to the input. Keep the tone controls in both channels the same to avoid any phase errors caused by RC roll-off. You may want to run bass boosted and treble cut to help the final amplifier handle the new 60-Hz end of the 60-to-220-Hz band. You can make final adjustments on that later to compensate for the stereo amplifier you use, your own voice characteristics, or other small errors that may creep in—just like with a new rig or microphone.

That really is all there is to the audio section, and it is really cut and try, or twist and turn, once you have it all rigged together. You can get your best evaluation of lost bass response and the like by staying with single tones at first (i.e., 600, 800, 1000—up to the 2700-Hz point). Get your audio going, and we'll get it on the air in Part 2.■

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Over There

—notes from Kilroy

The US Army made me a radio ham, although that was not the intention. When they drafted me in 1941, before the shootin' began, they somehow had me pegged as a supply clerk, but I was not about to become a shopkeeper in uniform. Fortunately, all of this happened in a Signal Corps Battalion in South Carolina, and my request for a transfer to the Radio Section was finally approved—especially after I lied about all the radios I'd built before coming into the Army. Well, it was partly true: I had gotten one radio to work.

Photo A. The author at radio school in Ft. Jackson, South Carolina, deep in copying Morse code groups.

When I hear amateur radio newcomers talk now about how hard it is to learn code and theory, I smile a little. It was not hard for me — I just put in four or five hours a day, every day for three months, and I knew all that I needed. I was lucky. The Radio Section of the 56th Signal Battalion was composed mainly of hams, all of whom were very helpful. We spent many an evening around a BC-342 receiver listening to amateurs send CW on the 7-MHz band (then, 7 megacycles), and I picked up amateur procedure that way. But then the shootin' did start, and I did not get my ham ticket until I came back home in 1945.

I wound up in Algiers at Allied Force HQ as a radio operator. On the first night, they put me at a receiver and told me to copy what was coming in. The other

end of the circuit was, they informed me, Casablanca. Casablanca! Was Humphrey Bogart at the key? Whoever he was, he was a little too fast for me, so I sent the Army Z signal for QRS—"send more slowly." No response. I tried again. More speed. Then he cut back to about 5 wpm and sent in clear text: "Put the radio chief on."

I called the officer in charge, who sat down and shared the phones with me. Still in clear text, and still at 5 wpm, came the message: "Put a real operator on." The lieutenant took the bug (a Vibroplex automatic key) and ripped off a string of Morse that I could not read. "You won't have any trouble now, OM," he said. Another ham! And he was right. I worked the Casa circuit for weeks, and as my code speed came up, it actually became fun.

But working radio out of a main headquarters in a big city, while it had its advantages, was not my idea of being an Army radio operator. In a very foolish moment, I asked for a transfer and got it — to the First Armored Division, where I was put at a radio in an armored half-track and sent Morse with a key clamped to my thigh.

I was Net Control for a Combat Command, a small, highly-mobile unit of the Division. One of the ways we confused the enemy (and ourselves even more) was to change net frequency each midnight. This meant tht I had to get everyone zero-beat to the new frequency, which took at least an hour, during which all the radio operators in the whole German Army were saying to one another, "Vell, ve see that Jablin is now on 2.345 megs tonight."

Some of the operators in the net had very little experience, and the fellow in the Ordnance Company was getting his training "on the job." One night, after all stations had checked in on what was approximately the frequency, he came back to me and asked for a signal report. I gave him a 5 by 5 — strong and readable. Then he came back on phone and confessed that he really did not know how to load up a BC-191 transmitter.

Photo B. Livestock on the desert was a little different from that at home, as the half-track driver discovered.

Right then and there, a few miles from the enemy line, I instructed him about tuning a transmitter using the final plate meter. Then, unthinking, I joked: "If you don't think that you're getting out, hold the key down and touch the base of the whip antenna."

He must have tried it as soon as I told him. You never heard such vile language on the air! The BC-191 ran about 75 Watts in and about 25 Watts to the antenna (not efficient, but reliable), and I'll bet that he had a blister on his finger for a long time.

The German Army (and we, I guess) had radio intelligence sections which tracked down the other side's transmitters for one reason or another. I discovered one of the reasons one night on the North African desert. Every time that I made a transmission, a few 88mm shells dropped nearby. Pretty soon I got the connection and gave up the radio until we moved to a new location.

Come to think of it, we must have had *some* kind of radio intelligence. One of the operators at Allied Force HQ in Algiers just could not get along with his fellow GIs, his officers, Army regulations, or Algerian wine, so they shipped him up front. Somehow, in the middle of the Algerian nowhere, he found a bottle of wine, which inspired him to retune his radio to an Algiers frequency which he'd remembered and send a personal message to his old CO, asking his forgiveness and a transfer back to AFHQ. Someone intercepted him and he did get back to Algiers, but as a prisoner. The Army was stuffy about that sort of operating.

All of the radio equipment that I used during World War II was tunable; we had little crystal-controlled operation except for some mobile FM stuff. By today's standards, signals were broad and not terribly stable. This meant that the CW note was not especially pleasant to hear, but if transmitter and receiver were reasonably close in frequency, solid copy was possible.

The combination I used most was the SCR-193. This consisted of a BC-312 receiver (still to be found at hamfests) and a BC-191A transmitter, plus associated antenna tuner, dynamotor power supply, etc. The 312 was a superb receiver for its time. Its main drawbacks were a bad case of backlash in the gear-driven dial, an occasional drifting local oscillator, and its weight — about 200 pounds, it seemed, when you were trying to wrestle it into or out of its mounting.

The 191A was another kind of beast. It was a basic "Master Oscillator-Power Amplifier" rig (MOPA), a circuit which had been popular with hams for

many years before. "Master Oscillator" was 1930s lingo for a vfo, preferably one with the instability built in. When you keyed it on CW, the oscillator gradually came up to frequency to make a dot or dash, then dropped right off, giving the Morse a very distinctive "yoop" sound. Amateurs who tried to put the 191 on the ham bands after the war quickly heard from the FCC. The PA had, as I mentioned, about 75 Watts input. This often was loaded into a whip which physically or electrically had no reference to the operating frequency. We did the best that we could with the antenna tuner, which often worked.

The SCR-193 could be mounted in a jeep, a truck, a tank, an aeroplane, or, with an ac version of the receiver, it could be fixed. That is why I saw so many of them.

We "field radio operators" were not supposed to do much maintenance; changing tubes and lubricating dynamotors were all that the regulations permitted. When something went really wrong, we were supposed to send the radio back to "second echelon," which had its own limitations on what it was supposed to do. No one paid much attention to all of this. If you thought that you could fix it and you had the time, you tried. We had the manuals which came with the equipment, but many of us used the *Radio Amateur's Handbook* as our basic reference.

To this day, I hate to use earphones, for a very funny reason. We had our half-track at a forward observation post and I was operating from outside the track, using the phones and key on long extension cables. The phones prevented me from hearing the first mortar shells come in, and by the time I tried to find shelter under the vehicle, it was too late. A few shell fragments caught me in the leg and elsewhere, and I was away from the radio for a few months.

When the Army decided that they wanted me back at work, the North African campaign was over. I was put on a troopship to Naples, Italy. This short voyage produced one of the mysterious interludes in my Army career. About an hour after we left port, I was paged on the PA system and told to report to the Army officer in charge. He asked if I were, indeed, a radio operator, and by this time, I felt qualified to say yes. He then took me to the ship's radio shack and sat me in front of a receiver, with orders to listen for signals, to copy anything I heard, and "don't touch the tuning!"

I sat there for a whole week, except for meals and sleep, when I was relieved by another operator. And I never heard a thing.

In Italy, I spent some time in a replacement depot while the Army lost my records and found them again. When my papers did show up, I discovered that I'd been reclassified "Field Radio Operator and BAR (Browning Automatic Rifle) Gunner." I'd never seen a BAR, and to date I have never used one. But — if the need should arise — I am qualified. The Army says so.

After rediscovering the fact of my existence, the officers in charge of my life put me on a truck and sent me north toward the action. The truck stopped at the 120th Engineer Combat Battalion and a lieutenant with a clipboard called my name and serial number. I looked around at the bulldozers and other heavy equipment and said, "Sir, there must be some mistake. I'm a radio operator, not an engineer." He checked my name and number again. "Well, Jablin, you're an engineer now."

On the way to Battalion HQ, I passed a jeep and saw an SCR-193 mounted in it. I was home again!

Combat engineering had its own light moments. I was the operator of the jeep radio; we used the car for reconnaissance and other general errands. Mainly, we chased around Italy and (later) France, looking for blown bridges, mined roads, and other hazards to health—except for the four months that I sat in a hole on Anzio doing nothing.

Actually, one never did "nothing" in the Army. Our S-2 (battalion intelligence officer) had an inordinate affection for explosives and believed that every soldier in an Engineer Division should share that love. Therefore, he filled our idle Anzio days with classes in how to use TNT, dynamite, black powder, and all the rest — how to make booby-traps and how to defuse them, and what a shaped charge is and how to blow a bridge with one. Life was one great Fourth of July.

Then I discovered that mine detectors were considered radio equipment (they had batteries and tubes) and part of my job

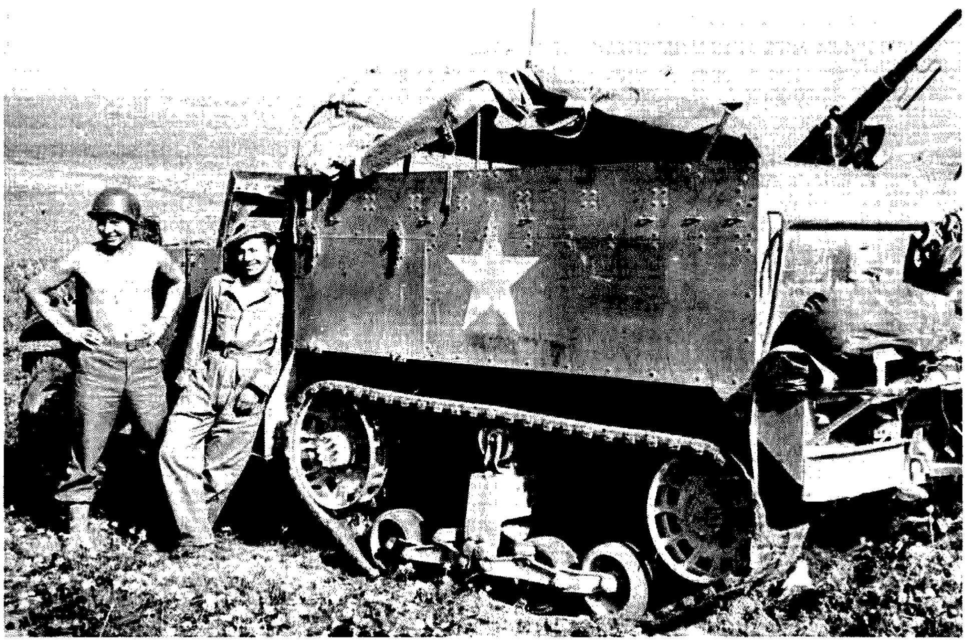

Photo C. This was the 1941 model of an ATV—All-Terrain Vehicle—complete with SCR-193 radio, 30- and 50-caliber machine guns, armor plating, and a canvas top to keep out the rain . . . in the desert.

Photo D. No matter what the locale, a GI haircut was part of the Army uniform. The spots on the photo are from sand which got into the developing tank. Film was processed in a small tent at night.

Photo E. The SCR-193 was mounted behind the front seat of this Command Car, and the whole rear compartment was the "radio shack." The rig got a good workout during maneuvers in the Carolinas during the summer of 1941.

was to keep these gadgets working. If you've ever read the catalog description of a Heathkit metal locator, you know the general principle behind mine detectors. Later models, designed to locate non-metallic mines, worked like VHF grid-dip oscillators. The men who swept roads and fields with these devices gave me frequent invitations to come along and watch them work, the philosophy being that it must be very interesting for me to see them use the equipment I'd worked on. It was interesting, but if I turned such invitations down, the response was likely to be: "Don't you think that you did a good job fixing this damn thing?"

So, the radio communications was mixed with a good deal of military engineering.

The other operators in the battalion did not share my preference for CW, and therefore we used phone most of the time. This led to some interesting voice communications (very much against Army rules) when we used slang or obscure references to avoid the trouble of encoding messages.

The jeep was laid up one day and my company moved ahead, leaving it in a French barn — and me to keep an eye on it — until a repair part could be brought back. As evening fell, there was a knock on the door and a Frenchman stuck his head in. "Monsieur," he said, "Des Allemands sont arrivés (The Germans have come)." Great! I was the only GI left in town. "How many?" I asked, continuing in French. "Nine," was the answer.

The odds were nine to one, and no matter what the magazine stories said, I didn't believe that one American (me) was a match for nine Germans. I got on the radio, and the heck with military procedure. Without any preliminaries, I began right after pressing the mike button: "Do you know who this is and where I am?" My buddy at Company HQ recognized my voice and remembered that I'd been left behind; he gave me an affirmative. "Some of Walter's cousins have dropped in for a baseball game up the road . . . want to join in?" I continued. Walter was one of the radio ops. He was of German extraction, and we used to kid him about the German Army being full of cousins of his.

The other operator got the message. "I'll tell Uncle Bill and we'll be along," he said. "Over." Uncle Bill was Major Williams, the Exec Officer. Shortly after, a GI truck drove up with several soldiers from HQ, along with Uncle Bill. Actually, no fight developed. The Germans were tired, cold, hungry, and very much in a mood to surrender. But I was glad that I'd had the radio.

Uncle Bill came to my rescue another time, too. Our battalion was to put an assault pontoon bridge across a river under cover of darkness, and as soon as night fell, the trucks loaded with boats drove toward the shore. Motors shut off, they silently coasted the last mile or so down a hill. They were followed by my jeep, driven by a brand new reconnaissance officer fresh from the States.

"Send HQ a message and tell them that we're here," he ordered me.

Now, the dynamotor on the SCR-193 made a fearful racket when it was turning over, and when the transmitter key was hit, the load made it whine like a siren.

"Lieutenant," I said, "There's a whole woods full of Germans on the other side of that river and they don't know that we're here yet. If I use the radio, they'll know that something is going on. Besides, HQ knows that we are here — they sent us."

"Soldier," he told me, "I'm ordering you to tell HQ that we have arrived on the scene."

I stuck with it. "Lieutenant, I'll walk back to HQ with the message, but I'm not touching the radio." At that point, construction began on the bridge and he had to supervise something or other. "We'll continue this later," he promised.

When the bridge was completed (the Germans were awfully surprised), we drove back to Battalion HQ and I headed for my sleeping bag. "Just wait a moment," the lieutenant told me. "We are going to see the Executive Officer." We entered the CP (Command Post) tent and he told Major Williams that he was going to prefer court-martial charges against me. "Hold on, son," said the Major. "Don't use that word so fast. Jablin, what happened?"

I told him the story, including my offer to carry a message back on foot. Uncle Bill thought for a while.

"Lieutenant," he finally said, "you've just arrived here. A lot of us have managed to live through this thing for a long time, and I reckon that you want to survive, too. If you intend to stay alive to get back home, you'd better listen to some of the men who have had the experience."

The lieutenant and I became very good friends, and I occasionally let him use the radio himself. ■

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Busman's Holiday

—combine hamming with pleasure on your next vacation

The thrill of being on the other end of a pileup from an exotic spot is the dream of any ham who has ever tasted DX. While most just dream about it, we did it!

"We" means myself and a few local ham friends. Probably the hardest part is convincing the XYL to let you go. We found the best way to achieve this is to let her visit her mother, since she would not enjoy the hour after hour "on-the-air" routine of a DXpedition.

Photo A. A sample of the excellent wood carvings of Belize. The dark, mahogany-like wood carvings made wonderful souvenirs for the DXpedition crew. Here, Rodger K4BKK/VP1RS poses beside the "Goliath" being carved.

Our first spot was chosen when, during a contact on 20 meters one evening, Norman VP1KT in Belize suggested that we visit him. He coordinated all the license paperwork and before you knew it, I was VP1RS. Loren W4YU became VP1DX, his son, Mike WB6SJD, became VP1MM, and Erv K4HEM became VP1EF. Norman even arranged, through the hotel assistant manager, for us to be able to erect two antennas on the roof of the Fort George Hotel in Belize City.

From the moment we arrived, finding Norman at the foot of the steps coming off the plane, to the frantic climbing about on the roof erecting the antennas, to the nonstop beer drinking (we were afraid to drink the water), to the hour after hour of endless pileups (total: 2500 contacts, SSB and CW), to the local sightseeing and buying Zaracote wood carvings, to the fright of almost missing our plane back, it was four solid days of excitement, and anyone who heard us on the air could tell we were having the times of our lives. We called ourselves the Tunnel Radio DX Club (after my business) and our QSL manager (Phil WB4INC) was still getting cards over a year later. That was July, 1978, and we thought we had worn out the excitement of DX.

That was until the spring of 1979, when Erv and I decided to do it again. Loren and Mike, having other commitments, were sorry they couldn't make it again. We started searching the globe for some ex-

otic spot . . . maybe an island? We chose Sint Maarten since it counted as a separate country from the rest of the Netherlands Antilles. An over-the-air contact with PJ2AAX got his cooperation in aiding with the license paperwork. As it turned out, our applications went to Curacao, the capital, then were sent to Sint Maarten for the signature of the Governor there, and then went back to Curacao for the signature of the Governor there. This process normally can take as long as six months, but with the help of John PJ2AAX and Fred PJ2FR, we got the final signature on the morning we were to depart for the island.

Photo B. Tunnel Radio DX Club DXpedition to Sint Maarten Island (PJ7), July 11-15, 1979. Left to right: Rodger K4BKK/PJ7, Erv K4HEM/PJ7, and Dee VP2EEK, who dropped by for a visit to the operation.

Since local calls are not issued to visitors anymore, I became K4BKK/PJ7 and Erv was K4HEM/PJ7. We were quite shocked that upon arrival at the hotel where we had made reservations, nobody was there! Sitting on our suitcases in the sand, with the mosquitoes biting, we came close to panic. Fortunately, we found a guest in one cottage who drove us down the road to a most beautiful resort, the Caravanserai. We settled into a studio apartment complete with kitchen. (Now, *this* is the way to operate!) Soon after checking in, we sought out the assistant manager and explained our situation. He, being an understanding chap, gave us permission to string two trap dipoles between the palm trees out back. It was after midnight when we tacked up one dipole six feet off the ground only to find that only a few stations could hear us that evening. Being tired from traveling, we hit the sack with the idea of getting up early to erect the antennas.

6:00 am found Erv trying to cast a line with his fishing rod over the top of a palm tree. Three casts, and three times caught high up in the tree. I finally tied the line around a rock, hurled it over that and two other palms, and the antennas were up.

Both antennas performed fine—one was donated by Bassett Antennas and the other by Bing W4IB. Like kids in a candy store, the next few days were filled with hour after hour of pileups. A contest that hit that weekend stole some of our fire, since we kept getting covered up by contesters.

That, and those few times when the bands were lousy, gave us time to sightsee. We visited Phillipsburg, the capital of Dutch Sint Maarten, and found some real bargains in the duty-free shops. The binoculars I purchased came in handy during a visit to a nude beach on the French side of the island (FS7-land).

Between the pileups, the immaculate beaches, the nightlife at the casinos, and the friendliness of the locals, it was another vacation/DXpedition we'll remember for a lifetime. As for 1980, who knows where you'll find us? Keep listening! ■

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A Soft Approach to Logging

—electronic data base management for hams

The amateur exploring uses for a microprocessor in the ordinary pursuit of his hobby will find the possibilities almost endless. It seems likely that in the not too distant future, all amateur equipment will come complete with microprocessor. Most applications will involve some form of process control, but not all. Many amateurs have found that these midgets are well suited to encoding and decoding CW and RTTY signals. As new uses are invented, there will be scores of articles describing them.

In contrast to process-control applications, microprocessors—particularly those which are general purpose—lend themselves well to indirect support. Numerical solution to problems such as filter or antenna design is one example. Record keeping, such as through a logbook, is another. It is my purpose here to examine the record-keeping application. I hope that a number of questions concerning applicability and feasibility will be answered for the initiate.

A logbook, very simply stated, is an information-retrieval system. Unlike financial accounting, which also is information retrieval, it requires little, if any, numerical manipulation. It is merely a convenient methodical way of storing strings of characters. Meaning and interpretation is the responsibility of the user. The value of a log is in its availability for recovery of historic data. A principal drawback is in the time and effort needed to build and maintain the data bank.

From the standpoint of actual cash outlay, the amateur log may well be the least expensive functional item in the ham shack. A pencil and one ARRL log, at the cost of about $1.50, should be good for a year of average operation. If this is true, why consider any large investment for a substitute? Each individual must find his own answer to this question.

There have been several automated logbook programs written and undoubtedly there will be more. Each must stand on its own merits. Some are good, others are not. One recently-published article described a log program for a small computer. In it, the author used RAM (internal memory) for both program and log-data storage. This naive approach is, for all practical purposes, worthless. A beginner's machine could accommodate only about 30 or 35 log entries. Expanding the system to a full-blown 64K would not resolve the storage problem, even for an almost inactive amateur. It is this storage demand which virtually dictates the minimum system. It must be considered in any case, whether the system is to be manual or mechanical.

For any system, there must be first a purpose, then a need. The original purpose of the radio log, established by law, was to provide a detailed permanent record of all station activity. While the minute detail is no longer required, it is a very desirable feature. The purpose, then, is obvious.

Need will be measured individually by the desirability. A great number of amateurs have devised various methods for storing and recovering names and other information about prior contacts. This established a second—probably more important—purpose: that of very rapid search of historic data.

Next, one must decide about the log vehicle. The vehicle will be the item most affecting speed of recovery. This leads directly to investigation of the microprocessor.

In the case of an amateur log, an ARRL logbook can serve as a basis for determining just what information is to be retained. When designing a mechanical system, one does not have the freedom allowed in a manual method. First, electrical storage is expensive and often unavailable. Second, there are certain limitations inherent in the devices themselves. There always will be some conflict between capacity and speed, and, generally speaking, one or the other must be sacrificed to some extent. The system designer must determine which elements of data are important enough to keep, then he must design the form or format in which they will be represented internally and externally.

The number of records to be stored in a useful file depends upon station activity. Many operators easily will log in excess of 3000 contacts in the course of a year. Others may not exceed 300. Any general-purpose system should be designed to meet or exceed maximum stated demands. This may not always be

Program listing.

```
10 ' AMATEUR LOG PROGRAM
20 '      AMLOG
30 CLS:CLEAR500
40 DIM P$(5),W$(3),S1(10),SH(10)
50 DEFSTR S: DEFINT I
60 DEFFNA(D$)=10000*VAL(LEFT$(D$,2))+100*VAL(MID$(D$,4,2))+VAL(RIGHT$(D$
   ,2))
70 DATA "  FILE MAINTENANCE",ADD      APPEND RECORDS,MODIFY  CORRECT RECO
   RDS,"  OPERATING MODES",A0  CARRIER   A1 CW,A2  TONE CW   A3 AM,A3A
    SSB        A4 FAC,A5  TV          F1 FSC
80 DATA F2  AFSK       F3 FM,NFM NBFM       P  PULSE
90 FORI=1TO10:READSH(I):NEXT
100 Q$="ABCDEFGHIJKL"
110 S2="JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC"
120 S3="SUNMONTUEWEDTHUFRISAT"
130 S4="A0 A1 A2 A3 A3AA4 A5 F1 F2 P3 NFMP  "
140 S5="MMDDYY HHMM XXXXXX XXX XXX XXXXXXXXXX"
150 S6=" DATE  TIME  CALL  BND MOD NOTE"
160 S7="% % %% % % ## #### %    % ###MC %  % %          %   ####"
170 S8="%%%### #### %    % ### % % %         %
180 OPEN"R",1,"LFILE/TXT"
190 FORI1=0TO9:FIELD1,(25*I1)ASS9,25ASSI(I1):NEXT
200 ONERRORGOTO 230
210 PRINT@12,"SELECT ONE OF THE FOLLOWING MODES"
220 FORI=1TO10:I1=79+64*I:PRINT@I1,SH(I):NEXTI
230 PRINT@848,"MODE";:INPUTSM
240 IFSM="MODIFY"GOTO 1140
250 IFSM="ADD"GOTO 1450
260 M=INSTR(S4,SM):IFM=0GOTO 230
270 M=(M-1)/3+1:A$=STRING$(25," "):D$=LEFT$(TIME$,8):D=FNA(D$)
280 CLS:PRINT@778,"YOU ARE NOW IN THE LOGGING MODE":PRINT@842,"ENTER THE
    OPERATING BAND IN MC"
290 PRINT@912,STRING$(25," "):PRINT@912,"";:INPUT"BAND";B%
300 MID$(A$,1,4)=MKS$(D)
310 MID$(A$,15,1)=MID$(Q$,M,1)
320 MID$(A$,13,2)=MKI$(B%)
330 S$="":PRINT@838,"COMMANDS ARE: LOG  LOGP  LOGL  FIND  OFF  CLEAR  ST
    OP":PRINT@912,STRING$(25," "):PRINT@912,"COMMAND";
340 INPUTS$:GOSUB 840
350 K=INSTR("LOG FIN OFF CLE ADD MOD STO",LEFT$(W$(1),3))
360 IFKON(K-1)/4+1GOTO 380  , 810  , 560  , 550  , 1450 , 1140 , 1610
370 GOTO 330
380 IFNW<2GOTO 330
390 IFP%=0CLS
400 IFP%<5GOTO 430
410 PRINT@784,"LOG TABLE IS FULL   "
420 FORI=1TO2000:NEXT:GOTO 330
430 IFLEN(W$(2))<4GOTO 330
440 T$=MID$(TIME$,10,5)
450 T%=100*VAL(LEFT$(T$,2))+VAL(RIGHT$(T$,2))
460 MID$(A$,5,2)=MKI$(T%)
470 P%=P%+1:P$(P%)=W$(2)
480 IFP%>1GOTO 490  ELSEL$=D$+" "+T$+STRING$(50," ")
490 MID$(L$,10+0*(P%-1),6)=W$(2):PRINT@64,L$;
500 IFLEN(W$(1))<%GOTO 330
510 H$=MID$(W$(1),0,1):L%=138+64*P%
520  IFH$="F"GOSUB 590  :GOTO 330
530 IFB$="L"GOSUB 600
540 GOTO 330
550 CLS:P%=0:GOTO 330
560 IFP%=0GOTO 330
570 PRINT@150,"LOG":GOSUB 980
580 GOTO 330
590 I3=0:I4=9:I5=1:I7=1:I8=LOF(1):19=1:GOTO 610
600 I3=9:I4=0:I5=-1:I7=LOF(1):I8=1:I9=-1
610 PRINT@L%,"      SEARCHING FOR ";W$(2);
620 E$=STRING$(6," "):MID$(E$,1,6)=W$(2)
630 FORJ%=I7TOI8STEPI9
640 GET1,J%
650 FORI%=I3TOI4STEPI5:C$=MID$(SI(I%),7,6)
660 IFC$=E$GOTO 690
670 NEXTI%:NEXTJ%
680 PRINT@L%,STRING$(19," "):RETURN
690 GOSUB 730
700 PRINT@L%,"";
710 PRINTUSINGS7;G$,D1%,M$,Y%,T%,E$,F%,SX,N$,R%;
720 RETURN
730 GOSUB 1260
740 M1%=INT(D/10000)
750 D1%=INT((D-10000*M1%)/100)
760 Y%=D-10000*M1%-100*D1%
770 M$=MID$(S2,3*(M1%-1)+1,3)
780 GOSUB 1090
790 R%=10*(J%-1)+I%+1
800 RETURN
810 PRINT@586,STRING$(54," "):L%=586
820 PRINT@650,STRING$(60," "):GOSUB 590  :L%=650:GOSUB 600  :GOTO 330
830 '
840 NW=1:IFS$=""NW=0:RETURN
850 FORL=LEN(S$)TO1STEP-1:C$=MID$(S$,L,1):IFC$=" "THENNEXT
860 FORI9=1TO3:W$(I9)="":NEXT:K8=0:K9=0:NW=1
870 K9=K9+1:C$=MID$(S$,K9,1)
880 IFC$<>" "W$(NW)=W$(NW)+C$:K8=0:IFK9=LRETURNELSEGOTO 870
890 IFK0=1GOTO 870  ELSEK8=1:NW=NW+1:GOTO 870
900 '
910 K9=0:FORI9=1TOLEN(A$):
   C$=MID$(A$,I9,1):
   IFC$<>"."GOTO 930
920 X9=K9+1:IFK9<2GOTO 960
    ELSEER=1:RETURN
930 IFC$<>"+"ANDC$<>"-"GOTO 950
940 IFI9=1GOTO 960  ELSEER=1:RETURN
950 IFC$<"0"ORC$>"9"ER=1:RETURN
960 NEXT:ER=0:RETURN
970 FORB%=0TO9:LSETSI(B%)="99":NEXT:RETURN
980 GOSUB 1560
990 FORK%=1TOP%:PRINT@138+64*K%,"";:PRINTP$(K%);" ";
1000 MID$(A$,7,6)=STRING$(6," "):MID$(A$,7,4)=P$(K%)
1010 MID$(A$,16,10)=STRING$(10," ")
1020 INPUT"NAME";SN:MID$(A$,16,10)=SN
1030 LSET SI(I%)=A$
1040 IFI%<9GOTO 1060
1050 PUT1,J%:J%=J%+1:I%=0:GOSUB 970  :GOTO 1070
1060 I%=I%+I
1070 NEXTK%:PUT1,J%:P%=0
1080 PRINT@146+64*K%,"QSO LOGGED";:RETURN
1090 IFM1%>2Y1%=Y%+1900:M2%=M1%+1:GOTO 1110
1100 Y1%=Y%+1899:M2%=M1%+13
1110 J1=INT(365.25*Y1%)+INT(30.6001*M2%)+D1%+5
1120 D2%=J1-7*INT(J1/7)
1130 G$=MID$(S3,3*D2%+1,3):RETURN
1140 CLS:PRINT@15,"EXAMINE OR MODIFY RECORDS":PRINT@79,"ENTER BLANK LINE
     FOR NO CHANGE":PRINT@143,"TO EXIT SPECIFY RECORD NR 0"
1150 PRINT@270,"RECORD NR";:INPUTN%:IFN%=0GOTO1250
1160 PRINT@331,S6;
1170 J%=INT((N%-1)/10)+1:I%=N%-10*(J%-1)-1
1180 GET1,J%:GOSUB 1260 :SN=MID$(SI(I%),7,6)
1190 PRINT@390,"OLD";:PRINT@395,"";
1200 PRINTUSINGS8;D,T%,SN,P%,SX,N$;
1210 PRINT@454,"NEW";STRING$(20," ");:PRINT@459,"";
1220 GOSUB 1310
1230 IFE%GOSUB1690 :GOTO1210
1240 GOTO1140
1250 CLOSE 1:CLS:GOTO 180
1260 D=CVS(LEFT$(SI(I%),4)):T%=CVI(MID$(SI(I%),5,2))
1270 F%=CVI(MID$(SI(I%),13,2))
1280 M=INSTR(Q$,MID$(SI(I%),15,1)):IFM=0M=I
1290 SX=MID$(S4,3*(M-1)+1,3)
1300 M$=RIGHT$(SI(I%),10):RETURN
1310 E%=0:ONERRORGOTO 1440
1320 LINEINPUTA$:IFA$=""RETURN
1330 IFLEN(A$)<25GOTO 1440
1340 GOSUB1620
1350 IFE%GOSUB1690 :GOTO1440
1360 X$=STRING$(25," "):D=VAL(LEFT$(A$,6))
1370 MID$(X$,1,4)=MKS$(D):T%=VAL(MID$(A$,8,4))
1380 MID$(X$,5,2)=MKI$(T%):MID$(X$,7,6)=MID$(A$,13,6)
1390 F%=VAL(MID$(A$,20,3)):MID$(X$,13,2)=MKI$(F%)
1400 I1=INSTR(S4,MID$(A$,24,3)):IFI1=0I1=1
1410 I1=(I1-1)/3+1:MID$(X$,15,1)=MID$(Q$,I1,1)
1420 MID$(X$,16,10)=MID$(A$,28,10)
1430 LSET SI(I%)=X$:PUTI,J%:RETURN
1440 PRINT@459,STRING$(37," "):E%=1:RETURN
1450 CLS:ONERRORGOTO 1540 :PRINT@146,"APPEND RECORDS":PRINT@206,"ENTER B
     LANK LINE TO EXIT"
1460 PRINT@331,S6;:PRINT@395,S5;:PRINT@454,"ADD";
1470 PRINT@459,STRING$(37," "):PRINT@459,"";
1480 LINEINPUTA$:IFA$=""GOTO 200
1490 GOSUB1620
1500 IFE%GOTO1540
1510 GOSUB 1560
1520 E%=0:GOSUB 1360
1530 IFE%=0GOTO 1550
1540 GOSUB1690 :GOTO1478
1550 PUT1,J%:GOTO 1470
1560 J%=LOF(1):IFJ%=0J%=1:GOTO 1590
1570 GET1,J%:FORI%=0TO9:IFLEFT$(SI(I%),2)="99"GOTO 1600
1580 NEXTI%:J%=J%+1
1590 GOSUB 970  :I%=0
1600 RETURN
1610 STOP
1620 E%=0:E$=LEFT$(A$,2)
1630 IFVAL(E$)<1ORVAL(E$)>12GOTO1680
1640 E$=MID$(A$,3,2):IFVAL(E$)<1ORVAL(E$)>31GOTO1680
1650 E$=MID$(A$,8,2):IFVAL(E$)>23GOTO1680
1660 E$=MID$(A$,10,2):IFVAL(E$)>59GOTO1680
1670 RETURN
1680 E%=1:RETURN
1690 PRINT@459,"REJECTED";STRING$(31," "):FORI2=1TO1000:NEXT:RETURN

DONE
```

possible, particularly with small computer systems.

At the very least, the volume will suggest tape or diskette storage. Except for tape systems such as those with the IBM 5110 or Hewlett-Packard 9825, tape cassettes are far too slow to be useful. Disk systems vary widely in both capacity and speed. An 8-inch diskette on the IBM 5110 will hold 1.3 million bytes. The 5-inch minidisk on a single drive for the TRS-80 accommodates only about 58 thousand. Few amateurs are prepared to spend upward of fifteen thousand dollars for a hobby computer, but the microprocessor built for the hobbyist is well within reach of most. With these smaller, slower systems, the record must be carefully designed and the programs as clean as possible if recovery speed and storage capacity are important.

Design of my AMLOG system started with the selection of the Radio Shack TRS-80 as the vehicle. It was to be built around a 16K machine with at least one disk drive. It was not to require a printer. This would keep the initial investment as low as possible. Six data elements—DATE, TIME ON, CALL, BAND, MODE, and SCRATCH PAD—were selected for permanent record. By packing this into a 25-byte record, a TRS-80 system physical record could hold ten logical records. A single-drive system would allow storage of approximately 2000 lines of log. There is no magic in this design; it is simply one of several possible compromises involving capacity, search speed, and internal processing time.

A good mechanical logging system requires at least four independent processes:

- It should allow log entries concurrent with the station operation.
- The system should recover information about

```
HOW MANY FILES 1

MEMORY SIZE

RADIO SHACK DISK BASIC VERSION 2.2

READY

RUN"AMLOG/BAS"
```

Table 1.

```
SELECT ONE OF THE FOLLOWING MODES
FILE MAINTENANCE
ADD       APPEND RECORDS
MODIFY    CORRECT RECORDS
OPERATING MODES
A0    CARRIER    A1    CW
A2    TONE CW    A3    AM
A3A   SSB        A4    FAC
A5    TV         F1    FSK
F2    AFSK       F3    FM
NFM   NBFM       P     PULSE
MODE_
```

Table 2.

```
APPEND RECORDS
ENTER BLANK LINE TO EXIT
DATE     TIME   CALL     BND   MOD   NOTE
MMDDYY   HHMM   XXXXXX   XXX   XXX   XXXXXXXXXX
ADD _
```

Table 3.

```
EXAMINE OR MODIFY RECORDS
ENTER BLANK LINE FOR NO CHANGE
TO EXIT SPECIFY RECORD NR0

RECORD NR 55

      DATE     TIME   CALL     BND   MOD   NOTE
OLD   022077   1620   WB2AXA   14    A3A
NEW _
```

Table 4.

```
YOU ARE NOW IN THE LOGGING MODE
ENTER THE OPERATING BAND IN MC
BAND _
```

Table 5(a).

```
YOU ARE NOW IN THE LOGGING MODE
COMMANDS ARE: LOG LOGF LOGL FIND OFF CLEAR STOP
COMMAND _
```

Table 5(b).

prior contacts as quickly as possible.

- Provision must be made for initial build-up of a data base and for appending log entries to the file in an off-line operation.
- There must be some method for locating and correcting erroneous entries.

These processes can be separated and done in two or three programs. For practical purposes, the real-time logging and search must be combined. The remaining can be in either one or two programs. However, given adequate internal storage, all can be handled by a single program. AMLOG is a single program encompassing all four processes in a command-driven environment.

General Description

AMLOG is a TRS-80-based program designed for management of an amateur radio station log. Log entries can be made in real time or can be entered later. In real-time operation, the program will, at the user's option, recall the first, the last, or both entries of an identified station. Any previously-stored record can be recalled for examination and correction if necessary. Provision is made for building the initial data base and appending records to the file off-line. The program operates in a minimum 16K environment with one or more disk drives. A single drive will accommodate about 2000 log entries; two drives and the formatted diskette will hold in excess of 3000.

Stored Record

Six data elements are contained in a 25-byte logical record. The information retained is:

1) DATE—Dates taken from the internal clock or as input by way of the keyboard are in the form MMDDYY. They are stored on disk as hexadecimal. Displayed on the screen, the form is such as: WED 10 JAN 79.

2) TIME—The starting time of a contact, also taken from the clock or input by keyboard, is in the form of HHMM. It is stored as hexadecimal and may be in the time zone of the user's choice.

3) CALL—The call of the station contacted is entered as up to six characters alphanumeric. It is stored and returned as entered.

4) BAND—The operating band is represented as a three-digit value. The meaning may be coded as the user chooses or be such as 7 for 7 MHz or 21 for 21 MHz.

5) MODE—The mode of operation is a code used by the FCC. Twelve are acceptable. These are A0, A1, A2, A3, A3A, A4, A5, F1, F2, F3, NFM, and P.

6) NOTE—A ten-character scratch pad is included to be used in any manner the user desires. It is suggested that it be used to retain the name of the station operator. Since names are usually short, the pad can be used to hold some additional information.

Program Preparation

If only one disk drive is to be used, make a DOS backup, then remove all unnecessary programs. Store program AMLOG on it and run without "write protect." If more than one drive is available, the program can be stored on any drive. Put a write protect on the system disk in drive 0 and use a blank formatted disk in drive 1 for the log file. Perform the following:

1) Bring the TRS-80 up in the DOS.
2) Set the internal clock.
3) Enter the date.
4) Call the clock.
5) Call BASIC.

The appearance of the screen after entering the appropriate information necessary to get and run the program is shown in Table 1.

Program Operation

When the run is started, the clock will appear in the upper right screen. The user is prompted as shown in Table 2.

The user must respond to "MODE _" with one of the mode codes to continue. There are three major modes of operation:

1) ADD—This is used when building a new file or when appending records to a previously-established

record file. Its primary use is that of building the initial data base, but it also is used to update a file in the event that the logging was not accomplished in real time.

2) MODIFY—In this mode, the operator can recall any number of records in any sequence for inspection or for correction.

3) COMMAND—All real-time logging of contacts is done in this mode. It is invoked by a response to the initial prompting of one of the station operating modes.

ADD Mode

The ADD mode appends records to the file in the order in which they are entered. Since the log sequence is usually in time, entries should be in the same order as they would appear in a manual log. Insertion of records is not allowed. If there is a period of contacts which were not entered in the real-time operation, these should be appended before any further real-time entries are made. When the ADD mode is invoked, the program will display an entry guide and pause for operator action. It appears as shown in Table 3.

The data line is position-oriented so that input must follow the guide. To be accepted, the input line must contain all entries up to the NOTE field, which can be blank if desired. Any detected error will cause the line to be rejected. The word REJECTED will appear on the input line for a short period of time, then the cursor will return, indicating reentry is ready.

The ADD mode is terminated at any time by entering a completely empty ADD line. To do this, hit ENTER with only the cursor showing.

MODIFY Mode

In this mode, records are recalled for inspection and any necessary corrective action. The prompting is as shown in Table 4.

In the Table 4 prompting, the user has called for record 55. The record content is displayed and the program pauses for a new entry. If no change is to be made, hit ENTER. If a change is to be made, the entire record must be reentered. As with the ADD mode, the input is position-oriented. Use the original entry as a guide.

To exit this mode, merely specify RECORD NR Ø.

COMMAND Mode

This mode is used to enter contacts into the log during station operation. It is called when the proper emission mode code is entered in response to the first prompted entry. The user must first identify the operating band and is prompted to do so as shown in Table 5(a). On entry, the COMMAND line prompting appears as shown in Table 5(b). Use of each command is explained below.

1) LOG—The command word LOG must always be followed by a station call. An acceptable command line would appear: COMMAND LOG WB9XXX. As the LOG command is executed, the program takes a snapshot of the clock, retaining the hour and minutes. The DATE, TIME, and CALL appear at the top of the screen and the command line will reappear at the lower command line position. The program is paused awaiting the next command.

The LOG line is *not* posted to the log at this time. Since round-table QSOs are quite frequent, the system is programmed to allow entry of up to five callsigns for the same QSO. If an unposted LOG line appears at the top of the screen, any subsequent LOG XXXXXX will add the callsign to the log list. An attempt to enter more than five such callsigns will cause the program to inform the user the table is full. The command will be discarded.

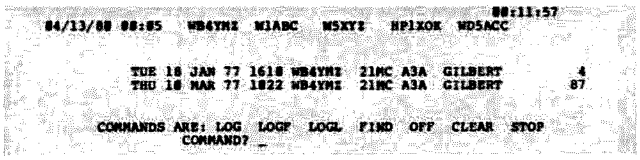

Fig. 1. A sample QSO with five other stations. FIND command was used to display previous contacts with WB4YMZ.

2) LOGF—This is an extension of the LOG command and operates exactly as does LOG except that it initiates a search. Given the command LOGF WB9XXX, the program will display the top log line. The file will be opened and searched for the first (earliest) logged entry for WB9XXX. If a prior entry is found, the record will be displayed below the log line. If there has been no previous contact, only the station call will be displayed. Five such lines can be displayed, one for each of the permitted round-table entries.

3) LOGL—This, too, is an extension of the LOG command. It differs from LOGF only in the fact that it will display the last (latest) log entry for the specified station.

4) FIND—This command requires a station call, as in FIND WB9XXX. It is used to initiate a search for a specified station without entering the call into the log line. The search will display both the earliest and latest entries for the station. If there has been no prior entry, only the station call will appear. Two lines are reserved immediately above the command prompting lines for this display.

5) OFF—This single word command signals to the program that the QSO has terminated and that the log lines are to be posted to the file. The user is prompted for entry of the NOTE or NAME line for each of the station calls appearing in the log line. The records are posted in the order entered and at the time the NAME prompting is answered. The NAME entry is actually the 10-digit scratch. Any ten characters can be sent to the file.

6) CLEAR—This single word command will initialize the log line without leaving the command mode. If there are any station calls appearing in the log line, this command will remove them without posting to the log.

7) STOP—The STOP command is as it implies. The result is the same as hitting the break key.

Fig. 1 illustrates a fictitious session in which six stations are in a round-table QSO. The top line is the clock, followed by the log line with five station entries. Two lines resulting from a search for previous WB4YMZ contacts are grouped under the log line. The number appearing at the extreme right of the record line is the record number for that log entry. The two record lines resulted from a FIND command.

If the situation were actually as pictured, an OFF command would post five lines in the log. These would be identical except for the station callsign and the name of the station operator. ■

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RTTY with the H8

—a Heath-based RTTY system

The 8-bit microcomputer is ideally suited to controlling a radioteletype (RTTY) amateur station. Normally manual functions such as character shift (LTRS or FIGS) and end-of-line detection can be done automatically by the computer. Complex functions such as text storage, automatic CQ, and Morse code identification can easily be implemented in the computer's software.

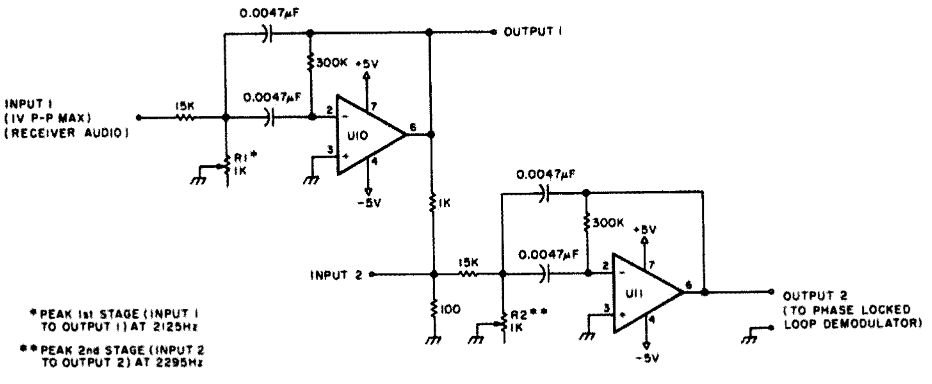

Fig. 1. RTTY input filter.

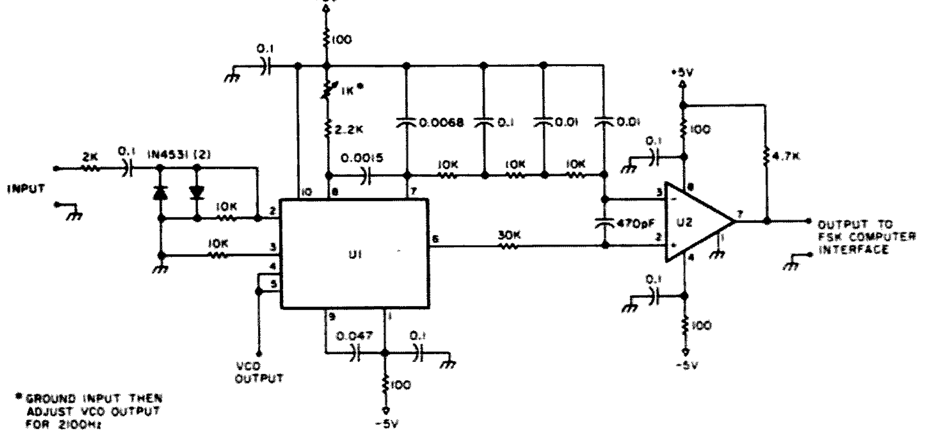

Fig. 2. Phase locked loop FSK demodulator.

Amateur RTTY Conventions

Amateur RTTY in the high frequency (HF) radio spectrum (1 through 30 MHz) uses frequency-shift keying (FSK) to transmit Baudot characters. Each Baudot character consists of a start bit, five data bits, and 1½ stop bits. Baudot code consists of two subsets of characters, LTRS and FIGS. LTRS consists of all the uppercase alphabetic characters and FIGS consists of the numbers and miscellaneous punctuation characters. The high state or "mark" is by convention the higher frequency of the two FSK signals. A frequency shift of 170 Hz has replaced the old standard of 850 Hz. Rates of both 60 and 100 words per minute are now in use but 60 wpm is still dominant.[1] A popular means to generate FSK is to

feed audio FSK into the microphone input of a single-sideband (SSB) suppressed carrier radio transmitter.

System Description

The RTTY system described in this article consists of the following equipment: 1) Heath H8 computer, 16K memory, serial (H8-5) and parallel (H8-2) interface boards; 2) Heath H9 video terminal; 3) dual GE 5121 cassette tape decks; 4) Heath SB-300 single-sideband receiver; 5) Heath SB-401 single-sideband transmitter, and 6) author-constructed RTTY interface.

No hardware modifications were done on any of these equipments. This minimal system will receive and transmit RTTY on all authorized HF bands. A tuning aid and inverted code switch are included to improve reception. All transmit and receive functions are controlled from the H9 terminal as follows:

CTRL-A—Transmit Morse code identification
CTRL-B—Go to transmit mode (turn on transmitter)
CTRL-C—Transmit buffer (CQ or message)
CTRL-D—Force LTRS code during receive mode
ESC KEY—Go to receive mode (turn off transmitter)

Shift characters are automatically transmitted when called for by Baudot convention. After 72 characters, line feed, two carriage returns, and the LTRS code are automatically transmitted. A 28-character type-ahead buffer is included in the transmit program to prevent loss of text.

RTTY Input Filter

The bandwidth of the SB-300 receiver is 2.1 kHz (350 through 2450 Hz). Approximately 300 Hz of bandwidth is required to receive 60 wpm, 170-Hz shift RTTY.[2] The phase locked loop demodulator used in the RTTY interface unit will attempt to lock onto any signal within 400 Hz of its nominal vco frequency. Without a narrow bandwidth filter, near-frequency signals will cause significant receiving errors. The easiest place to add a receiver filter is between the audio output of the receiver and the RTTY interface. The filter of Fig. 1 has a bandwidth of 300 Hz centered at 2210 Hz and a voltage gain of 10. Each stage should be adjusted separately using an accurate signal generator and an output indicator. In operation, input 1 is connected to the receiver audio output and output 2 is connected to phase locked loop demodulator input.

Phase Locked Loop FSK Demodulator

The demodulator shown in Fig. 2 converts audio frequency shifts into serial binary data. Within device U1, a phase detector sends a voltage to a vco, forcing it to the same frequency (phase) as the input signal. This forcing voltage is the actual output of the phase locked loop. The potentiometer shown in Fig. 2 is used to adjust the zero-input vco frequency to a value of 2100 Hz. A frequency counter should be used for this adjustment. The device U2 converts the phase locked loop output to TTL voltage levels.

FSK Computer Interface

The serial word from the demodulator is converted to a valid parallel word and sent to the computer by the FSK computer interface shown in Fig. 3. The UART (U3) is hardware-pro-

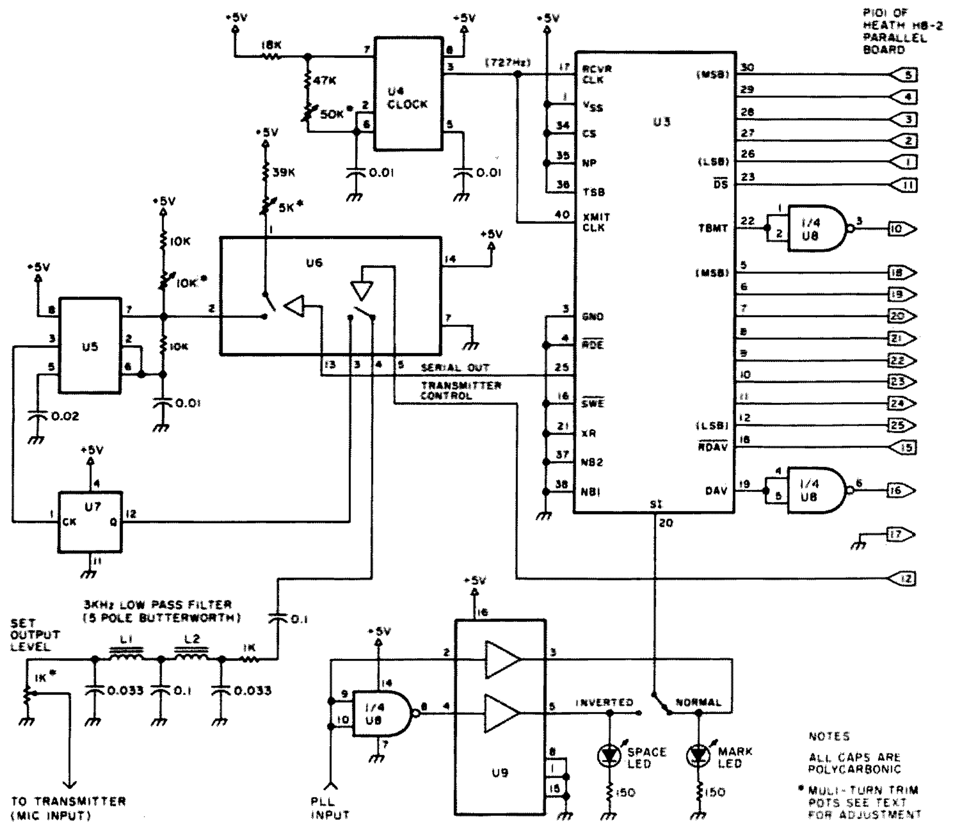

Fig. 3. FSK computer interface.

Control interrupt program listing.

```
                        * CONTROL INTERRUPT PROGRAM - PROVIDES DIRECTION FOR
                        * CTRL A,B,C,D OF THE CONSOLE DRIVER ROUTINE.
                        * THE ADDRESS OF THIS PROGRAM MUST BE LOADED INTO
                        *  $CSIC OF HEATH'S CONSOLE DRIVER AS FOLLOWS:
                        *          AT 040.250  LOAD  000
                        *          AT 040.251  LOAD  044
                        * THIS PROGRAM TESTS $CSLCTL OF THE CONSOLE DRIVER
                        *  AFTER A CONTROL INTERRUPT.  THE RESULT OF THE
                        *  TEST IS LOADED INTO A MEMORY SCRATCHPAD (042.000)
                        *  WHICH IS TESTED BY BOTH THE RECEIVE AND
                        *  TRANSMIT PROGRAMS.  AFTER SCRATCHPAD IS LOADED
                        *  $CSLCTL IS ZEROED.

044.000                       ORG     44000A
044.000  072 252 040  START   LDA     40252A   $CSLSTL
044.003  376 300              CPI     300Q     CTRL D:D=0
044.005  302 015 044          JNZ     CTRLC
044.010  026 000              MVI     D,00     SET D=0
044.012  303 061 044          JMP     FALSE
044.015  376 240      CTRLC   CPI     240Q     CQ
044.017  302 032 044          JNZ     CTRLB
044.022  041 000 042          LXI     H,42000A
044.025  066 003              MVI     M,30     CQ CODE
044.027  303 061 044          JMP     FALSE
044.032  376 220      CTRLB   CPI     220Q
044.034  302 047 044          JNZ     CTRLA    GOTO XMIT
044.037  041 000 042          LXI     H,42000A
044.042  066 002              MVI     M,20     XMIT CODE
044.044  303 061 044          JMP     FALSE
044.047  376 210      CTRLA   CPI     210Q     ID
044.051  302 061 044          JNZ     FALSE
044.054  041 000 042          LXI     H,42000A
044.057  066 001              MVI     M,10     ID CODE
044.061  315 065 044  FALSE   CALL    Z252     ZERO $CSLCTL
044.064  311                  RET
                      * Z252 SUBROUTINE - ZERO $CSLCTL
044.065  041 252 040  Z252    LXI     H,40252A $CSLCTL
044.070  066 000              MVI     M,00
044.072  311                  RET
044.073                       END     START
```

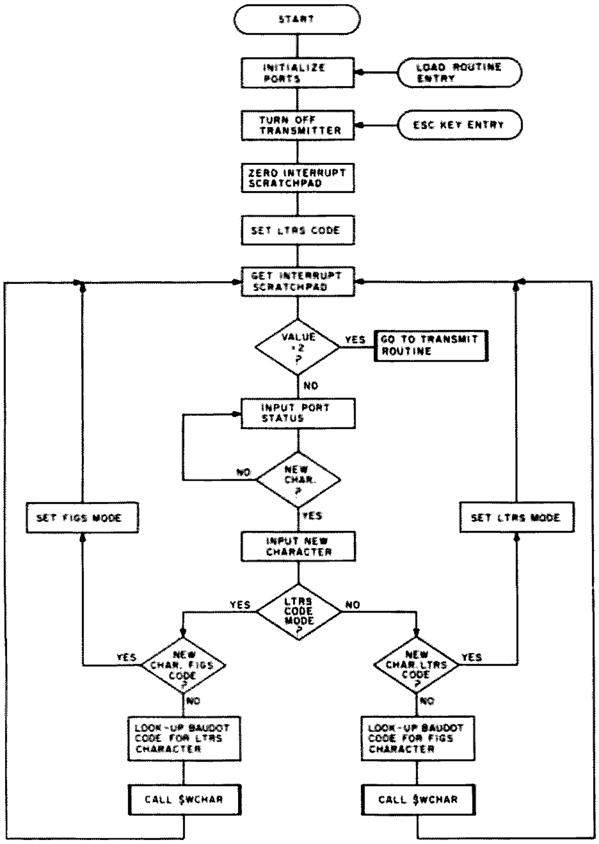

Fig. 4. RTTY receiver flowchart.

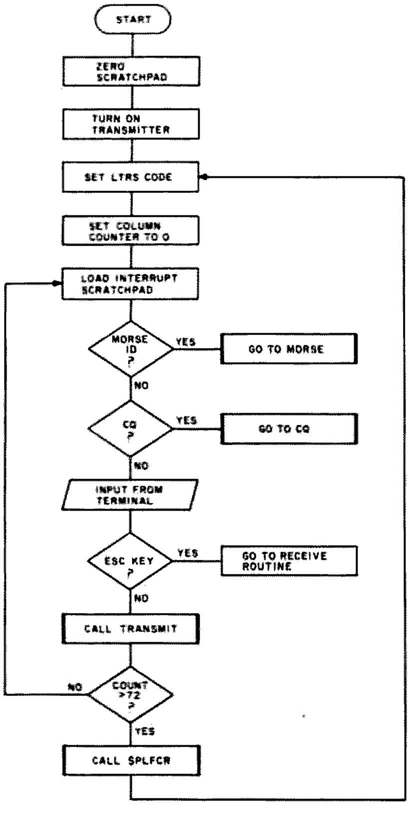

Fig. 5. RTTY transmit routine.

grammed for 5-bit words and 1½ stop bits. The UART's clock, U4, is adjusted for a frequency that is 16 times the RTTY baud rate. For 60 wpm, the frequency of the clock is 727 Hz. When the UART detects and loads a valid Baudot word, it signals the computer on the DAV (data available) line. After the computer accepts the parallel word, it signals back on the RDAV (reset data available) line, allowing the UART to load another word in its buffer. The PLL input circuits, including U9 and part of U8, allow receiving of normal and inverted signals and provide a needed tuning aid. When a RTTY signal is correctly received, the mark LED should light during idle moments between characters and both should light during continuous transmission.

In the transmit mode, the UART signals the computer to load a word using the TBMT (transmitter buffer empty) line. After the computer has loaded a Baudot word, it signals the UART to begin serial transmission using the DS (data strobe) line. The UART adds the correct number of start (1) and stop (1½) bits and then transmits the word serially at a baud rate of one-sixteenth its transmit clock rate. The serial transmit signal operates an electronic switch in U6 that keys a two-frequency oscillator (U5). When the serial out line is low, the switch is open and U5 should be adjusted by the 10k-Ω potentiometer to oscillate at 4250 Hz. When the serial line is high, the switch is closed and U5 should be adjusted by the 5k-Ω potentiometer to oscillate at 4590 Hz.

The J-K flip-flop device, U7, divides the output frequency of U5 by two to provide a symmetrical square wave at the correct mark and space frequencies. The output of U7 goes through an electronic switch to a low-pass filter and then to the microphone input of the SSB radio transmitter. The second electronic switch is controlled by the "reader on/off" line from the H8-2 parallel interface board. This arrangement allows the computer to turn the transmitter on and off using the transmitter's voice-operated switch (VOX) and also to transmit a Morse code identification signal. The 3-kHz low-pass filter converts the square wave output of U7 to a sine wave. The 1k-Ω potentiometer should be adjusted to provide the same output level as the microphone normally used with the transmitter. The complete filter and level adjust potentiometer should be well shielded to prevent stray noise from being transmitted.

H8-2 Parallel Interface Board

The FSK computer interface is connected to one of three parallel ports of Heath's H8-2 parallel interface board. The port address jumpers for the selected parallel port should be connected for 100_8. On that port, connect the logic jumpers as follows: 1) $A_1 - A_2$, open; 2) $B_1 - B_2$, open; 3) $C_1 - C_2$, shorted, and 4) $E_1 - E_2$, shorted. The output of the FSK computer interface (Fig. 3) is connected to the parallel port at P101 by a ribbon cable terminated with the Heath-supplied 25-pin connector.

SSB Receiver and Transmitter Operation

Both the SSB receiver and transmitter must be operated in the upper sideband (USB) mode for correct polarity reception and transmission. The receiver should have less than 100 Hz/H drift after warm-up. Most SSB transmitters are not designed to operate at the 100% duty cycle required of RTTY. The manufacturer's specifications

RTTY receive program listing.

```
                        *     RTTY RCVR  -  10 AUG 1979
                        *     BY LEWIS THOMPSON

                        * THIS PROGRAM ACCEPTS VALID BAUDOT CHARACTERS THROUGH
                        *  PORT 100. CONVERTS THEM TO ASCII AND THEN SENDS THEM

                        *  TO HEATH'S CONSOLE DRIVER FOR DISPLAY ON TERMINAL.
                        * THIS PROGRAM REQUIRES THE CONSOLE DRIVER AND THE
                        *  CONTROL INTERRUPT PROGRAM FOR OPERATION.
                        * THE ADDRESS OF THE CONTROL INTERRUPT PROGRAM MUST BE
                        *  LOADED INTO THE CONSOLE DRIVER AS FOLLOWS:
                        *           040.250  LOAD  000
                        *           040.251  LOAD  044
                        * CTRL-D FORCES THE LTRS CODE.
                        * CTRL-B CAUSES A BRANCH TO RTTY XMTR.
                        * THE COMPLETE RTTY PROGRAM SHOULD BEGIN AT THE
                        *  FIRST STEP OF THE RECEIVER PROGRAM (040.150)
                        *  SO THAT ALL SYSTEM PORTS ARE PROPERLY INITIALIZED.

040.147                 $WCHAR  EQU     40147A
040.152                 $PRSCL  EQU     40152A
041.150                 START   ORG     41150A
041.150  315 152 040            CALL    $PRSCL
041.153  076 201                MVI     A,201Q     GUARANTEE OUT OF MODE
041.155  323 101                OUT     101Q
041.157  076 100                MVI     A,100Q     RESET PORT
041.161  323 101                OUT     101Q
041.163  076 116                MVI     A,116Q     MODE WORD
041.165  323 101                OUT     101Q
041.167  076 047                MVI     A,47Q      TURN  XMTR OFF
041.171  323 101                OUT     101Q
041.173  076 000                MVI     A,0Q
041.175  062 000 042            STA     42000A     ZERO SCRATCHPAD
041.200  026 000                MVI     D,0Q       SET D=0
041.202  072 000 042    INPUT   LDA     42000A     INTERRUPT SCRATCHPAD
041.205  376 002                CPI     2Q         XMIT CODE
041.207  312 100 042            JZ      42100A     XMIT PROGRAM
041.212  333 101                IN      101Q       TEST FOR NEW CHAR.
041.214  346 002                ANI     2Q         UART STATUS
041.216  312 202 041            JZ      INPUT
041.221  333 100                IN      100Q
041.223  137                    MOV     E,A        SAVE CHAR.
041.224  172                    MOV     A,D        GET D
041.225  376 000                CPI     0Q         TEST D
041.227  312 262 041            JZ      LTRS
041.232  127                    MOV     D,A        SAVE D
041.233  173                    MOV     A,E        GET CHAR.
041.234  376 037                CPI     37Q        LTRS CODE
041.236  312 255 041            JZ      D0         JMP ON A=37
041.241  306 037                ADI     037Q       FIGS OFFSET
041.243  006 042                MVI     B,42Q      MEM. HIGH
041.245  117                    MOV     C,A        LOAD C WITH MEM. HI
041.246  012                    LDAX    B,C        LOAD A
041.247  315 147 040            CALL    $WCHAR
041.252  303 202 041            JMP     INPUT
041.255  026 000        D0      MVI     D,0Q       SET D=0
041.257  303 202 041            JMP     INPUT
041.262  127            LTRS    MOV     D,A        SAVE D
041.263  173                    MOV     A,E        GET CHAR.
041.264  376 033                CPI     33Q        FIGS CODE
041.266  312 305 041            JZ      D1         JMP ON A=33
041.271  306 000                ADI     0Q         LTRS OFFSET
041.273  006 042                MVI     B,42Q      MEM. HIGH
041.275  117                    MOV     C,A
041.276  012                    LDAX    B,C
041.277  315 147 040            CALL    $WCHAR
041.302  303 202 041            JMP     INPUT
041.305  026 001        D1      MVI     D,1Q       SET D=1
041.307  303 202 041            JMP     INPUT

                        * ASCII TO BAUDOT CONVERSION TABLE

042.001                         ORG     42001A
042.001  105                    DB      105Q       E
042.002  012                    DB      012Q       LF
042.003  101                    DB      101Q       A
042.004  040                    DB      040Q       SP
042.005  123                    DB      123Q       S
042.006  111                    DB      111Q       I
042.007  125                    DB      125Q       U
042.010  015                    DB      015Q       CR
042.011  104                    DB      104Q       D
042.012  122                    DB      122Q       R
042.013  112                    DB      112Q       J
042.014  116                    DB      116Q       N
042.015  106                    DB      106Q       F
042.016  103                    DB      103Q       C
042.017  113                    DB      113Q       K
042.020  124                    DB      124Q       T
042.021  132                    DB      132Q       Z
042.022  114                    DB      114Q       L
042.023  127                    DB      127Q       W
042.024  110                    DB      110Q       H
042.025  131                    DB      131Q       Y
042.026  120                    DB      120Q       P
042.027  121                    DB      121Q       Q
042.030  117                    DB      117Q       O
042.031  102                    DB      102Q       B
042.032  107                    DB      107Q       G
042.033  053                    DB      053Q       +(FIGS)
042.034  115                    DB      115Q       M
042.035  130                    DB      130Q       X
042.036  126                    DB      126Q       V
042.037  040                    DB      040Q       SP(LTRS)
042.040  063                    DB      063Q       3
042.041  012                    DB      012Q       LF
042.042  055                    DB      055Q       -
042.043  040                    DB      040Q       SP
042.044  007                    DB      7Q         BELL
042.045  070                    DB      70Q        8
042.046  067                    DB      67Q        7
042.047  015                    DB      15Q        CR
042.050  044                    DB      44Q        $
042.051  064                    DB      64Q        4
042.052  047                    DB      47Q        '
042.053  054                    DB      54Q        ,
042.054  041                    DB      41Q        !
042.055  072                    DB      72Q        :
042.056  050                    DB      50Q        (
042.057  065                    DB      65Q        5
042.060  042                    DB      42Q        "
042.061  051                    DB      51Q        )
042.062  062                    DB      62Q        2
042.063  043                    DB      43Q        #
042.064  066                    DB      66Q        6
042.065  060                    DB      60Q        0
042.066  061                    DB      61Q        1
042.067  071                    DB      71Q        9
042.070  077                    DB      77Q        ?
042.071  046                    DB      46Q        &
042.072  040                    DB      40Q        SP(FIGS)
042.073  056                    DB      56Q        .
042.074  057                    DB      57Q        /
042.075  073                    DB      73Q        ;
042.076  053                    DB      53Q        +(LTRS)
042.077                         END     START
```

should be consulted to determine a safe maximum power limit. The SB-401 transmitter is presently being operated at a plate current of 150 mA rather than the SSB-recommended 250 mA.

RTTY Interface Software

The speed requirements as well as the lack of complex mathematical expressions allowed the interface software to be written in assembly language. The software is divided into three separately assembled programs, plus Heath's console driver program. Listings of the three RTTY programs are included in this article.

RTTY Receiver Program

The receiver program uses the console driver and the CIP programs. An excellent description of Heath's console driver is contained in issue No. 2 of *Remark*.[3] The RTTY software entry point should be the start of the receive program (041.150 offset octal) to effect port initialization. Fig. 4 shows a flowchart for the receive program. Both the console terminal's serial port and the RTTY interface's parallel port are initialized at the beginning of the program. The command word, 047_8, sent to the control port (101_8) turns the transmitter off. The CIP program places different numbers in a scratchpad (042/000) based upon which CTRL key interrupts occur. The receive program initially zeros this location and then tests it for a branch to the transmit routine each time a new character loop is performed. After testing for a transmit program branch, the first bit of the control input port is tested to determine if a new character has been loaded in the RTTY interface UART. If a new character is present, it is loaded into the computer, thereby freeing the interface UART to search for the next character. After loading a character, the routine checks whether it is in the LTRS (D=1) mode. If it is in the LTRS mode, the new character is compared with the FIGS code. If the new character is the FIGS code, the FIGS mode is set (D=0) and the program loops back for a new character. If the new character is not the FIGS code, its numeric value forms the lower 8-bit address at which the Baudot character's equivalent ASCII value is stored. This value is sent to the terminal via the console driver routine $WCHAR for display. The same logic is followed for the FIGS code branch. The FIGS character's numeric value is added to an offset (37_8) to form the lower 8-bit address for entry into the conversion table. When a CTRL-D is keyed, the CIP program sets D=0, forcing the receive program into the LTRS mode.

RTTY Transmit Program

The transmit program consists of three separate routines: transmit, CQ, and Morse ID. The transmit routine together with the CIP and console driver programs generate Baudot code from the terminal. A flowchart for the transmit routine is shown in Fig. 5. The program begins by zeroing the scratchpad and then turning on the transmitter. Both the LTRS/FIGS register (D) and the column count register (E) are zeroed before the scratchpad is tested. The scratchpad is tested for either a branch to the Morse ID routine or the CQ routine. If both tests are

RTTY transmit program listing.

```
                        * RTTY XMTR
                        * BY LEWIS A. THOMPSON
                        * 3806 CARLISLE
                        * AUSTIN, TEXAS
                        * JAN. 6, 1979

                        * THIS PROGRAM GENERATES BAUDOT CHARACTERS FOR
                        *  TRANSMISSION THRU AN EXTERNAL UART AY-3-1015.
                        * PARALLEL PORT 100/101 IS USED BY THIS PROGRAM.
                        * THE BAUDOT CHARACTERS LTRS AND FIGS ARE
                        *  GENERATED BY PROGRAM WHEN NEEDED.
                        * AFTER 72 SPACES, LINE FEED-TWO CARRIAGE RETURNS-
                        *  AND LTRS CODE ARE GENERATED.
                        * THE CONSOLE DRIVER'S 20 CHARACTER TYPE-AHEAD
                        *  BUFFER IS USED.
                        * ALL PRINTABLE CHARACTERS ARE ECHOED TO TERMINAL
                        *  USING DRIVER ROUTINE.
                        * ESC KEY CAUSES A BRANCH TO THE RECEIVER ROUTINE.

040.144                 $RCHAR  EQU     40144A
040.152                 $PRSCL  EQU     40152A
040.147                 $WCHAR  EQU     40147A
041.167                 RCVR    EQU     41167A
041.153                 RCVR1   EQU     41153A
042.100                         ORG     42100A
042.100  076 000        START   MVI     A,0Q      SET A=0
042.102  062 000 042            STA     42000A    ZERO SCRATCHPAD
042.105  076 007                MVI     A,7Q      XMIT MODE WORD
042.107  323 101                OUT     101Q      TURN ON XMTR
042.111  026 000        NXLINE  MVI     D,0Q      SET LTRS CODE
042.113  036 000                MVI     E,0Q      SET COLUMN COUNT=0
042.115  072 000 042    SMLINE  LDA     42000A    INTERRUPT SCRATCHPAD
042.120  376 001                CPI     1Q        MORSE ID CODE
042.122  312 200 043            JZ      MORSE     GOTO ID ROUTINE
042.125  376 003                CPI     3Q        CQ CODE
042.127  312 100 044            JZ      CQ        CQ ROUTINE
042.132  315 144 040            CALL    $RCHAR    GET CHARACTER
042.135  376 033                CPI     33Q       ESC KEY CODE
042.137  312 167 041            JZ      RCVR      GOTO RCVR
042.142  315 161 042            CALL    XMIT
042.145  173                    MOV     A,E       RECOVER E
042.146  376 110                CPI     110Q      COMPLETED LINE (72)
042.150  302 115 042            JNZ     SMLINE
042.153  315 304 042            CALL    $PLFCR    XMIT LF,CR,CR,LTRS
042.156  303 111 042            JMP     NXLINE
                        * XMIT SUBROUTINE - THIS ROUTINE CONVERTS ASCII
                        *  CHARACTERS FROM TERMINAL TO BAUDOT THEN SENDS
                        *  THEM TO THE EXTERNAL UART VIA PORT 100.
042.161  345            XMIT    PUSH    H         SAVE H
042.162  315 147 040            CALL    $WCHAR    ECHO CHAR. TO TERM.
042.165  376 015                CPI     15Q       CR - ASCII
042.167  302 203 042            JNZ     $LF
042.172  076 010                MVI     A,10Q     CR - BAUDOT
042.174  315 343 042            CALL    $SEND     XMIT CR
042.177  036 000                MVI     E,0Q      SET COLUMN COUNT=0
042.201  341                    POP     H         RESTORE H
042.202  311                    RET
042.203  376 012        $LF     CPI     12Q       LF - ASCII
042.205  302 217 042            JNZ     $SP
042.210  076 002                MVI     A,2Q      LF - BAUDOT
042.212  315 343 042            CALL    $SEND     XMIT LF
042.215  341                    POP     H
042.216  311                    RET
042.217  376 040        $SP     CPI     40Q       SPACE - ASCII
042.221  302 234 042            JNZ     TEST
042.224  076 004                MVI     A,4Q      SPACE - BAUDOT
042.226  315 343 042            CALL    $SEND     XMIT SPACE
042.231  303 301 042            JMP     $INRE
                        * TEST FOR LETTERS OR FIGURES CODE
042.234  147            TEST    MOV     H,A       SAVE ASCII CHAR.
042.235  172                    MOV     A,D       GET D
042.236  376 000                CPI     0Q        TEST D
042.240  312 257 042            JZ      LTRS
042.243  174                    MOV     A,H       GET ASCII CHAR.
042.244  376 100                CPI     100Q
042.246  372 270 042            JM      $OUT
042.251  315 367 042            CALL    $PLTRS
042.254  303 270 042            JMP     $OUT
042.257  174            LTRS    MOV     A,H       GET ASCII CHAR.
042.260  376 100                CPI     100Q
042.262  362 270 042            JP      $OUT
042.265  315 355 042            CALL    $PFIGS
                        * LOOK-UP BAUDOT CHARACTER FROM TABLE
042.270  306 037        $OUT    ADI     37Q       BAUDOT TABLE OFFSET
042.272  117                    MOV     C,A       MEM. ADD. LOW
042.273  006 043                MVI     B,43Q     MEM. ADD. HIGH
042.275  012                    LDAX    B,C
042.276  315 343 042            CALL    $SEND     XMIT BAUDOT CHAR.
042.301  034            $INRE   INR     E         E=E+1
042.302  341                    POP     H
042.303  311                    RET
                        * $PLFCR SUBROUTINE - PRINTS LF+TWO CR'S+LTRS
042.304  076 002        $PLFCR  MVI     A,2Q      LF - BAUDOT
042.306  315 343 042            CALL    $SEND
042.311  076 012                MVI     A,12Q     LF - ASCII
042.313  315 147 040            CALL    $WCHAR
042.316  076 015                MVI     A,15Q     CR - ASCII
042.320  315 147 040            CALL    $WCHAR
042.323  076 010                MVI     A,10Q     CR - BAUDOT
042.325  315 343 042            CALL    $SEND
042.330  076 010                MVI     A,10Q
042.332  315 343 042            CALL    $SEND
042.335  076 037                MVI     A,37Q     LTRS CODE
042.337  315 343 042            CALL    $SEND
042.342  311                    RET
                        * $SEND SUBROUTINE - SENDS CHARACTER TO OUTPUT
                        *  THEN WAITS FOR HANDSHAKE FROM UART.
042.343  323 100        $SEND   OUT     100Q      SEND CHARACTER TO PORT
042.345  333 101        LOOP1   IN      101Q
042.347  346 001                ANI     1Q        MASK
042.351  312 345 042            JZ      LOOP1
042.354  311                    RET
                        * $PFIGS SUBROUTINE - SEND BAUDOT FIGS CODE
042.355  365            $PFIGS  PUSH    PSW       SAVE A
042.356  076 033                MVI     A,33Q     FIGS CODE
042.360  026 001                MVI     D,1Q      SET D=1
042.362  315 343 042            CALL    $SEND
042.365  361                    POP     PSW
042.366  311                    RET
                        * $PLTRS SUBROUTINE - SENDS BAUDOT LTRS CODE.
042.367  365            $PLTRS  PUSH    PSW       SAVE A
042.370  076 037                MVI     A,37Q     LETTERS CODE
042.372  026 000                MVI     D,0Q      SET D=0
042.374  315 343 042            CALL    $SEND
042.377  361                    POP     PSW
043.000  311                    RET
                        * XMTR TABLE
043.100                         ORG     43100A
043.100  015                    DB      15Q       !
043.101  021                    DB      21Q       "
043.102  024                    DB      24Q       #
043.103  011                    DB      11Q       $
043.104  004                    DB      4Q
043.105  032                    DB      32Q       &
043.106  013                    DB      13Q       '
043.107  017                    DB      17Q       (
043.110  022                    DB      22Q       )
043.111  004                    DB      4Q
043.112  004                    DB      4Q
043.113  014                    DB      14Q       ,
043.114  003                    DB      3Q        -
043.115  034                    DB      34Q       .
043.116  035                    DB      35Q       /
043.117  026                    DB      26Q       0
043.120  027                    DB      27Q       1
043.121  023                    DB      23Q       2
043.122  001                    DB      1Q        3
```

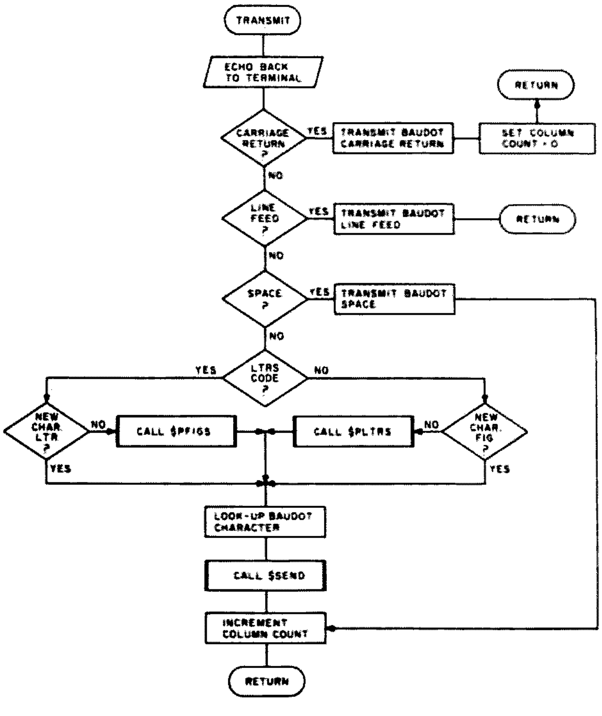

Fig. 6. Transmit subroutine.

invalid, the program gets the next character from the terminal using a console driver routine called $RCHAR. If the ASCII character is not the ESC key code, then the program calls the subroutine XMIT; otherwise, it branches to the receiver program. A flowchart of the XMIT subroutine is shown in Fig. 6. After being called, this subroutine immediately echoes the character back to the terminal for display using the console driver subroutine $WCHAR. XMIT then compares the ASCII character with the character for carriage return (CR), line feed (LF), or space. If any of these tests is valid, the valid character is converted to Baudot and transmitted. The CR test sets the column count to zero and returns to the main program for another character. The LF test simply returns to the main program for another character. The space test branches within the subroutine to a point where the column count is incremented, and a return to the main program is executed.

If all three tests are invalid, XMIT then tests the LTRS/FIGS register. If the program is in the LTRS mode, the new character is compared to 100_8. A positive result means the new character is an ASCII LTR and its Baudot equivalent is transmitted. If the comparison is negative, the new character is a FIG, and the Baudot FIGS shift character (33_8) must be transmitted before the character. After the Baudot character is transmitted,

```
043.123  012                DB      12Q       4
043.124  020                DB      20Q       5
043.125  025                DB      25Q       6
043.126  007                DB      7Q        7
043.127  006                DB      6Q        8
043.130  030                DB      30Q       9
043.131  016                DB      16Q       :
043.132  036                DB      36Q       ;
043.133  004                DB      4Q
043.134  004                DB      4Q
043.135  004                DB      4Q
043.136  031                DB      31Q       ?
043.137  004                DB      4Q
043.140  003                DB      3Q        A
043.141  031                DB      31Q       B
043.142  016                DB      16Q       C
043.143  011                DB      11Q       D
043.144  001                DB      1Q        E
043.145  015                DB      15Q       F
043.146  032                DB      32Q       G
043.147  024                DB      24Q       H
043.150  006                DB      6Q        I
043.151  013                DB      13Q       J
043.152  017                DB      17Q       K
043.153  022                DB      22Q       L
043.154  034                DB      34Q       M
043.155  014                DB      14Q       N
043.156  030                DB      30Q       O
043.157  026                DB      26Q       P
043.160  027                DB      27Q       Q
043.161  012                DB      12Q       R
043.162  005                DB      5Q        S
043.163  020                DB      20Q       T
043.164  007                DB      7Q        U
043.165  036                DB      36Q       U
043.166  023                DB      23Q       W
043.167  035                DB      35Q       X
043.170  025                DB      25Q       Y
043.171  021                DB      21Q       Z
                    * CO ROUTINE - THIS ROUTINE TRANSMITS THE CONTENTS
                    *  OF 'BUFFER'.
                    * CTRL-C WHILE IN THE XMIT MODE (CTRL-B) CALLS THIS
                    *  ROUTINE.
                    * CO EXITS TO MORSE ID WHEN A ASCII PERIOD IS
                    *  ENCOUNTERED IN THE BUFFER.
                    * THE COLUMN COUNTER IS USED IN THIS ROUTINE.
                    * BUFFER IS PLACED AT THE END OF THE RTTY PROGRAM
                    *  TO ALLOW A BUFFER LENGTH LIMITED ONLY BY MEMORY
                    *  SIZE.
044.100             CO      ORG     44100A
044.100  315 304 042        CALL    $PLFCR
044.103  036 000            MVI     E,0Q       SET COLUMN COUNT=0
044.105  041 166 044        LXI     H,BUFFER
044.110  176        LOOP2   MOV     A,M
044.111  376 056            CPI     56Q        PERIOD-ASCII
044.113  312 200 043        JZ      MORSE
044.116  315 161 042        CALL    XMIT
044.121  043                INX     H
044.122  173                MOV     A,E        GET COLUMN COUNT
044.123  376 110            CPI     110Q       COMPLETE LINE?
044.125  302 110 044        JNZ     LOOP2
044.130  315 304 042        CALL    $PLFCR
044.133  036 000            MVI     E,0Q       SET COLUMN COUNT=0
044.135  303 110 044        JMP     LOOP2
                    * LOAD BUFFER - THIS ROUTINE PERMITS CONSOLE TERMINAL
                    *  TO LOAD BUFFER.
                    * THIS ROUTINE IS MANUALLY ADDRESSED USING H8 FRONT
                    *  PANEL (LOAD PC THEN GO).
                    * END BUFFER TEXT WITH A PERIOD.  THIS WILL CAUSE
                    *  A BRANCH TO THE RECEIVER ROUTINE.
044.140  315 152 040 LOAD   CALL    $PRSCL     INITIALIZE TERM. PORT
044.143  041 166 044        LXI     H,BUFFER
044.146  315 144 040 GETCH  CALL    $RCHAR     GET CHAR.
044.151  315 147 040        CALL    $WCHAR     ECHO TO CONSOLE
044.154  167                MOV     M,A        MOVE CHAR. TO BUFFER
044.155  376 056            CPI     56Q        PERIOD-ASCII
044.157  312 153 041        JZ      RCVR1
044.162  043                INX     H
044.163  303 146 044        JMP     GETCH
044.166             BUFFER  DS      200
                    * MORSE ID
                    * JAN. 10, 1979
```

```
                    * THIS ROUTINE SENDS THE "READER ON" OR "READER OFF"
                    * COMMAND WORDS TO PORT 101 TO KEY THE XMTR FOR MORSE
                    * CODE IDENTIFICATION.
                    * THE VOX HOLD ON THE SSB TRANSMITTER SHOULD BE
                    * ADJUSTED SO THAT IT DOES NOT DROP OUT DURING THE
                    * WORD SPACE INTERVAL.
                    * CTRL-A WHILE IN THE XMIT MODE CAUSES A BRANCH TO
                    * THIS ROUTINE.
                    * THIS ROUTINE BRANCHES TO THE TRANSMIT MODE UPON
                    * COMPLETION.
000.053             DLY     EQU     53A
043.200                     ORG     43200A
043.200  026 020     MORSE  MVI     D,20Q      LOAD NO. OF MORSE CHARS.
043.202  041 300 043        LXI     H,TABLE    CODE TABLE
043.205  176         NXTC   MOV     A,M
043.206  207         NEXT   ADD     A          SHIFT LEFT
043.207  312 240 043        JZ      SPACE      IS ACC. EMPTY?
043.212  365                PUSH    PSW        SAVE CHAR.
043.213  322 227 043        JNC     DOT
043.216  076 200            MVI     A,200Q     LOAD DASH LENGTH
043.220  315 255 043        CALL    CODEGEN
043.223  361                POP     PSW        RECOVER CHAR.
043.224  303 206 043        JMP     NEXT
043.227  076 053     DOT    MVI     A,53Q      LOAD DOT LENGTH
043.231  315 255 043        CALL    CODEGEN
043.234  361                POP     PSW        RECOVER CHAR.
043.235  303 206 043        JMP     NEXT
043.240  076 200     SPACE  MVI     A,200Q     LOAD DASH LENGTH
043.242  315 053 000        CALL    DLY
043.245  043                INX     H          INX MEMORY POINTER
043.246  025                DCR     D          DEC CHAR. COUNT
043.247  302 205 043        JNZ     NXTC
043.252  303 100 042        JMP     START      GOTO TRANSMIT ROUTINE
                    * CODEGEN SUBROUTINE -
043.255  365         CODEGEN PUSH   PSW        SAVE A
043.256  076 007            MVI     A,7Q       TURN ON XMTR
043.260  323 101            OUT     101Q       SEND ON TO PORT
043.262  361                POP     PSW        RECOVER A
043.263  315 053 000        CALL    DLY
043.266  076 047            MVI     A,47Q      TURN OFF XMTR
043.270  323 101            OUT     101Q       SEND OFF TO PORT
043.272  076 053            MVI     A,53Q      DOT LENGTH SPACE
043.274  315 053 000        CALL    DLY
043.277  311                RET
                    * MORSE CODE TO OCTAL CONVERSION TABLE:
                    * A  140     O  360     2  074
                    * B  210     P  150     3  034
                    * C  250     Q  330     4  014
                    * D  220     R  120     5  004
                    * E  100     S  020     6  204
                    * F  050     T  300     7  304
                    * G  320     U  060     8  344
                    * H  010     V  030     9  364
                    * I  040     W  160     ,  126
                    * J  170     X  230     .  316
                    * K  260     Y  270     /  224
                    * L  110     Z  310     ?  062
                    * M  340     0  374
                    * N  240     1  174
                    * TWO "000" SHOULD BE USED TO GENERATE A
                    * WORD SPACE.
                    * THE NUMBER OF MORSE CHARACTERS INCLUDING
                    * SPACES MUST BE ENTERED INTO PROGRAM  AT
                    * 043.201 IN OCTAL.
043.300  220         TABLE  DB      220Q       D
043.301  100                DB      100Q       E
043.302  000                DB      0Q
043.303  000                DB      0Q
043.304  160                DB      160Q       W
043.305  004                DB      4Q         5
043.306  040                DB      40Q        I
043.307  050                DB      50Q        F
043.310  330                DB      330Q       Q
043.311  000                DB      0Q
043.312  000                DB      0Q
043.313  160                DB      160Q       W
043.314  004                DB      4Q         5
043.315  040                DB      40Q        I
043.316  050                DB      50Q        F
043.317  330                DB      330Q       Q
```

the LTRS/FIGS mode must be shifted to FIGS before a return to the main program is executed. When the program is in the FIGS mode, the LTRS code (37_8) must precede the next LTR to be transmitted. After any printable character is transmitted, the column counter (E) is incremented before a return to the main program is executed. The utility subroutines $PFIGS and $PLTRS shown in Fig. 7 handle the LTRS/FIGS conversions and $SEND subroutine does the actual character transmitting. If upon return to the main program the column count is equal to 72 (width of a standard TTY terminal), a subroutine

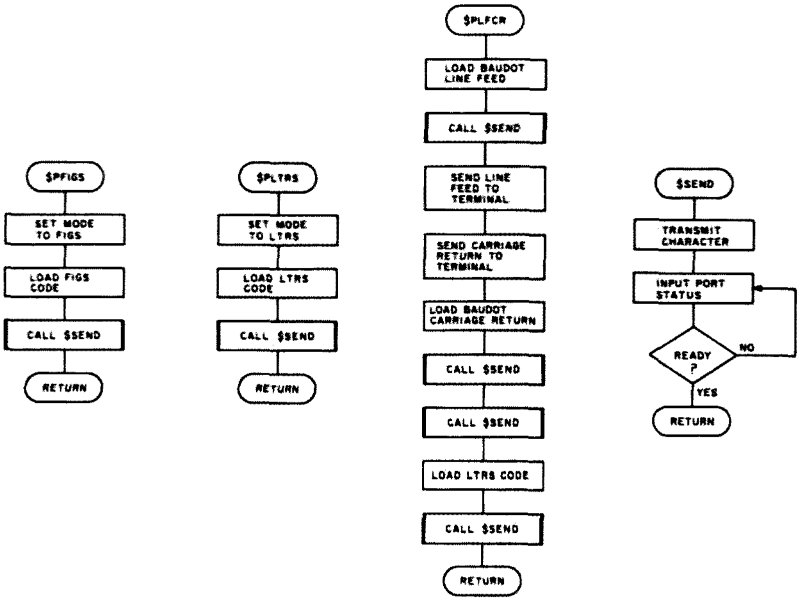

Fig. 7. Utility transmit subroutine.

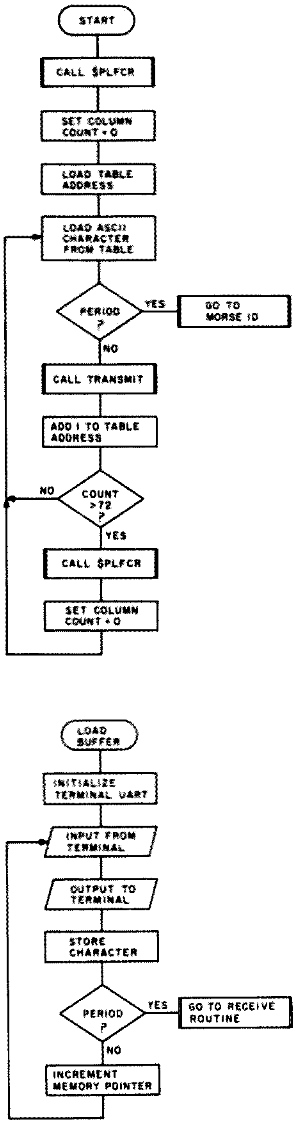

Fig. 8. CQ transmit program.

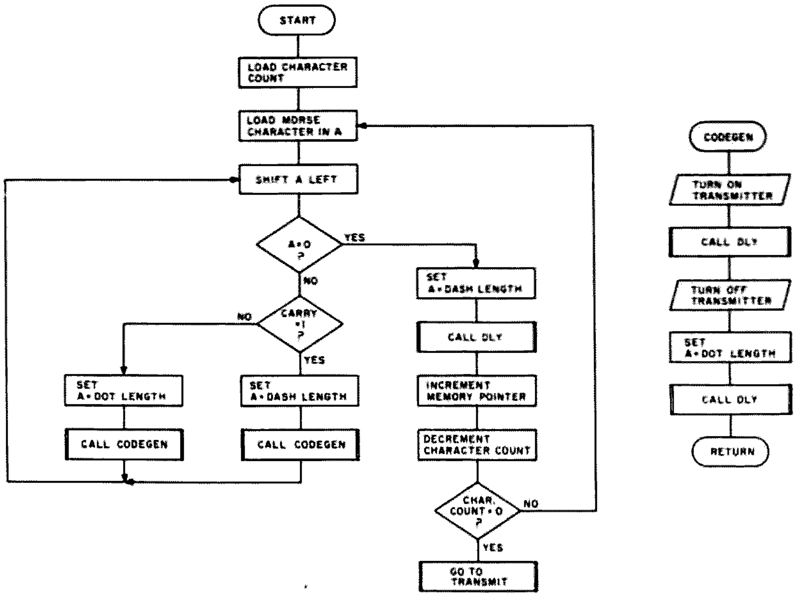

Fig. 9. Morse ID program.

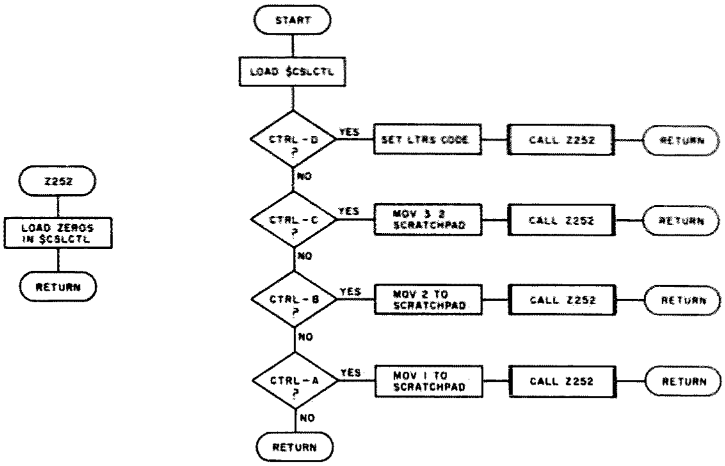

Fig. 10. Control interrupt program.

$PLFCR is called. $PLFCR transmits line feed, two carriage returns, and the LTRS shift character. The two carriage returns allow mechanical printers time to return to column zero before text starts again. After executing $PLFCR, the program branches back to "set LTRS code" to begin another loop through the program.

The CQ routine, whose flowchart is shown in Fig. 8, first calls $PLFCR then sets the column count to zero. ASCII characters are then sent sequentially to the XMIT subroutine until a period character is encountered. When a period is encountered in the buffer, a branch to the Morse ID routine is executed. After each column count of 72, the $PLFCR subroutine is called. A special, manually-executed routine, LOAD BUFFER (beginning at 044/140), is used to initially load the buffer. This routine sequentially loads ASCII characters from the terminal into memory until a period is sent. The period is stored and then the program branches to the receive program. The CQ buffer is placed at the end of the RTTY program so that the length of the buffer is limited only by the memory size (less stack requirements).

The flowchart for the Morse ID routine is shown in Fig. 9. This program generates Morse code characters by interrupting the audio output of the RTTY interface using the "reader on/off" control line of the H8-2 parallel port. (A complete discussion of this Morse code storage technique can be found in Reference 4.) Each Morse character is represented from left to right, one bit per element, using 0 for dot and 1 for dash. At the end of the character, a 1 is placed as a stop bit; remaining bits are filled with zeros. A complete alphanumeric conversion table in octal appears in the source code listing of the Morse ID program. A word space is generated by using two all-zero characters. The number of Morse characters must be loaded in 043/201 in octal. The program sequentially loads characters from TABLE into the accumulator. Each character is shifted left using ADD A one place per loop and then the carry bit is tested. If the carry bit is not set, a dot is transmitted. If the carry bit is set, a dash is transmitted. When only zeros remain in

the accumulator, a dash-length letter space is generated before the next character is loaded. The subroutine CODEGEN uses a subroutine DLY to generate dot and dash length time delays. DLY is part of Heath's H8 front panel monitor routine (in ROM) and uses the interrupt clock to generate time delays in milliseconds equal to twice the value of the accumulator.

Once the CQ buffer and the Morse ID tables have been loaded, the complete RTTY object program can be dumped onto a new tape preserving the custom tables.

Control Interrupt Program

The flow diagram for the CIP is shown in Fig. 10. Heath's H8 console driver program has interrupt processing for CTRL A, B, C, D, O, P, Q, and S. CTRL A, B, C, and D are available for user routines. When a CTRL A through D interrupt occurs, an identifying number is placed in $CSLCTL (040/252) and then a branch is executed to the user interrupt program found at the address labeled $CIS. The eight least significant bits of the address of the interrupt program (000_8) are placed in $CIS (040/250), and the eight most significant bits (044_8) are placed in $CIS+1 (040/251). The interrupt program tests the location $CSLCTL to determine which of the four CTRL interrupts has occurred. After either setting the LTRS code (CTRL-D) or moving one of the three numbers to a scratchpad, $CSLCTL is zeroed and a return executed.

Testing

The complete RTTY interface may be tested by tape recording the microphone output of the interface on an audio cassette recorder and then playing that signal back through the interface receiver. Perfect copy should result if everything is correct. The polarity of the system may be verified by the correct reception of amateur RTTY signals (usually found near 14.1 MHz) in the USB mode. ■

Partial Parts List

U1	—LM565CN phase locked loop—National Semiconductor
U2	—LM311H—National Semiconductor
U3	—AY-3-1015 UART—General Instruments
U4,U5	—LM555CN—National Semiconductor
U6	—CD4066AE—RCA
U7	—SN7473N—Texas Instruments
U8	—SN7400N—Texas Instruments
U9	—SN74LS365—Texas Instruments
U10,U11	—LM741CN—National Semiconductor
L1,L2	—85.5 mH (463 turns of No. 34 enamel wire on 1811P-A400-3B7 pot core—pot core from Ferroxcube)

References

1. *RTTY Handbook*, 73, Inc., Peterborough NH 03458, 1978, p. 17.
2. *Ibid*, pp. 65-66.
3. Robert Furtaw, ed., "Using the H8 Console Driver," *Remark*, No. 2, Heath User's Group, St. Joseph MO 49085, pp. 16-17.
4. L. Krakauer, "Efficient Storage of Morse Character Code," *Byte* 14, pp. 36-38, 1976.

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A Different Kind of Charger

—take a Gel/Cell to lunch

I have always been interested in rechargeable batteries and the means by which you can recharge these batteries. For instance, even the simple carbon-zinc dry cell can be recharged successfully to some extent using reverse current charging methods.[1] The nickel-cadmium battery is a sealed battery which was specifically designed to meet the need of having rechargeable battery power available for emergency and portable usage.

The nicad, while being much better suited for this service than the dry cell, still has some problems. Its low internal resistance allows it to supply much more current than a dry cell, but it requires considerable care when recharging to protect against permanent damage from overcharging. It also can be damaged by over-discharging the battery to the point that a single cell within it becomes reversed.

Depending on the application, nicads may not even go as long on a charge as a carbon-zinc dry cell. In fact, they tend to develop a "memory" of how long they are usually used and they will go dead before their Ampere-hour (Ah) rating says they should.[2] This can usually be corrected by cycling the battery through several complete discharge/recharge cycles, but it is time consuming and, if you forget and let it discharge too long, you may be looking for a new nicad. And nicads are quite expensive, being made of silver, nickel, and cadmium.

On the other hand, there is a new kid on the block with quite a bit to offer. The gelled electrolyte battery, or Gel/Cell™ as Globe-Union, Inc., of Milwaukee, Wisconsin, chooses to call their product, seems to

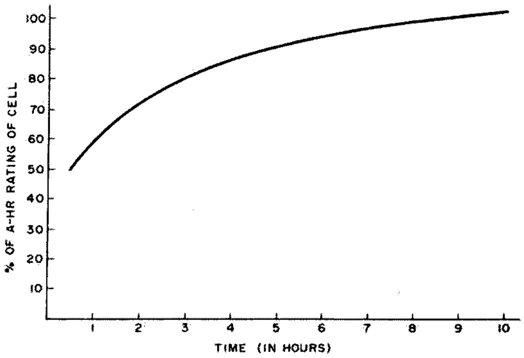
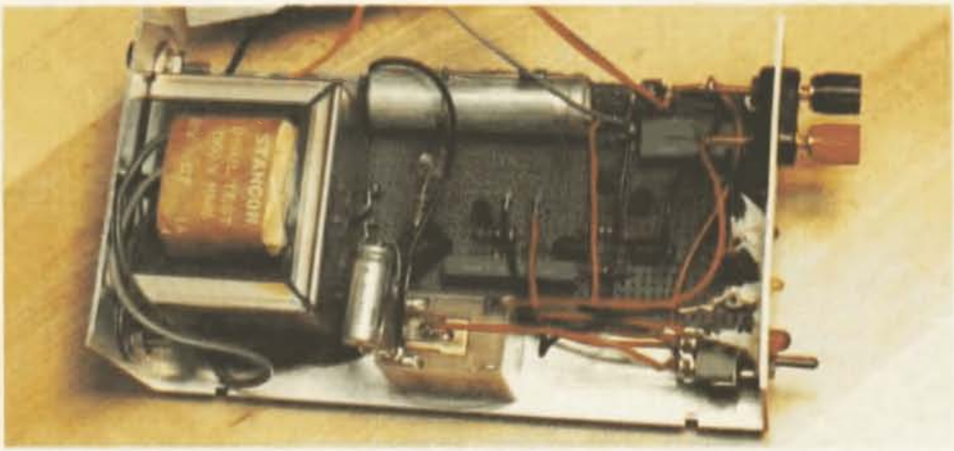


Fig. 1. Ampere-hour (Ah) rating vs. discharge time. The graph shows the approximate percentage of Ah capacity available when a Gel/Cell is discharged in less than the rated 20-hour time period. Note that capacity is nearly 100% above 10 hours. For example, a 4.5-Ah battery would be worth about 70% of its rated capacity when discharged in two hours. Seventy percent of 4.5 = 3.15 Ah for two hours, or about 1.575 Amps.

Gel/Cell charger with lid off.

Charger, Gel/Cell, and iron.



Top view of charger.

Charger in "homemade" case

have the best of both worlds.

The Gel/Cell is essentially a lead-acid battery like the one you use in your car except that the electrolyte is in a gelled state rather than a liquid. The battery is sealed so there are no liquid levels to check and no other routine maintenance to perform. They can be mounted in any position so they are ideally suited for use in medical equipment, tape recorders, or any piece of portable equipment that may be placed in unusual positions.

The Gel/Cell is comparable to the nicad in many ways, if not superior. It can be recharged over and over, 200 to 500 or more complete charge/discharge cycles or more. And the Gel/Cell does not suffer permanent damage from being totally discharged as does the nicad with its cell-reversal problem. So, if you accidentally leave your equipment on for two weeks, the batteries will come back. The Gel/Cell has a high current discharge ability like the nicad. Globe-Union's little GC 210, a 2-volt, 0.9-Ah battery, will put out 15 Amperes continuously for 1 minute!

The Gel/Cell is far above the nicad in many ways. It has no memory problem. You can use just 2% of its capacity for years and when you want 100%, it's there. You do, however, have to develop that capacity. Under cyclic conditions, the capacity of the battery actually increases until, after about 20 cycles, the full capacity is reached. Once developed, that capacity is retained over a long period of time.

Gel/Cells can be competitively priced since they are made of lead primarily. They may be series- or parallel-wired to obtain any desired multiple of 2 volts or current rating. That brings

up another interesting point. The Gel/Cell puts out 2 volts, so it takes fewer cells to make a given voltage.

In storage, they lose from 2 to 3% of their charge per month at room temperature. Other batteries may lose as much as 20-40% under the same conditions. Or, if kept on a "floating" voltage of 2.25 to 2.3 volts per cell, they can be kept for years ready to provide emergency service and will recharge themselves automatically.

Globe-Union's Gel/Cells are rated in Ampere hours at a 20-hour rate. In other words, a 12-volt, 4.5-Ah battery will supply 225 mA for 20 hours (225 mA × 20 hours = 4.5 Ah). The discharge curves are fairly linear, with most smaller batteries giving 60-70% of their rated 20-hour capacity when discharged in one hour. For example, the battery mentioned above will supply 3 Amperes for one hour, 1.75 Amperes for 2 hours and about 1 Ampere for 4 hours.[3]

Having acquired a Globe GC 1245 Gel/Cell, I wanted to put it to work running a Weller constant-temperature tip, 12-volt soldering iron for portable use. (This is the battery I was describing above.) A word here about what I observed of Globe's numbering system for their batteries. The letters "GC" seem to indicate "Gel/Cell" and the numbers are the voltage and Ah rating of the battery, in that order. So, GC 1245 is a Gel/Cell with a 12-volt terminal voltage and a 4.5-Ah rating at a 20-hour rate. GC 811 is an 8-volt battery at 1.1 Ah, etc. For an approximation of Ampere-hour capacity for other than the 20-hour rate, see Fig. 1.

The Weller iron draws about 3 or 4 Amps when heating and nothing when the desired temperature is achieved, so it should be able to run for about an hour using the GC 1245. Not bad. Now we need to look at the Gel/Cell's recharge characteristics.

Globe-Union gives some specific data on how to charge their Gel/Cells for optimum life (maximum number of cycles). The normal open-circuit voltage of a single cell is 2.12 volts. That's 6.36 volts for a "6-volt" battery (3 cells), 8.48 volts for an 8-volt battery, and 12.72 volts for a 12-volt battery, etc.

To recharge a battery to full charge, apply a dc voltage greater than the open-circuit voltage of the battery to the input terminals of the battery. The maximum current to the battery should be limited to about one-sixth the Ah rating of the battery. (See Table 1.)

As the battery begins to charge, the voltage at the terminals will rise. The voltage should be kept at a maximum of 2.4 volts per cell until the current through the cell (with 2.4 volts per cell applied) drops to about 2% of the Ah indicated current (see Table 1). When this condition is reached, the battery should be removed from the charger or placed on a "floating" charge voltage to prevent damage from overcharging.

The floating-charge voltage for a Gel/Cell is about 2.25 to 2.30 volts. When kept at this voltage, the battery will seek its own current requirement and maintain itself in a fully-charged condition. It can, at this voltage, also fully recharge itself after a loss of power. It will, however, take longer to reach a fully-charged state at this lower voltage.

There also may be some decrease in the total number of charge/discharge cycles when compared to batteries charged at the higher voltage. Globe-Union uses the term "floating voltage" instead of the term "trickle charge," as used with nicad batteries, since trickle charge infers a constant current charge with the cell seeking its own voltage. The floating-voltage method allows the Gel/Cell to draw the current necessary to satisfy itself.

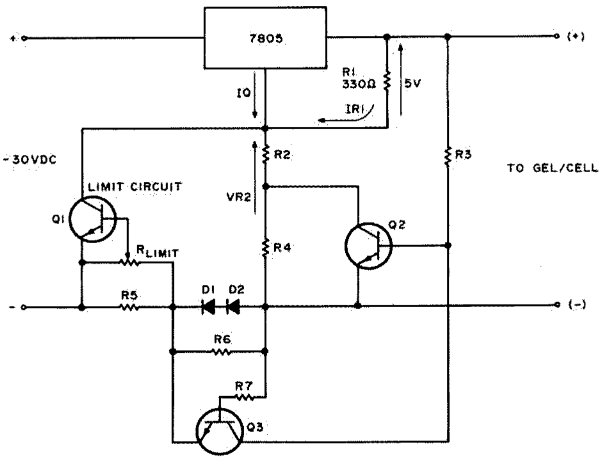


Fig. 2. Basic Gel/Cell charger.

BATTERY RATING (Ah)	MAXIMUM CHARGE CURRENT (mA)	END OF CHARGE CURRENT (mA)
.9	150	10-20
1.5	250	20-40
1.8	300	20-40
2.6	400	30-60
4.5	700	50-100
6.0	900	60-120
7.5	1200	80-160
20.0	4 Amps	100-300

Table 1. Maximum initial charge current and end of charge indicator.

The floating-voltage method is preferred since there is the possibility of overcharging the battery if you use the "trickle" method. Again, if it is necessary to obtain the maximum number of cycles from the battery, it should be current limited to 2.4 volts per cell and held there until full charge (as indicated by the current in Table 1) is reached and then switched to a float voltage of 2.25 volts per cell.

Well armed with this knowledge, I set out to design a charger that would allow me to get the maximum service from my Gel/Cell. I wanted to use a minimum of parts, but wanted it to be fully automatic and still meet the required specifications.

For my 12-volt Gel/Cell, the specs were as follows:

Maximum current = 700 mA.

Maximum voltage = 14.4 (2.4 V × 6 cells = 14.4).

Full charge current = 50-100 ma.

Float voltage = 13.5 Volts (2.25 V × 6 cells = 13.5).

I chose the 78xx/LM340T-xx series of 3-terminal voltage regulators as the starting point since they are current limited and have internal thermal protection. They have a fairly constant current through the common or ground terminal of about 5 or 6 mA, which allows them to be used as an adjustable regulator with the addition of a minimal number of parts. I chose a five-volt regulator since they are easy to come by, and by pulling the ground pin low, the output will drop to 5 volts, which should be sufficient to limit the current to less than 700 mA.

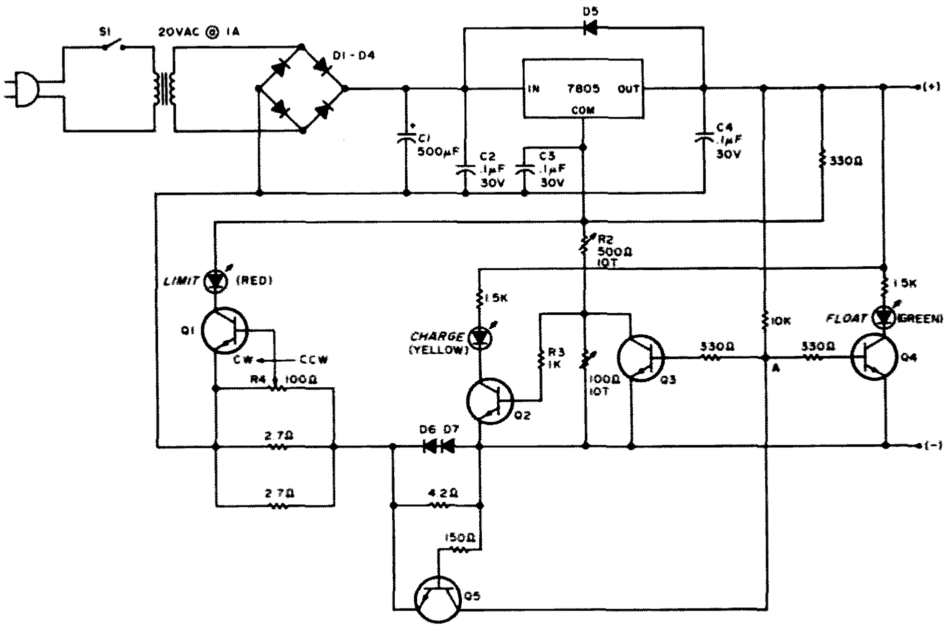


Fig. 3. Finished Gel/Cell charger. Notes: C2-C4—.1 uF, 30 WV or greater; D1-D7—1 Amp or greater at 50 piv or greater; resistors are ¼-Watt unless otherwise specified in the text; Q1-Q5 are 2N2222 or equivalent.

Refer to the circuit of Fig. 2. A fairly constant current is supplied to R2 from the 7805 and the 330-Ohm resistor. That current flows through R2 and R4 causing the ground pin on the regulator to be raised and also the output of the regulator. When the current through the R6-D1, D2 combination is low enough to turn off Q3, as indicated by the end of charge current, then Q2 turns on, pulling the R2-R3 junction to about 0.2 volts above the output (−) lead. R2 can be calculated: VR2 = Float voltage − regulator voltage − Q2Vce (sat) = 13.5 − 5.0 − 0.2 = 8.3 volts. R2 = VR2/IR2 = 8.3/(5 mA + 5 V/330 Ω) = 8.3/20 mA = 415 Ohms (approximately).

R4 is calculated in much the same manner: VR4 = Charge voltage − regulator − VR2 = 14.4 − 5.0 − 8.3 = 1.1 volts. R4 = 1.1 V/20 mA = 55 Ohms (approximately).

Assuming that Q2 has *an* hfe of 50 or more, then I chose R3 to be about 25 times R2 to allow Q2 to be fully turned on with Q3 off: R3 = 25 × 400 = 10k.

Q3 is a silicon transistor which stays on as long as the base-emitter voltage is above .5 or .6 volts. While it is on, it holds Q2 off, and the regulator is giving the hard-charge voltage of 14.4 volts. R6 is chosen so that with about 100 mA through the battery, there is just enough voltage to keep Q3 on. R7 limits the current through the base-emitter junction of Q3 to less than 5 mA. D1 and D2 are two forward-biased silicon diodes which limit the voltage across R6 to about 1.6 volts for currents much greater than 100 mA. R6 can be calculated: R6 = 0.5 V/100 mA = 5 Ohms.

R5 is selected so that at maximum allowable current the voltage across it will be more than enough to turn on Q1 which, in turn, pulls the output voltage down. R5 also should be small enough so that the drop across it will not be considerable, either. I chose 1 volt at the rated current of 700 mA: R5 = 1 V/700 mA = 1.42 Ohms.

Final Touches

The 7805 is current limited and thermally protected, but don't forget to put it on some kind of a heat sink or enough heat will build up and it will protect itself, turning off the charger. Check the wattage rating on those resistors carrying a lot of current. Quarter-watters are fine for everything but R5 and R6. For those use:

For R5, $P = I^2R$, where I^2 is the maximum current squared. $P = (.7)^2(1.35) =$ 0.66 Watts or 0.33 Watts for each 2.7-Ohm resistor.

For R6, $P = E^2/R$, where E^2 is the forward drop of D1 and D2 squared. $P = (1.6)^2/5 =$ 0.51 Watts. One Watt of dissipation is indicated. Also use usual precautions such as bypass caps.

Fig. 3 is the finished working model of my charger for my Globe-Union 1245 Gel/Cell. Adjustment is fairly simple.

With no battery attached, adjust R2 for the floating voltage of 13.5 V dc (2.25 volts/cell × 6 cells = 13.5 volts). Next, adjust the full-charge voltage by jumpering point A to the emitter of Q3 and adjusting R3 for an output voltage of 14.4 V dc. (2.4 volts/cell × 6 cells = 14.4 volts.)

The current limit control, R4, is a little more difficult to set. I set the control to full counterclockwise, then connected the battery, with an ammeter in series with the battery, to the charger. A partially discharged Gel/Cell will draw in excess of the maximum allowable charge current from an unregulated supply, so all you need to do is turn the limit control until the meter indicates 700 mA.

The charger is ready for service. Connect the Gel/Cell and watch the lights. The yellow LED indicates the battery is charging. If the red LED also is on, you know that the charger is limiting and you can expect the terminal voltage to be below 14.4 volts. As the fully-charged condition nears, the red LED will go out and the voltage will reach 14.4 volts. When full charge is reached (charge current below 100 mA), the yellow LED will go out as the green one comes on.

This circuit has been in use for some time now with a 12-volt soldering station. It works very well, and it is so nice not to have to worry about handling the battery charging. It really takes care of itself.

Gel/Cells are very handy to use and quite durable, too. More and more are showing up on the market from the surplus houses now, so why not pick one up and enjoy real trouble-free battery operation? ■

References

1. "A Simple Reverse Current Battery Charger," W6FPO, *73 Magazine*, October, 1973, p. 55.
2. "Making Nicads Behave," K2OAW, *73 Magazine*, December, 1974, p. 33.
3. For more information on Gelled Electrolyte batteries, contact Globe Battery, Division of Globe-Union, Inc., 5757 North Green Bay Avenue, Milwaukee WI 53201, (414)-228-2394.

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"No Problem . . . No Problem"

—tales of DX contesting with VP2KC

This is not the official story of the VP2KC world-record contest team. That story will be written by others, and since *CQ Magazine* sponsored the contest, will almost certainly be published there. I was just one of the operators, and this is my story.

For those who are not avid contest followers, the Southeastern DX Club and friends put together a serious multi-multi operation from VP2KC during the sideband part of the CQ-WW contest in October, 1979. The organizers of this effort were shooting at PJ9JR's world record of 29 million points. Now, as everyone knows, VP2KC is on St. Kitts, St. Kitts is in North America, and contacts within North America count only two points. So all those U.S. QSOs count only two points for us, but three points for our competitors a few miles to the south, because their island is considered to be South America. So, what chance did we have? The organizers must have been crazy! Everyone knows you can't even win this contest from a two-point country, let alone think about world records. But I guess they knew something that everyone else didn't, because at 2400Z when the bands went quiet, we had 37.7 million points, a new world record, and a real proud feeling.

One of Prinair's finest. (Photo by WA4PBW)

This whole thing got started in the spring of 1979 when Hugh Valentine N4RJ and Paul Newberry N4PN hooked up with Ellis "Kit" Carson VP2KC. Kit is a retired businessman from Indiana who isn't really retired. When one thinks of retired businessmen living in the Caribbean, the picture that comes to mind is some doddering old fool who

spends his days on the veranda watching the sugar cane grow. Well, that's not Kit. He makes frequent trips to the States for both business and pleasure in his private plane, is involved in countless activities, and is an influential member of the St. Kitts Board of Tourism. The idea of having a world-class contest station appealed to Kit, so Paul and Val made a trip to St. Kitts to explore the possibilities.

What they found can only be described as a DX contest paradise. Kit has a spacious estate with ample room for any and all kinds of antennas. There is an unobstructed water path to Asia, the States, Europe, and Africa, and a fairly good shot to the Pacific. There's a mountain to the south, but this turned out not to be a problem. Also, considering the main house and the surrounding cottages, there was room for six stations without crowding. But if anyone thinks that, having found the place, they forgot about it until contest time, let me assure you that this was not the case. The work started then.

Enter Ernie K1PBW. Ernie is one of the finest low-band operators in the world. If you doubt it, check some of the recent contest scores. But, more importantly, Ernie is a technical wizard. Between spring and the contest, Ernie spent more than fifty days on the island. He personally rewired the whole estate. The old electrical system just wasn't up to the task. On a good day, line voltage dropped 25 volts when Kit keyed his Drake linear. That was on a good day. When Ernie finished, six full power stations could operate, and you could barely tell from the line voltage if they were idling or transmitting. And, just in case the local power failed, there was a 17 kW diesel generator rigged up to be on line within thirty seconds. One stumbling block out of the way.

Spacious interior of a Prinair wide-body. This is one of the few airlines where you can get both a window and an aisle seat at the same time. (Photo by WA4PBW)

But Ernie also knew antennas. There were more low-band antennas than many people could even keep track of. The 160-meter transmitting antenna was a real masterpiece. A separate 116-foot tower was devoted to this purpose—counting the mast at the top, 132 feet of radiator. But that was only the part you could see. There were 18,000 feet (you read it right) of radials. That's about three and a half miles of radials! It took ten men ten days to bury them—one hundred man-days in the radials. A fair number of people commented that VP2KC was the loudest Caribbean station they had ever heard on 160. Now they know why.

The 75-meter transmitting antenna was also Ernie's work. It was a five-element phased vertical array. I doubt that anyone made scientific measurements of gain or directivity, but the 75-meter operators swore by it. On the other hand, Kit's wife, Annie Green, swore at it. It wasn't especially unsightly, but it was located right in the middle of her golf course. Between the verticals, the guys, and the feedlines, the green was just about unusable. Fortunately, Kit prevailed, and the array stayed in place. However, it was gone before noon the day after the contest. I hope that everyone who needed St. Kitts on 75 got it during the contest.

W3BTX	K1PBW	WD4RCO
W4GIW	WA4PBW	N4RJ
W4HR	K4PHE	WB4RUA
W4LVM	K4PI	K4UEE
N4NX	N4PN	N5UR
JA3ODC	K5PP	AA4V
K3OIH	W4PPT	N4WW

Table 1. Operator list.

Band	Raw QSOs	Zones	Countries
160	547	11	47
80	1150	22	95
40	1730	28	109
20	4520	39	153
15	5760	39	145
10	5100	35	128

Table 2. Statistics. Notice how close we came to 5-band DXCC in one weekend.

The pre-contest briefing took place on the VP2KC patio. (Photo by WA4PBW)

And then there were the receiving antennas. The tremendous Caribbean QRN made the verticals next to useless for receiving. So Ernie installed a series of Beverages for receiving on both 160 and 75. Some had as much as a quarter mile of feedline, with remote preamplifiers. I'm not sure exactly how many there were, but knowing how Ernie does things, I am sure that there was at least one directive, low-noise receiving antenna pointed at every area of the world where low-band activity was expected, and probably a few spares for good measure. Also, there were dipole spotting antennas—at least one per station. Remember the three and a half miles of radials? Think about how much coax there must have been! I've got to believe that the Belden and Amphenol stockholders must have been real pleased with their dividends.

But we're not finished with Ernie yet. By my count, there were 24 pieces of Drake B and C line equipment—receivers, exciters, and transceivers. Ernie modified all of them with the full range of Sherwood contest goodies and with a few of his own. With six stations in close proximity, there was essentially no cross-station interference. But most amazing to me was the spotting equipment. On any given band, the spotter, who was in the same room with the operator, could tune to within a few kHz of the transmit frequency with absolutely no problem. This alone was probably worth several multipliers. There was not a single equipment failure during the contest, and most of the credit goes to Ernie. If you're getting the idea that the whole thing would have been impossible without Ernie, I think you're right. Those fifty days on the island were very busy ones, I'm sure.

So the other guys stayed in Atlanta and loafed, right? Wrong! Who do you suppose arranged for the operators, the towers, the beams, the wire, the radios, the parts, the transportation, the accommodations, the scheduling, and the etcetera? The etcetera list is about a page long and extends down to the pencils and the scratch pads. All it takes is one missing etcetera to really screw up the whole works. Val N4RJ is a dentist who probably could have made a fine salesman. If you don't think it takes salesmanship to convince 29 operators to spend a thousand dollars each to go to St. Kitts (St. what??) in chase of wild geese, you should try it sometime. But remember, you're going to need more than 29 sales. If you want 29, then get solid, "swear-on-their-Granny's-grave" commitments from 49. Besides the sales effort, Val, Paul, and Bob K4UEE all made at least one pre-contest trip to the island. The rest of the towers and beams were their work.

There were others who made significant contributions. Bob W4HR was in charge of the operating plan. We knew well in advance just exactly what countries and zones, on what bands, and what hourly QSO rate, by band, it was going to take for the record. Bob passed the plan along to Mike K4PI. In all cases where Mike saw that a particular country was needed and no avid contesters were known to be active in that country, an attempt was made to arrange a schedule. I know at least a hundred letters went out, and it may have been several hundred. This was an ongoing process. As schedules materialized or failed to materialize, the operating plan was refined and amended.

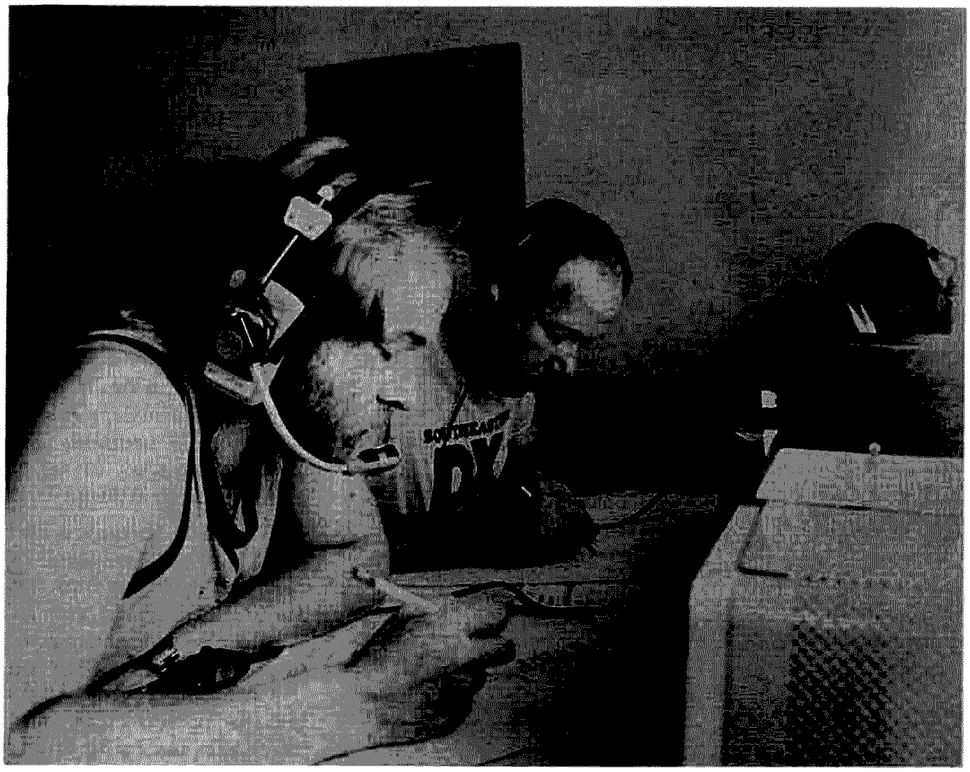
Van W4GIW is associated with a travel agency. As operator commitments were received, Van arranged for their transportation and accommodations. The rates were much more favorable than we could probably have worked out as individuals. GIW, GIW . . . where have I heard that before? Must be PI9GIW from 1973. That was a world record, too. And most of the people I've already mentioned were participants in that one. At least I'm not getting mixed up with a bunch of rookies here.

The weeks went by, and soon it was time for some important decisions, like whether or not my wife Pat was going. First she said no, and then maybe, and then yes. And by departure time, I couldn't have kept her away with a cannon. About ten of the wives were going, and she planned to enjoy herself whether or not I was going to be foolish enough to waste a whole weekend with those silly radios.

Both of us had busy work schedules, so we couldn't leave until the Thursday before the contest . . . very early Thurs-

day, I might add. We had a 6:00 am flight, and a 4:00 am wake-up time comes so, so early. That was our first mistake. Our next mistake had to do with the clothes we wore. It was unusually cold in Atlanta, but we knew it would be very warm on St. Kitts, so we compromised with medium-weight clothes. As we stood shivering in the pre-dawn cold of the parking lot at the Atlanta airport, we had a good while to regret that decision while we waited for the shuttle bus.

But that was soon behind us. On board the Delta wide-body, we met Winston WA4PBW, who was to be the group's official photographer. Several of the photos you're looking at are Winston's work. Also on board were John WB4RUA and his charming friend Diane. The flight to San Juan was smooth, on time, and enjoyable. It was also the last enjoyable experience with an airline for some time, as we were about to encounter Prinair.



The 10-meter station—W4LVM is operating, WD4RCO is logging, and K5PP is spotting. (Photo by K4PHE)

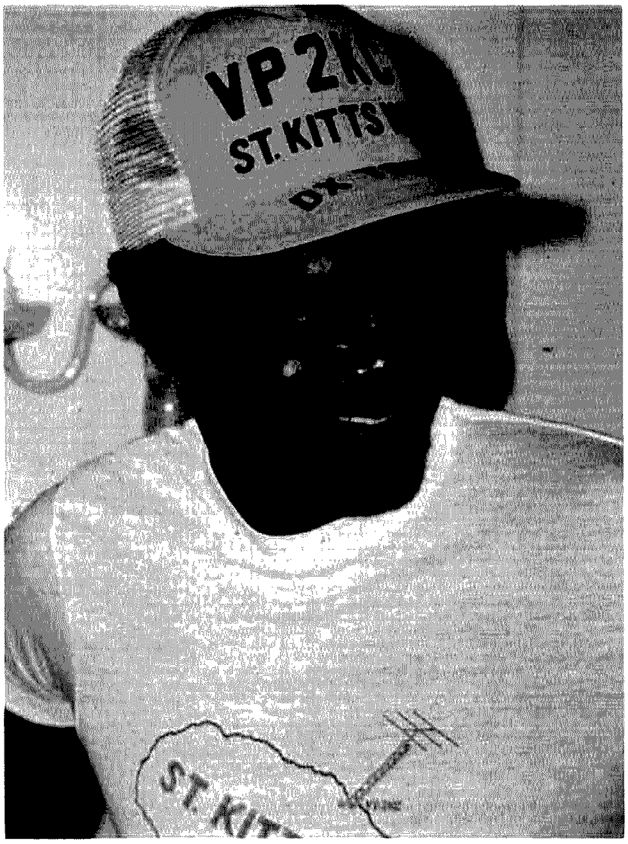
We had plenty of time in San Juan to have a few drinks, wander through the duty-free shops, and check in with Prinair. The first surprise came when John had to luggage-check the linear he was hand-carrying and I had to check the power supply I was carrying. At least the ladies got to keep their purses. The next surprise came when the agent asked each of us our weight and dutifully recorded it. It really wasn't much of a surprise when we got to the gate and were advised that the flight would be "somewhat delayed." When we finally got to board, I was thinking that maybe it should have been delayed somewhat more. The aircraft was a decrepit twin-engine clunker of dubious manufacture. Sure enough, we lost an engine en route to St. Thomas.

So, another delay. "No problem," the pilot assured us. We were soon to learn that Prinair didn't really consider any passenger inconvenience to be a problem. Depends on your perspective, I'm sure. At least the air conditioner and the Coke machine in the Prinair lounge worked, so we made the best of it. Bob K4UEE and his wife Mary had left the day before so they could spend a little time in St. Thomas, and they were there when we arrived. The plan was for them to join us for the rest of the trip to St. Kitts. But when the replacement aircraft was ready to board, the pilot decided that he had enough passengers. "No, No. I come with sixteen, I leave with sixteen," said the pilot. We waved good-bye to Bob and Mary, who were having a heated discussion with the Prinair folks. Confirmed reservations are included among the variety of things that present no problem to Prinair.

Fortunately, both engines worked on the leg to St. Martin. There was another short delay there, but basically the trip was without further incident until we arrived in St. Kitts. You may recall the clothes that weren't warm enough in Atlanta. Well, from San Juan on south, they were far too warm, and I was really looking forward to a shower and fresh clothes in St. Kitts. To this day, I can't even begin to describe how I felt when we discovered that Prinair left the luggage in San Juan. "No problem," they assured us. Ah, jeez!!

Although we were hours late, our cab drivers were right there waiting. We piled into Mr. Coker's cab and headed for the Fairview Inn. At that point, I was so tired and discouraged that I remember almost nothing about the ride, except that there was a woman from Chicago who rattled on about nearly everything to no one in particular. Funny how memory works. When we registered at the Fairview, I was handed a red plastic bag containing a yellow VP2KC contest team hat, some paperwork, and a contest team T-shirt. A clean T-shirt!! Well, I got my shower and half a change of clothes. Alas, all Pat got was a shower, but no change of clothes. Like they say, half a loaf . . .

What with all the delays, we were far too late for Kit's pre-contest party. I'm told it was quite an event. The Premier was there, as were the Communications Minister, several other St. Kitts dignitaries, and nearly all of the local hams. I was really sorry to have missed it. So what did we do? We sat around the pool and enjoyed several Fairview Specials, a delicious rum punch. Pat and I were not alone in our plight. Austin



Were the island authorities in our corner? This is Z.A. "Zeff" Joseph, the St. Kitts Communications Minister. (Photo by WA4PBW)

N4WW and Steve AA4V were also without luggage. I think Winston may have lost his as well, but at least he had a few essentials in his camera bag. A few more Fairview Specials and a delicious dinner later, I was no longer tired or discouraged. I was ready to work DX!

Jack W4PPT strung up a dipole from the windmill tower and we were in business. Fred Lam, the Fairview owner, is both a gracious host and very kindly disposed toward hams. Arrangements were made so that we could operate all night without disturbing anyone. It's really fun to be on the other side of the pileup. It's also a great pleasure to operate below the American phone band where the DX is at. And so we went at it until the wee hours. When we finally quit, I wondered how I was going to make it back to the room, since it was pitch black outside. Then a man in a white uniform popped out of the bushes with a flashlight in one hand and a club in the other hand. As soon as he recognized me as a guest, he escorted me to the room, lighting the path with his flashlight. I'm sure glad he did recognize me, since that was a mighty big club and I suspect he used it for something besides balancing the flashlight.

After a day like that, I would have expected to sleep till noon, but for some reason, both Pat and I were up early—before they began serving breakfast, in fact. So, we just wandered around the grounds, enjoying the natural beauty. St. Kitts is really a beautiful island, and Fred Lam evidently takes great pains to preserve that beauty. The foliage is breathtaking, but not ostentatious. It's difficult to describe, but there's a world of difference between formal gardens that look like they were planted there and a natural setting where the trees and flowers look like they belong there. At the Fairview, everything looks like it belongs. And I don't recall seeing a single neon sign. I remember thinking that I could probably get used to the idea of never going back to Atlanta.

But, back to reality and more pressing matters—a call to Prinair to find out about the luggage and reconfirm the return trip. "No problem, sir. It will be on the morning flight." Well, OK. Relax and enjoy. Not much else we could do. As it turned out, there was no morning flight. A few more phone calls, and we learned that the FAA had grounded Prinair. But, "No problem, sir. One of the other airlines will bring it." Ah, jeeez! Arrrgh!

So, we went into town to buy essentials. Our contest T-shirts and VP2KC contest team hats made us instant celebrities. N4PN, N4RJ, and K1PBW had been interviewed on local television a few days before, and W4PPT had addressed the Rotary Club. And, of course, the Premier's attendance at the pre-contest party had been well publicized. Most of the people didn't really grasp what a DX contest is (do they anywhere?), but they seemed to be genuinely happy we were there. Thirty minutes later, we had toothbrushes, toothpaste, new clothes, and a rented car. Another shower, fresh clothes, and we were ready for anything. Simply amazing how a little thing like a toothbrush can brighten your day.

Besides missing the pre-contest party, those of us without luggage had missed not only the last-minute preparations, but the pre-contest fun as well. Even though I wasn't there to enjoy it personally, the following episode bears repeating. Obviously, the direct quotes shown are not really direct quotes, but I think I've captured the essence of the QSO between N4NX and Unnamed Competitor on Nearby Island (UCONI):

UCONI: "I've noticed a whole bunch of you Southeastern DX guys signing portable VP2K. What are you all doing there?"

N4NX: "Well, we thought we might enter the contest. Make a few contacts, you know . . . "

UCONI: "You guys know you don't have a chance, don't you? You're just DXers, and you're up against a finely-honed contest team here."

N4NX: "Well, yeah, you're probably right. We really don't have a lot of experience with this contest stuff. But since we're here, I guess we'll go ahead with it. You never know, we might get lucky."

UCONI: "There's not that much luck in the world! I've got $25 that says we beat you! How about it?"

N4NX: "$25? Well, hem . . . haw, I don't know. $25, you say? Hem . . . haw, do you really want to do that?"

UCONI: "Sure! That's right!! $25!!! How about it?"

N4NX: "Weeelll, I really can't do that, but I'll tell you what I will do. How about $100?"

UCONI: "Uhh, umm, ahh, OK then. (This shoe tastes awful.) You're on. $100 it is . . . "

N4NX: "Right, very good. Any witnesses on frequency?"

Tremendous pileup: "Yeah, I did . . . Me, too . . . Got it all on tape . . . every word . . . hook, line,

and sinker . . ."

N4NX: "Well, nice talking to you. Good luck in the contest. QRZ from N4NX/VP2K . . ."

Anyway, by then it was time to leave for Kit's and the final pre-contest briefing. So we piled into the rented cars and headed for VP2KC on the other side of the island. A full day on the island must have jaded me a bit, because the first thing that struck me about Kit's estate was not the beauty, but the antennas. Besides the 160-meter vertical and the five-element 75-meter array, there were four other towers. One supported a two-element Telrex on 40 meters, another a five-element Telrex on 20, the third a three-element Telrex on 15, and the fourth a three-element Telrex on 10 meters. The element spacing on the 15-meter antenna was a bit wide because it used to be a 20-meter array before N4PN tuned it with a hacksaw. Hacksaw adjustments to Telrex antennas indicate that the adjustor is either very serious or very weak under the rafters. What kind of people was I hooked with here?

View from the 20-meter tower, looking over the 10- and 15-meter beams and three of the 75-meter verticals on the golf course. (Photo by K4PHE)

When we made the final head count, there were 21 operators. There had been a couple of last-minute cancellations, and we lost a few more to Prinair. About five people were stranded due to the grounding. Three made it as far as the Virgin Islands, where they operated from KP2A. This put something of a crimp into the operator scheduling plan, but no real problem, as Prinair was fond of telling us. The original operator schedule had each operator scheduled to do a specific task (operate, log, or spot) at a specific station during a specific time period. Rest periods were scheduled as well. W4HR had worked it all out on his computer, considering both the operators' stated preference and their known operating skills. There was no computer to redo it, so there was a manual revision—everyone was assigned an initial position, with instructions to continue as long as they were able.

About an hour before contest time, everyone made one last equipment check and made sure they were thoroughly familiar with everything. And everything was ready to go—right on down to sharp pencils and scratch pads. Each station even had a booklet of schedule info for the rare and semi-rare ones. The booklet was organized by schedule time and included the station's call, schedule frequency, and even the beam heading. With organization like that, how could we miss? The pre-contest pileup built. I was on 10 meters and the JAs were rolling in. From Asia, the Caribbean in general is considered good DX, and VP2K especially so. Extensive publicity in the JA DX press helped us immeasurably. By 0000Z, it sounded like half of Japan was on frequency.

This is a good time to tell you about Masa JA3ODC. All good things eventually come to the southeast, and Masa is no exception. He's a graduate student in Florida, and finding him was one of the best things that ever happened to us. He used to be a chief operator at the renowned contest station, JA3YKC, and judging from his performance at VP2KC, he learned his lessons very well. Most of the rest of us would be well pleased with a 250-per-hour QSO rate, but Masa at his peak was running 480! That's eight QSOs a minute! And since most of the QSOs were in Japanese, he had to log for himself, as the rest of us had a problem understanding who he was working. It wasn't long before he became known as "JA machine." Needless to say, his skills were very much in demand.

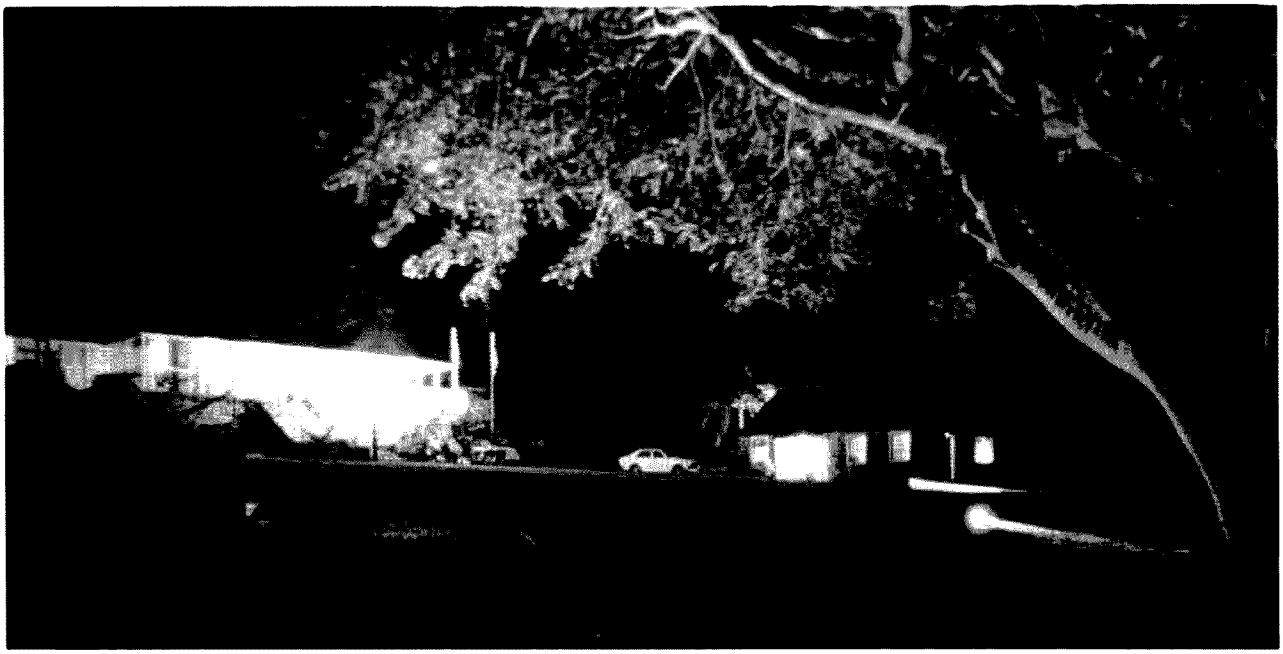
The rest of Asia must also have considered VP2K to be a good catch, if UØY's reaction is any indicator. UØY, as you may recall, is a Russian operation in that part of the Soviet Union that counts for Zone 23. I found them on 10 meters well past midnight. Ten was nearly dead, and I was making one last check before shutting down the station for the night. Naturally, I was pleased, since Zone 23 is usually difficult, especially on 10 meters. The QSO went something like this:

Me: "VP2KC."

UØY: "AP2KC, you're 5923 (ho-hum)."

Me: "Thank you. You're 5908. Please correct the call. This is Victor Papa Two Kilo Charlie."

UØY: "Oh! Oooh! Veeee



Light from the filaments of the 4CX5000s at peak of the contest. (Photo by WA4PBW)

P2KC! My dear friend, you are 5923. Where are your other stations? And what is QSL info, please, my very dear friend?"

I think we worked them on all bands except 160, and they reported that they heard us there, but couldn't work us.

I left the ten-meter station and wandered through the other stations. It was past sunrise in Europe, but the 75-meter station was still clicking off Europeans. And 15 was still wide open, with Masa working JAs at a tremendous pace. All the stations were manned, so I had a sandwich and a cold bottle of Carib, the local beer, and found a place to nap. Morning was there about three seconds after I closed my eyes.

Kit VP2KC and his XYL, Annie Green, at the victory celebration. (Photo by WA4PBW)

W4HR and W4GIW were continuously monitoring progress versus the master plan and feeding it back to the stations. We always knew what we had to do to stay on track—work more 3-point QSOs, find more multipliers, switch to U.S. QSOs to pick up the QSO rate, or whatever. As with many things in life, the only sure road to success is to make a realistic plan and stay with the plan. All of the operators understood that, and to my knowledge, there were no serious episodes of "hot-dogging" or resistance to constructive criticism. The importance of proper planning, monitoring, and feedback can't be overemphasized.

One of the major events of the weekend for me was "The Arrival of the Luggage!" Whatever I was doing at the moment came to an immediate halt. In retrospect, I'm glad it wasn't in the middle of a QSO with Burma, because that

would have forced me into a very difficult decision. I must have luxuriated in that shower for a full fifteen minutes and spent the next fifteen minutes walking around with a silly grin, just thinking about how good it felt to be wearing my very own clean, comfortable clothes again. Even thinking about Prinair couldn't spoil the pleasure of the moment.

Much of the weekend sort of ran together, and I don't remember a lot of details with any clarity. I recall that Pat and some of the other wives came to visit and that we spent a few minutes sitting near the pool. I also remember operating, spotting, logging, eating, drinking, and napping, but nothing that really stands out until late Sunday morning. We had just finished changing shifts in the 10-meter station when W4HR came in to tell us that we were over the hump. According to preliminary count, we had nearly 30 million points and a new record. This didn't really come as a surprise, since we had been right on plan for hours and knew it was just a matter of time. Even so, those were welcome words. We had nearly nine hours to go, so even if the preliminary count was off, or if the dupe rate was exceptionally high, there was plenty of time. The rest of the contest was more like fun than work. We even stopped for about ten minutes in midafternoon so that all operators could get into the group pictures.

Almost all of our schedules were on the hour, so it seemed very unusual to find that we had a 10-meter schedule with FK8CR at exactly 2038Z. So, at exactly 2038Z, I swung the beam and tuned to the appointed frequency. Eddy was right there waiting to provide an extra multiplier. It turned out that it was already Monday in New Caledonia, and the 38 minutes was what Eddy needed to drive home from work on his break and warm up the radio. With cooperation like that, how can you lose?

It was over, and the champagne flowed. Some believed all along, others had their doubts, and for still others, the full impact hadn't dawned. After all, it isn't every day that we break world records. We were all dead tired, but not too tired for a victory dinner. So, off to the Ocean Terrace Inn to eat. Besides being tired, I had also had a bit too much bubbly, and so the only thing I recall about the meal was that it was delicious. On the other hand, considering the exhilaration of the moment, I probably would have remembered a meal of bread crusts and swamp water as delicious.

But, soon came the morning, sobriety, and another chance to deal with Prinair. Pat's schedule called for her to leave that day. Fortunately, Prinair was flying again. Also fortunately, Pat and I had each called Prinair at least once a day since we arrived, to reconfirm. If ever there were confirmed reservations, we had them. Still, we were uneasy and arrived at Golden Rock Airport well before flight time. Thankfully, everything went smoothly, and the flight departed with Pat aboard—only thirty minutes late, which was a superb performance.

Also on board was N4WW, in whose name the car was rented. So, off to Sunshine Car Rental, where it turned out to be a lot easier to simply say, "Dr. Regal requires his car for another day. I will pay you now." "Yes, sir, no problem," replied the clerk. By golly, the first "no problem" that really was no problem. Also no problem was getting a driver's license at the local police station. With only one day to go, I had seriously considered doing without the license, but then I considered the probable view from the St. Kitts jail. Thus, the trip to the police station for the license.

Time out for an official operators photo. Left to right, from top row down—W4GIW, VP2KC, K4PHE, W4PPT; WB4RUA, N4NX, K4UEE; K3OIH, W3BTX, N4PN; AA4V, W4LVM, N4WW; K4PI, K5PP, K1PBW (partially hidden); WA4PBW, N5UR; JA3ODC, N4RJ, WD4RCO, W4HR.

Back to VP2KC for the cleanup operation. The rest of the crew had been at work while I was at the airport with Pat, so there really was little left to do. As I mentioned earlier, the 75-meter vertical array had disappeåred without a trace. The beams and the big 160 vertical stayed, so Kit still has a big signal on almost all bands.

That evening, there was a private cocktail party at the Fairview, but Fred Lam invited those of us who were still staying there to attend. We hadn't missed the Premier after all. Both he and the Governor General were there, as well as a large group of local dignitaries. They didn't really understand what a DX contest was, but they did understand what a world record was, and they were glad their little island had one. All in all, a very enjoyable evening.

Later on, W4PPT and I went to use the impromptu dipole to raise Atlanta so I could find out if Pat had arrived safely. Talk about bad conditions to the States! We tried and tried and tried with absolutely no results. The 3CØ operation was on at the time, and finally in desperation we called "CQ Atlanta" on the Annabon transmit frequency. A very long "CQ Atlanta." When not a single catcall or obscenity resulted, it was fairly clear we just

weren't making the grade into the States. After a long while, and with a lot of help from a 6Y5, we finally got N4YD on frequency. Pat's trip was relatively uneventful, and she was safe and sound at home.

Next morning, most of the rest of us were scheduled to leave. At breakfast, we speculated what surprises Prinair might have for us that day and how to counter them. Nearly all of us arrived early at the airport to await the passenger list, telexed from San Juan. When it finally came, those of us who found our names breathed easier, and those who didn't went wild. There were pleas, threats, bribes, and a flurry of activity with the other airlines. In a way, I felt sorry for the agent, who had to make very careful decisions to ensure he would be alive to spend his bribes. After much anguish and lots of negotiation, all but two of us made it.

By this time, we were all familiar with "forgotten" luggage, so there was careful scrutiny of the procedures. Each of us made quite sure that we saw our personal luggage and equipment loaded. Only twenty minutes late (probably also a new world record), we were taxiing down the runway. The intercom was out of order, so the co-pilot shouted over the engine noise something about seat cushions for flotation, good luck, and banzai! I have the highest respect for the Prinair pilots. Anyone who can fly something with so many broken rivets and loose nuts has got to be good. Actually, the flight was smooth and uneventful, so the photographers among us amused themselves with shots of miscellaneous loose parts.

We arrived in San Juan, kissed the ground, and headed for customs to await the luggage. And did we ever wait and wait and wait. We knew it must be there, because we watched them put it on board. But being basically trusting souls, it never occurred to us that they might take it off at some intermediate stop. They did. No luggage again! Arrrrgh!! I couldn't believe it. Suffice it to say that my thoughts at that moment are entirely unprintable. Use your imagination.

Lunch that day is worth a comment. Throughout our stay on St. Kitts, the food was simply superb. Every meal was delicious, attractive to the eye, and served by people who obviously took pride in what they were doing. Even the sandwiches were great. Thinking about those delicately seasoned lobster sandwiches makes my mouth water. So, after all that, guess what we had as soon as we got back on U.S. soil? Almost without exception, we selected and eagerly devoured a greasy cheeseburger and equally greasy french fries. That must say something about the American palate.

Well, Eastern brought the luggage from St. Martin, Delta got us back to Atlanta, and so it ended. Long after I've forgotten how wretched Prinair is, I'll remember the beauty of St. Kitts and the friendliness of its people. I'll remember the hospitality of Kit Carson and his lovely wife. And I'll certainly remember how it feels to hold a world record. In a way, I hope someone breaks that record soon, because that will be the perfect reason to return to St. Kitts and do it all again. ■

Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, Attn: Social Events.

YELLOWSTONE
AUG 1-3

The Wyoming-Idaho-Montana-Utah Amateur Radio Council will hold its Yellowstone National Amateur Radio Convention on August 1-3, 1980, at the convention center in West Yellowstone MT. The convention will feature a full program starting Friday morning and running through Sunday. Activities will include forums, contests, crafts, movies, swap tables, dealers, banquets, and much more. There are hotel-motel accommodations available adjoining the convention center and RV parks and campgrounds close by. There are airports and gas available in West Yellowstone. For more information, write WIMU, PO Box 20116, Salt Lake City UT 84120.

MACON MO
AUG 2

The Tri-County ARC, NEMO ARC, and Macon County ARC will hold the 2nd annual North Central Missouri Hamfest on Saturday, August 2, 1980, from 9:00 am to 5:00 pm at the Macon County Fairgrounds Park, Highway 63 south, Macon MO. There will be free parking, an enclosed area for commercial displays, food available on the grounds, and YL activities. Tailgaters are welcome. Tickets for the prize drawing will be available for $1.00 each at the door. The major prize will be either a color TV, an allband receiver, or a handheld two-meter transceiver. Talk-in on 146.52, 147.69/.09, and 146.07/.67. For more information, contact Charles Coy WBØENV, 601 McKinley, Moberly MO 65270.

JACKSONVILLE FL
AUG 2-3

The Jacksonville Hamfest Association is pleased to announce that the 1980 Jacksonville Hamfest and ARRL Florida State Convention will be held on August 2-3, 1980, at a new location, the Orange Park Kennel Club at the intersection of I-295 and US Highway 17. Advance registration is $3.00 and is available from Jacksonville Hamfest, 1249 Cape Charles Avenue, Atlantic Beach FL 32233. Price at the door will be $3.50. A large indoor swap mart will be featured, with tables available at $5.00 per day. The table reservations can be ordered from Andy Burton WA4TUB, 5101 Younis Road, Jacksonville FL 32218. Interesting programs and forums are planned, as well as door prizes and many manufacturer and dealer exhibits. Plenty of family activities are available close by. The headquarters hotel is the Best Western located just across the street from the hamfest. Special rates of $23.00 single and $28.00 double are available; reservations should be made through the local number (904)-264-1211 to get the low rates. A special DXers' forum and dinner banquet will feature a Spratly Island presentation by Stu Woodward K4SMX. Also, Bill Barr N4NX will present a show on the VP2KC world record effort of over 32 million points in the CQ WW contest (1979). Reservations for the banquet can be obtained for $11.50 each by writing N4KE, 258 Wesley Road, Green Cove Spring FL 32043. For the fly-in ham, Herlong Airport is the closest landing site. Free weekend parking and rental automobiles are available. Phone (904)-783-2805 for more information. For more general information, write JHA, 911 Rio St. Johns Drive, Jacksonville FL 32211.

WARREN OH
AUG 2-3

A "DXpedition to the Center of the World" will be operated by the Warren Amateur Radio Association from 1300 GMT Saturday, August 2, 1980, to 2000 GMT Sunday, August 3, 1980. Frequencies will be 28.625, 21.360, 14.285, 7.235, and 3.900 MHz SSB. We will also monitor 21.125 for CW fans. QSL for a beautiful certificate with a large SASE (DX–2 IRCs) to W8VTD, Center of the World DXpedition, Box 809, Warren OH 44482.

ANGOLA IN
AUG 3

The Steuben County Radio Amateurs will hold their 22nd annual FM Picnic and Hamfest on Sunday, August 3, 1980, at Crooked Lake, Angola IN. Admission is $2.00. There will be prizes, picnic-style BBQ chicken, inside tables for vendors and exhibitors, and overnight camping (with a fee charged by the county park). Talk-in on 146.52 and 147.81/.21.

LEVELLAND TX
AUG 3

The Hockley County Amateur Radio Club and the Northwest Texas Emergency Net will sponsor their 15th annual picnic and swapfest on Sunday, August 3, 1980, beginning at 8:00 am at the city park in Levelland TX. This is an event for the entire family. A $3.00 registration fee is requested but not required. Lunch will begin at 12:30 pm with a bring-your-own-picnic-basket lunch. There will be swapping all day, with tables provided. Talk-in on 146.28/.88.

PITTSBURGH PA
AUG 3

The South Hills Brass Pounders and Modulators Radio Club will hold its 43rd annual hamfest on Sunday, August 3, 1980, on the south campus of the Community College of Allegheny County, located in West Mifflin Borough, just south of Pittsburgh PA. There will be ample indoor air-conditioned facilities on the ground floor with free table space. Electricity for equipment and/or displays will be available. There will be hard-surface parking available, food and refreshment at nominal cost, and airport and motel accommodations within a one-mile radius. For more information and pre-registration, write Bruce K. Banister WB3AKK, 5954 Leprechaun Dr., Bethel Park PA 15102, or phone (412)-833-3978.

PETOSKEY MI
AUG 9

The Straits Area Radio Club will hold its Swap and Shop on Saturday, August 9, 1980, from 9:00 am until 4:00 pm, at the 4-H Building, Emmet County Fairgrounds, Charlevoix Avenue (¼ mile west of the intersection of US 131 and 31), Petoskey MI. Free parking (Friday night for self-contained vehicles) and refreshments will be available. Features include a ladies' bus tour to Cross Village with Mort Neff as conductor, one main prize, and smaller prizes hourly. There will be a donation of $2.00 at the door. Table space is also $2.00. Talk-in on .52 and .07/.67.

BURLINGTON VT
AUG 9-10

The Burlington Amateur Radio Club will hold its annual International Hamfest on August 9-10, 1980, at the Old Lantern Campground, 14 miles south of Burlington VT. Admission is $4.00. Planned events include a flea market, commercial exhibitors, interesting and useful door prizes, and the traditional Can-Am tug-of-war. Talk-in on .34/.94. For more information, contact Hap Preston W1VSA, PO Box 312, Burlington VT 05402.

CEDARTOWN GA
AUG 10

The Cedar Valley Amateur Radio Club will hold its annual Cedar Valley Hamfest on August 10, 1980, from 8:00 am to 4:00 pm at the Polk County Fairgrounds, on US 278, two miles east of Cedartown GA. There will be food, drinks, and prizes. Talk-in on 147.72/.12 (WR4AZU). For more information, contact Jim T. Schliestett W4IMQ, Secretary, Cedar Valley ARC, PO Box 93, Cedartown GA 30125, or phone (404)-748-5968.

CONCORD NC
AUG 10

The Cabarrus Amateur Radio Society will hold its second annual hamfest on Sunday, August 10, 1980, at the Boys Club on Spring Street, Concord NC. Admission is $2.00, with children under 12 admitted free. There will be a covered flea market area, dealer displays and sales, door prizes, and YL activities. Flea market tables are $3.00 each, with setup time at 0700 EST Sunday morning. There will be hot coffee, hot dogs, homemade cakes, and ample parking. Major prizes include a TS-520SE and a TS-7600.

You do not have to be present to win 1st or 2nd prizes. Talk-in on 146.52 and 146.055/146.655 (club repeater K4CEB/R). For more details, contact Jim Austin, PO Box 1290, Concord NC 28025.

ST. CLOUD MN
AUG 10

The St. Cloud Radio Club will hold its annual hamfest on August 10, 1980, at the Whitney Park Senior Center from 9:00 am until 5:00 pm. There will be free overnight camping available one mile from the site at the Sauk Rapids Lions Park. Food will be available and Uncle Tom's (W0CF) chili will be featured. There will be a swapfest and prizes. For more information, write William (Bill) R. Zins WA0OTO, RR 4, St. Cloud MN 56301 or phone (612)-253-3428.

LEXINGTON KY
AUG 10

The Bluegrass Amateur Radio Society will hold its annual ARRL Central Kentucky Bluegrass Hamfest on August 10, 1980, starting at 8:00 am at the Fasig-Tipton Sales Paddock, Newton Pike, Lexington KY. Admission is $3.00 in advance and $3.50 at the gate. This fee includes parking. There will be grand prizes, hourly door prizes, indoor exhibits and distributors, a paved outside flea market, and food service will be available. Talk-in on 146.16/.76. For details, write Bluegrass Hamfest, Attention: Edward Bono WA4ONE, 2077 Dogwood Drive, Lexington KY 40504.

NEW KNOXVILLE OH
AUG 10-16

The Way International will hold its annual Rock of Ages Festival on August 10-16, 1980, in New Knoxville OH. K8MP/8 will operate from this Christian music festival on 3.930, 7.230, 14.330, and 146.52. Commemorative "ROA 1980" QSLs will be sent to those stations worked.

WILLOW SPRINGS IL
AUG 10

The Hamfesters Amateur Radio Club will hold its 46th annual hamfest on Sunday, August 10th, 1980, at Santa Fe Park, 91st and Willow Springs Road, Willow Springs IL (near Chicago). Gates will open at 6:00 am. Tickets at the gate are $3.00 each or $2.00 each in advance. There will be free coffee for the early birds, games for the kids, prizes for the YLs, and the world-famous shoppers' row. Children under fifteen are free. For more information and advance tickets, send an SASE and a check to Hamfesters Amateur Radio Club, PO Box 42792, Chicago IL 60642.

OAKLAND NJ
AUG 16

The Ramapo Mountain Amateur Radio Club will hold its annual flea market on Saturday, August 16, 1980, at the American Legion Hall, Oak Street, Oakland NJ. Indoor tables are $5.00 and tailgating is $3.00. There is no admission fee for buyers. Refreshments will be available on the premises. Talk-in on 147.49/146.49 WR2AHD or 146.52 simplex. For advance reservations and information, call Bud Hauser WA2JUO at (201)-797-8471 or (201)-791-0589.

FARMINGTON ME
AUG 16-17

The Sandy River Amateur Radio Club will hold a hamfest/flea market on Saturday and Sunday, August 16-17, 1980, at the Farmington Fairgrounds, Farmington ME. Admission is $1.00, with no charge for tailgating. Commercial dealers are welcome. Door prizes will be awarded both days and on Sunday there will be a raffle at 1:00 pm. Features include free camping from 5:00 pm Friday until Sunday afternoon and refreshments and snacks both days (with a lobster or chicken dinner served late Saturday afternoon). Talk-in on 146.37/.97 and 146.52. For more information and a map, send an SASE to Charles Stenger W1HTG, Box 111, East Dixfield ME 04227.

FT BRAGG NC
AUG 16-17

The Cape Fear Amateur Radio Society's 4th annual hamfest will be held on August 16-17, 1980, at the Main Officers' Club, Ft. Bragg NC. Tickets are $1.00 in advance and $2.00 at the door. There will be 9,000 square feet of air conditioned space available. Prizes will include a TS-120S, a triband beam, a handie-talkie, and a rotor. There will be a Saturday night social and a QCWA luncheon meeting on Sunday. Talk-in on 146.31/.91, 147.93/.33, and 146.52. Send an SASE to Marie Presler WA4YMM, PO Box 35171, Fayetteville NC 28303, for tickets.

NORTH HAVEN CT
AUG 16-17

The South Central Connecticut Amateur Radio Association will hold its Super Scarafest '80 on August 16-17, 1980, at the Ramada Inn, at Exit 12 of I-91, North Haven CT 06473. Booths will be available. Features will include a ham and computer flea market, an auction, special events for non-ham spouses and children, and drawings for prizes throughout the show. Prizes will include a solid-state low-band transceiver, a synthesized two-meter HT, a microcomputer, and a 600-MHz frequency counter. Admission will be $4.00, pre-registration before July 1, and $5.00 at the door for both days. Talk-in on 146.01/146.61. For further information, write Super Scarafest '80, PO Box 5265, Hamden CT 06518, or call Jeff Wayne K1YLV at (203)-281-6038 between 9:00 am and 9:00 pm EST.

BEAR DE
AUG 17

The Fifth Annual New Delmarva Hamfest will be held on Sunday, August 17, 1980, at Gloryland Park, Bear DE. Admission will be $2.00 in advance and $2.50 at the gate. Tailgating will be $2.50 and tables under the pavilion, $4.00. Prizes, food and drinks will be available. Talk-in on .52 and .13/.73. For more information, send an SASE to Stephen Momot K3HBP, 14 Balsam Road, Wilmington DE 19804. Make checks payable to Delmarva Hamfest, Inc.

HUNTSVILLE AL
AUG 17

The North Alabama Hamfest will be held on Sunday, August 17, 1980, at the Von Braun Civic Center in Huntsville AL. Admission is free. There will be prizes, exhibits, forums, an air-conditioned indoor flea market, and ladies' activities. Tours of the Alabama Space and Rocket Center are available for the family. A hamfest supper will be held on Saturday night. A limited number of camping sites with hookups are available at the VBCC on a first-come-first-served basis. Flea market tables are available for $3.00. Talk-in on 3.965 and .34/.94. For more information, write NAHA, PO Box 423, Huntsville AL 35804.

LAFAYETTE IN
AUG 17

The Tippecanoe Amateur Radio Association, Inc., will hold its 10th annual Lafayette, Indiana, Hamfest on Sunday, August 17, 1980, rain or shine, at the Tippecanoe County Fairgrounds, 18th Street at Teal Road (Indiana Highway 25), Lafayette IN. There is no extra charge for flea-market setups and they can be made any time after 1800 hours on Saturday. Advance tickets are available by mail at $2.50 per ticket. Send payment and an SASE by the 10th of August to J. B. Van Sickle K9KRE, RR1, Box 63, West Point IN 47992. Tickets are also available at the gate. Pre-registration and grand prizes will be ICOM IC-2A synthesized 2m hand-helds with tone pads and chargers. Many other prizes will be awarded throughout the day. There will be forums, on-the-grounds parking, and food and drinks available at reasonable prices, as well as overnight camping on the grounds Saturday night. Talk-in on 146.13/.73 and 146.94. The call-in station is W9REG.

MONTGOMERYVILLE PA
AUG 17

The Mid-Atlantic Amateur Radio Club will hold its annual J.B.M. Hamfest on Sunday, August 17, 1980, from 9:00 am to 4:00 pm, rain or shine, at the Route 309 Drive-in Theatre, ¼ mile north of Rte. 63, Montgomeryville PA (6 miles north of the Fort Washington interchange of the Pennsylvania Turnpike). Admission is $2.50 with $1.00 additional for the first tailgate space and 75¢ for each additional tailgate space. Tailgate setup begins at 8:00 am. Features will include refreshments, raffles, door prizes, and a sanctioned transmitter hunt by the Freedom Foxhunters Association. Talk-in on 147.66/.06 (WB3JOE) or 146.52. For further information, call Don Schuenemann WB3AYT at (215)-822-9076, or write the Mid-Atlantic Radio Club (MARC), Box 14429, Philadelphia PA 19115.

REND LAKE IL
AUG 17

The Shawnee Amateur Radio

Association Hamfest will be held on August 17, 1980, at the North Marcum access area on Rend Lake in southern Illinois. Complete recreational facilities, including beach and campsites, will be available. Talk-in on 146.25/.85, 146.52, and 3.925.

WARREN OH
AUG 17

The Warren Amateur Radio Association will hold its 23rd hamfest on August 17, 1980, at Trumbull Branch, Kent State University. There will be five acres of flea market, tech forums, DX programs, inside dealer displays, and XYL activities. For further information, QSL to WARA, PO Box 809, Warren OH 44482.

TACOMA WA
AUG 23-24

The Radio Club of Tacoma (W7DK) will hold its annual Hamfair on August 23–24, 1980, at the campus of Pacific Lutheran University, 122nd and Park Avenue. Registration is $4.00 and the banquet is $6.00. Events include a flea market, door prizes, commercial displays, a banquet, a loggers' breakfast, seminars, and much more. Talk-in on .88/.28. For additional information, contact Joe Winter WA7RWK, 819 No. Mullen, Tacoma WA 98406 or phone (206)-759-9857.

BLUEFIELD WV
AUG 24

The East River Amateur Radio Club, Inc., will sponsor Bluefield Hamfest '80 on Sunday, August 24, 1980, from 9:00 am to 4:00 pm, at the Bluefield Armory-Civic Center, one mile north of Bluefield WV on US 52. Admission, which includes a prize ticket, is $2.00 in advance and $3.00 at the gate. Children under 12 will be admitted free. Prizes include a Ten-Tec Argonaut 80-10m QRP transceiver, an 80-10m trap vertical antenna, a Cushcraft 11-element 2m beam, and more. Tables are $5.00, or $4.00 each for 3 or more, and tailgaters are $2.00. There will be something for the entire family. Food, dealers, a flea market, forums, demonstrations, and entertainment will be available. Talk-in on .89/.49 and .52/.52. For more information, send an SASE to Bluefield Hamfest '80, 2113 Hemlock Hill, Bluefield WV 24701.

LA PORTE IN
AUG 24

The annual LaPorte County Hamfest will be held, rain or shine, on Sunday, August 24, 1980, at the County Fairgrounds on Highway 2, west of LaPorte IN (50 miles SE of Chicago). There will be an outdoor paved flea market area, indoor tables at $1.00 each, and overnight trailer hookups available on site for early birds. Advance tickets are $2.00. For reservation or information, send an SASE to PO Box 30, LaPorte IN 46350.

MARYSVILLE OH
AUG 24

The Union County Amateur Radio Club will hold its fourth annual Hamfest-80 on Sunday, August 24, 1980, at the fairgrounds in Marysville OH. There will be a free gate until 10:00 pm Saturday; then admission is $2.00 each or $1.50 in advance. Features will include free overnight camping, free movies Saturday night, breakfast served all night until 10:00 am Sunday, many prizes, including a Kenwood TR-2400, a flea market, ARRL forums, and MARS and FM meetings. For more information or advance tickets, write UCARC, 13613 US 36, Marysville OH 43040, or phone (513)-644-0468.

ST. CHARLES IL
AUG 24

The Fox River Radio League will hold its annual hamfest on Sunday, August 24, 1980, from 8:00 am to 4:00 pm at the Kane County Fairgrounds, St. Charles IL. There will be a free outside flea market and a large inside display area. Table discounts are available for prepaid registration. Contact Gary Senesac KA9ADP, 926 Britta Lane, Batavia IL 60510, for details. Refreshments and a hot lunch will be available. Talk-in on 146.94. Tickets are $1.50 in advance and $2.00 at the gate. Contact Jerry Frieders W9ZGP, 1501 Molitor Road, Aurora IL 60505.

SEWELL NJ
AUG 24

The Gloucester County ARC will hold its second annual hamfest on Sunday, August 24, 1980, from 8:00 am to 3:00 pm at Gloucester County College, Tanyard Road, Sewell NJ. Tickets are $2.00 in advance, $2.50 at the door, and dealers' and tailgaters' admission is $5.00. Tailgaters can set up at 7:00 am and indoor and outdoor spaces will be available. There will be food and prizes. Talk-in on .52 and .78/.18. For information and tickets, contact Bob Grimmer KN2QWO, 229 William Avenue, Barrington NJ 08007.

WATERLOO IA
AUG 24

The Iowa 75 Meter Net will hold its annual swap meet and picnic on Sunday, August 24, 1980, at Hickory Hills Park, south of Waterloo IA. A potluck meal will start at noon and a program will follow (with prizes). For further information, contact Loveile J. Pedersen WBØJFF, Net Secretary, 2327 W. Reinbeck Rd., Hudson IA 50643.

WENTZVILLE MO
AUG 24

The Saint Charles Amateur Radio Club will hold Hamfest '80 on August 24, 1980, at the Wentzville Community Center, Wentzville MO. Featured will be a flea market with free space, prizes, equipment displays, grab bags, a cake walk, free bingo, and refreshments. Free doughnuts and coffee will be available to the early birds. Talk-in on .07/.67 and .34/.94. For information on motels, tickets, displays, prize lists, camping, etc., contact Jim Short AGØU, Rt. 1, Box 40, O'Fallon MO 63366.

MT PLEASANT IA
AUG 28-SEP 1

The Mt. Pleasant, Iowa, Amateur Radio Club invites hams attending the Midwest Old Threshers Reunion in Mt. Pleasant from August 28-September 1, 1980, to stop by and register in the guest book at the ham shack. Last year nearly a quarter of a million people attended this show of antique steam engines and first-rate entertainment, and 150 hams visited the ham shack. The club provides communications for crowd control with talk-in on the 147.99/.39 Mt. Pleasant repeater and 146.52 simplex. A station will also be operating on 3970 kHz with the call WØMME. There is a special QSL card to commemorate the event. For more information, write Dave Schneider WDØENR, 507 Vine, Mt. Pleasant IA 52641.

SYDNEY NS
AUG 29-SEP 1

The Sydney Amateur Radio Club will host the 1980 Maritime Convention, Ham Ceilidh 80, on Labor Day weekend, August 29 – September 1, 1980, at the Isle Royale Hotel, Sydney, Cape Breton Island, Nova Scotia, Canada. There will be plenty of free parking and shopping for the ladies. The program will include many items of interest and will cater to amateurs along with their XYLs. Friday evening, August 29, will be a special event with registration and a ham get-together. For more information, contact the Sydney Amateur Radio Club, Box 1051, Sydney, Cape Breton, Nova Scotia CAN B1P 6J7.

GEORGETOWN IL
AUG 30-31

The Illiana Repeater System, Inc., amateur radio club will hold its 11th annual Danville, Illinois, Hamfest, Saturday and Sunday, August 30-31, 1980, at the Georgetown, Illinois, Fairgrounds. Advance gate donations are $1.50 per adult; $2.00 at the gate, with children 14 years and younger free. Activities will include two days of flea markets, commercial exhibitors, RTTY setups, an Antique Wireless Association display, a home-brew builders contest, a USAF MARS station, and other interests. Meals and refreshments will be served both days and overnight camping facilities are available. For more information or advance tickets, send an SASE to Illiana Repeater System, Inc., PO Box G, Catlin IL 61817.

MARSHALL MI
AUG 31

On Sunday, August 31, 1980, from 8:00 am to 5:00 pm, "Historic Marshall's" 72/12 E. S. Team will hold its Trunk 'n Trailer Bash on the whole block of 615 S. Marshall Avenue, Marshall MI (1830 site of Michigan's capitol and governor's mansion). The donation is $2.00, spaces are $5.00, and inside space is 50 cents a foot. There will be free parking and a huge consignment area for the mini-swapper. For further information, send an SASE to K8UCQ, 110 Perrett, Marshall MI 49068.

NASHVILLE TN
AUG 31

The 31/91 Short Mountain Repeater Club will sponsor the annual Cedars of Lebanon Hamfest and Family Picnic on the last Sunday in August. Prizes, swimming, horseback riding,

and other sports will be available. Everyone is welcome. For more information, contact John Fite W4PFP, Watertown TN; phone: (615)-237-3621.

PECATONICA IL
AUG 31

The third annual Rockford Hamfest and Illinois State ARRL Convention will be held at the grand exhibition hall at the Winnebago County Fairgrounds at Pecatonica, just west of Rockford on US Route 20. Tickets are $2.00 in advance or $2.50 at the gate and are available from any RARA member. They may also be obtained by mail by writing to RARA, PO Box 1744, Rockford IL 61110 and including a business-size SASE. Food and campsites (with electric and sanitary hookups) will be available, as well as plenty of free parking. For flea market dealers, there will be 300 tables available at a nominal charge. There will be speakers and forums, demonstrations and discussions, and prizes. Talk-in on 146.01/.61 Rockford repeater, or 146.52.

PENSACOLA FL
AUG 31

The Five Flags Amateur Radio Association, Inc., will hold its 1980 Ham-A-Rama on August 31, 1980, from 8:00 am to 4:00 pm at the Pensacola Municipal Auditorium, Pensacola FL. Admission will be $1.00 and swap tables will be available for $5.00 each. Additional information can be obtained by writing to the FFARA, PO Box 17343, Pensacola FL 32522.

AUGUSTA NJ
SEP 6

The Sussex County Amateur Radio Club will hold its second annual hamfest on Saturday, September 6, 1980, at the Sussex County Farm and Horse Show grounds, Plains Road off Route 206, Augusta NJ. Admission for sellers at the outside flea market is $5.00 at the door and $4.00 in advance. Admission for indoor sellers is $6.00 at the door and $5.00 in advance. Admission for buyers is free and a door prize ticket is $1.00. Talk-in on 147.90/.30 and 146.52. For pre-registration and information, write Sussex County Amateur Radio Club, PO Box 11, Newton NJ 07860, or call Ed Woznicki AC2A at (201)-852-3268.

GRAYSLAKE IL
SEP 6-7

The Chicago FM Club will hold Radio Expo '80 on September 6-7, 1980, at the Lake County Fairgrounds, Rtes. 45 and 120, Grayslake IL from 9:00 am to 4:00 pm both days. The flea market is open from 6:00 am to 6:00 pm. Tickets, good for both days, are $2.00 each before September 1st and $3.00 at the gate. Indoor flea market space is free with an admission ticket on a first-come basis. Bring your own table and chair. Outside are many acres of available space. Features will include commercial exhibitors in ham radio and computers, ladies' programs, hourly door prizes with a super drawing at 3:00 pm on Sunday with prizes worth thousands of dollars. Food, nearby hotels, free parking, and camping with some hookups will be available. Talk-in on 146.16/.76 or 222.50/224.10 WA9ORC. For advanced tickets, send an SASE to Radio Expo Ticket, PO Box 1532, Evanston IL 60204. For more information, call (312)-BST-EXPO.

MELBOURNE FL
SEP 6-7

The Platinum Coast Amateur Radio Society will hold its 15th annual hamfest and indoor swap-and-shop flea market on September 6-7, 1980, at the Melbourne Civic Auditorium. Admission is $3.00 in advance and $4.00 at the door. Swap tables are $5.00 per day. There will be food and plenty of free parking available, as well as awards, forums, and meetings. Talk-in on .25/.85 and .52/.52. For reservations, tables, and information, write PCARS, PO Box 1004, Melbourne FL 32901.

FINDLAY OH
SEP 7

The Findlay Radio Club will hold its 38th annual Findlay Hamfest on Sunday, September 7, 1980 (*not* September 27, as previously published), at a new location, the Hancock Recreational Center, just east of I-75 exit 161, on the north edge of Findlay, 40 miles south of Toledo. Tickets are $2.00 in advance and $2.50 at the door. Reserved tables are $2.50 per half. There will be forums on Saturday evening and setup Sunday at 5:00 am. Main prizes are a TS-120S with supplies, two TR-2400s, and an AT-120 matcher. For tickets, information, and reservations, send an SASE to PO Box 587, Findlay OH 45840.

PENNSAUKEN NJ
SEP 7

The South Jersey Radio Association will hold its 32nd annual hamfest on Sunday, September 7, 1980, on the grounds of the Pennsauken Senior High School, Hylton Road (1½ miles SE on Rte. 73 from the Tacony Palmyra Bridge), Pennsauken NJ. Admission is $3.00 and tailgate or booth space is $5.00 per seller. Features wil include a flea market, prize drawings, contests, bingo for the ladies, and games for the children. Talk-in on 146.52 or 146.22/.82. For more information, contact Edwin T. Kephart W2SPV, Hamfest Chairman, 4309 Willis Avenue, Pennsauken NJ 08109.

PORT JEFFERSON NY
SEP 7

The Suffolk County Radio Club will hold its third annual Electronic Flea Market on September 7, 1980, with a rain date of September 14, 1980. The site is the Odd Fellows Hall, Jane Boulevard, Port Jefferson LI NY. Walk-ins will be $1.50 and sellers will be $3.00. Gates will open at 7:00 am. Bargains, prizes, food, and friendship will be available. Talk-in on .52, .94, and 223.50. For further information, contact Floyd Davis WA2SDI at (516)-234-9376.

SOUTH DARTMOUTH MA
SEP 7

The South Eastern Massachusetts Amateur Radio Association will hold its annual picnic and flea market on Sunday, September 7, 1980, from 9:00 am until 4:00 pm at the Stackhouse Fairgrounds, Faith Street, South Dartmouth MA. The rain date will be September 14, 1980. Sales space is $6.00 and tables for rent are $4.00. There will be free parking, entertainment, and food and beverages for sale. Talk-in on 147.60/147.00 or CB channel 11. For information, write SEMARA, PO Box P-105, South Dartmouth MA 02748, or phone (617)-997-3674 or (617)-994-4838.

HAMBURG NY
SEP 12-13

The 9th annual Ham-O-Rama '80 hamfest will be held on September 12-13, 1980, at the Erie County Fairgrounds. Advance tickets are $3.00. There will be exhibits, tech programs, prizes, flea markets, plenty of free parking, and free RV hookups. For more information and tickets, contact Ron Brodowski KC2P, 260 Hilltop Drive, Elma NY 14059, or phone (716)-652-6754.

VALPARAISO IN
SEP 14

The Porter County Amateur Radio Club, Inc., will hold its annual hamfest on September 14, 1980, at the Porter County Fairgrounds, Valparaiso IN. Featured will be a flea market, technical sessions, door prizes, and bingo. Food will be available. Advance tickets are $1.50 and tickets at the gate are $2.00. There will be dealers and commercial exhibitors, as well as free indoor and outdoor space. Gates will open at 6:00 am. Talk-in on 147.96/.36 and 146.52. For tickets and information, write Charles Baker W9SJN, PO Box 251, Portage IN 46368.

WHITESTONE NY
SEP 18

The Tu-Boro ARC will hold its annual auction on September 18, 1980, at the Odd Fellows Hall, 149-14 14th Avenue, Whitestone NY. Doors will open at 6:00 pm for sellers and at 7:00 pm for buyers. Donation is $1.00 per person. Beer and soda will be available. Talk-in on 146.52. For information, call Walt WB2PFO at (212)-539-5732 nights, and Ed WB2IBQ at (212)-746-4082.

TYSONS CORNER VA
SEP 27-28

The National Capitol DX Association will sponsor DXPO 80 on Saturday and Sunday, September 27-28, 1980, at the Ramada Inn, junction of Rte. 7 and I-495, Tysons Corner VA. Saturday's half-day session will include Phase I of the DXPO Program, an Attitude Adjustment Party, and a banquet with prizes and surprises. Sunday's session will feature Phase II of the DXPO Program. Unless you have previously attended DXPO, write to Dick Vincent K3AO, Rte. 1, Box 230, Bryantown MD 20617, for more information. If you have any program suggestions, contact John Boyd W4WG, 8424 Reflection Lane, Vienna VA 22180.

Contests

from page 25

GMT, band, and emission. Logs must be received not later than September 13th. The first contact for each claimed multiplier must be indicated and numbered and a checklist of contacts and multipliers should be included. Multi-operator stations should be noted and calls of participating operators listed. Logs and comments should be sent to: Englewood Amateur Radio Assoc., Inc., Post Office Box 528, Englewood, New Jersey 07631.

A #10 size SASE should be included for results. Stations planning active participation in NJ are requested to advise the EARA by August 2nd of their intentions so that they can plan for full coverage from all counties. Portable and mobile operation is encouraged.

RHODE ISLAND QSO PARTY
1700 GMT August 16 to
0500 GMT August 17
1300 GMT August 17 to
0100 GMT August 18

Sponsored by the East Bay Amateur Wireless Association. RI stations work other RI stations and the rest of the world. Others work RI stations only. The same station may be worked once per band and mode. RI Novice and Technicians sign with /N or /T to designate license class.

EXCHANGE:

Send RS(T) and state, province, country, or RI county. Members of East Bay AWA will also identify themselves with "MEMBER."

FREQUENCIES:

Phone—3900, 7260, 14300, 21360, 28600, 50.110, 144.2.

CW—1810, 3550, 3710, 7050, 7110, 14050, 21050, 21110, 28050, 28110.

Use of FM simplex is encouraged, but no repeaters are allowed.

SCORING:

RI stations score 2 points per QSO, RI Novice and Technician stations score 5 points per QSO. Multiply total QSO points by the number of RI counties, states, provinces, and DX countries worked.

Others score 2 points per RI QSO and 5 points per QSO with RI Novice or Technician. Multiply total QSO points by the number of RI counties worked (5 maximum: Bristol, Kent, Newport, Providence, and Washington).

All stations score an additional 5 points for each QSO with a member of the East Bay AWA.

AWARDS:

Certificates will be awarded to the top-scoring station in each RI county, state, province, and DX country; the top-scoring Novice and Technician station in each RI county and state; and the ARC in each state, province, and DX country that submits the highest aggregate score with a minimum of 3 logs per club.

ENTRIES:

Logs must show date/time in GMT, call exchange, band, and mode. On a separate sheet show name, call, mailing address, club affiliation (if any), total QSO points, multiplier claimed, and final score. Entries must be postmarked no later than September 15th. Send logs and summary to: East Bay Amateur Wireless Assoc., PO Box 392, Warren RI 02885. Include an SASE for a copy of the results.

ALL ASIAN CW CONTEST
Starts: 0000 GMT August 23
Ends: 2400 GMT August 24

The purpose of this contest is to enhance the activity of radio amateurs in Asia and to establish as many contacts as possible during the contest periods between Asian and non-Asian stations. Please note the contest periods have been extended, scoring methods have been changed, and awards have been added for US stations.

Entry classifications include single-operator/single-band (160-10 meters), single-operator/multi-band, and multi-operator/multi-band. For single-operator classes, never transmit two signals or more at the same time. Only one signal at all times should be used. For multi-operator entries, never transmit two signals or more on each band at the same time. Only one signal per band should be used. In all classes, no crossband contacts are allowed.

EXCHANGE:

OM stations send RS(T) plus two numbers representing operator's age. YLs send RS(T) plus "00."

SCORING:

Non-Asian stations score 3 points per Asian QSO on 160 meters, 2 points on 80 meters, and 1 point on all other bands. The multiplier is the number of different Asian prefixes worked on each band, according to the WPX rules. Please note that JD1 stations on Ogasawara (Bonin and Volcano) Islands belong to Asia. JD1 stations on Minami Torishima (Marcus) Island belong to Oceania. Do not count US military radio stations in the Far East (KA) as being in Asia.

Asian stations use same contact scoring, but for contacts with non-Asian stations. The multiplier is the number of different countries worked on each band according to the DXCC countries list.

The sum of the contact points on each band times the sum of the multipliers on each band will give the final score.

ENTRIES & AWARDS:

Contest rules recommend using a summary and log sheet format similar to those shown on page 21 of the June, 1980, *73*. Please use separate sheets for each band and keep all times in GMT. Show each multiplier only the first time on each band. Both logs and summary sheets must arrive in JARL, PO Box 377, Tokyo, Japan, on or before November 30th. Entries can be disqualified for violation of the contest rules, false statements in the report, or taking points from duplicate contacts on the same band in excess of 2% of the total.

Certificates will be awarded to those having the highest score in each entry in proportion to the number of participants from each country and also those from each call area in the United States. Only highest score if 10 or less entries, second place if 11 to 20 entries, third place if 21 to 30 entries, fourth and fifth places if 31 or more entries. In addition, the highest score in each continent of the single-operator/multiband and multi-operator/multiband entries will receive a medal and certificate from the Minister of Posts and Telecommunications of Japan.

WORKED ALL BRITAIN CONTEST—VHF
Starts: 0900 GMT August 31
Ends: 2100 GMT August 31

This is the last of the five Worked All Britain contests for this year.

All contacts must be made on the VHF bands above 30 MHz. Operating classes include: single- or multi-operator, single- or multi-band, and SWL. In the case of multi-operator, only one transmitter may be used at any time. There is a special section for mobile operators.

EXCHANGE:

RST, QSO number from 001, WAB area and county. Book numbers and districts may be requested but are not mandatory as part of the exchange.

SCORING:

Score 5 points for each completed QSO. Stations may be worked on other bands for extra points.

Multipliers for UK contestants are each WAB area and each overseas country (DXCC list). In addition, Alderney, Guernsey, Jersey, and Sark count as separate countries. The remainder of G, GD, GI, GM, and GW count as one multiplier only.

Multipliers for overseas contestants are each WAB area, county, and each G prefix (G, GD, GI, GM, and GW). Multipliers count on each band, i.e., a station worked on three bands = 3 multipliers.

For mobile entries, every contact made from a different area will count five points, but the multiplier counts once only (e.g., mobile station X from ten different areas—score is 10 times 5 points, but only one multiplier for the mobile station).

AWARDS:

Certificates for the leading contestant in each class or entry. For awards, each G prefix is separate. There will also be certificates issued to the leading contestants from each DXCC country and also to SWLs. Certificates for 2nd and 3rd will be issued if there are 10 or 25 entries from a particular country or call area.

ENTRIES:

Logs must show the TITLE of the contest, name and full postal address of contestant, QSO details, total points claimed, multipliers claimed, and the full details of all operators when multi-operator entry is submitted. Logs must be sent to the contest manager: R. L. Senter G4BFY, 27 Station Road, Thurnby, Leicester LE7 9PW, England.

Entries must be postmarked

not later than one calendar month following the date of the contest and must be received by the contest manager not later than 40 days following the said contest. A signed declaration that the station was operated in accordance with the current licensing conditions must accompany all entries. It is a condition of entry that the decision of the WAB Contest Manager and the WAB Committee shall be absolute in the case of dispute. For SWLs, all stations logged must be participating in the contest and giving serial numbers which must be logged. The results will be reported to the RSGB and the Contest Manager will supply a detailed result sheet on receipt of an SAE on or after November 1st.

KA8COI

Amateur station KA8COI will be operating as a special event station this Labor Day, September 1, 1980, during the course of the annual Muscular Dystrophy Telethon hosted by Jerry Lewis. The time will be from 0330 to 2230 GMT and the frequency will be 7.230 MHz SSB. A numbered certificate will be available to all stations making contact with KA8COI during this period. There will be no charge or fee for the certificate. Stations are requested to send an SASE with their QSL and mention their QSO number (which will be given them on the air). No third-party traffic will be handled on the behalf of the Muscular Dystrophy Association and no solicitations for donations will be made over the air. Anyone wishing to donate to the MDA is urged to do so through their local telethon station. The MDA is a non-profit charity; donations would be tax-deductible.

The Muscular Dystrophy Association has been contacted about this operation and has issued their formal approval. The certificate will bear the signature of Jerry Lewis, National Chairman for the MDA. Send QSL information, QSO number, and SASE to: KA8COI—MDA Certificate, PO Box 332, South Webster OH 45682.

DX

from page 16

ly CW by Eric, as neither of these countries is particularly rare if one works all modes. QSLs for all SM0AGD operations to SM3CXS.

N6DX, N2KK, and JA1BK finished their Pacific Islands operating in May at A35DX, Tonga, canceling the planned last stop at Wallis Island. Reports would indicate that much if not most of the operating by this group was on 6 meters.

Jurgen Carow DF3OL and nine other German hams spent two weeks in Sri Lanka teaching radio. Jurgen made 575 CW contacts while he was there using 4S7OL. QSL to W0JRN, *Callbook* address.

More Germans, this time members of the Wiesbaden Amateur Radio Club, vacationed in Leichtenstein and operated DA1WA/HB0. North Americans send cards to Steven Hutchins, Box 4573, APO NY 09109. You may have seen the special on Leichtenstein on CBS's "60 Minutes" recently; much of their economy is postage stamps sold to collectors around the world. Unfortunately, the millions they had printed for the Olympics were destroyed in May.

K6LPL/KH3
APRIL, 1980

The trip to Johnston Island was initially planned in February, 1980, when it became obvious that activity from KH3, especially on single sideband, was very low. There was great difficulty in securing permission to land on the island due to long-standing military policy, but with the help of Joe Merdler N6AHU and Congressman James Corman, the military was persuaded that I was not a "dangerous, radical type."

Once permission was secured from the Defense Nuclear Agency, they became extremely cooperative and anxious to ensure the success of the trip.

I arrived by Air Micronesia on April 21, 1980, at 1100 local time (2100Z). After 30 minutes of indoctrination in the use of gas masks, I was shown the MARS station. The layout was quite nice, but the equipment was badly in need of alignment and maintenance.

I brought a Kenwood TS-520SE, 2 GLA 1000 amplifiers, OSCAR equipment, a complete Microlog RTTY station, and various peripheral equipment for the use of the resident General class operator, KH3AA, and this equipment is to be left on the island for any future hams that may be stationed there. This equipment was donated by the Southern California DX Club and the Southern California DX Foundation.

There was an excellent antenna system already in place on the island, including 2 TA 36 beams at 60 ft., an 80-meter dipole at 70 ft., and a 2-element 40-meter beam at 65 ft., so no further antennas were needed.

After station set-up, the first CQ was called and the pileup was horrendous. Over 2,000 contacts were made in the first 18 hours. The pileups were orderly and well-behaved. Initially, I worked split on 10 and 15 meters, but as the first initial rush calmed down, it became obvious that working transceive by call districts resulted in a 20% higher QSO rate. This was made possible only by the excellent signal and good propagation conditions, and I would not recommend it under ordinary circumstances. The highest QSO rate was an unsustainable 5.8 per minute for stateside stations. The rate for JAs was approximately four per minute, and Europe was quite variable. The European hams were quite unruly and never seemed to follow instructions, even though they were repeated in six languages. The only general exceptions to this rule were the Scandinavian and Soviet stations who seemed to follow instructions fairly well. The number of QSOs continued at approximately 2,000 per day until the last 36 hours, when conditions deteriorated to the States, but the JAs picked up the slack. They are a pleasure to work with once you get used to their strange phonetics.

By the last day, I needed only Zone 26 for WAZ, and I got that with the help of W6PJX and W7PHO when I worked HS5AID.

I should say a word about propagation from this location. There were two excellent openings to Europe per day on both 10 and 15 meters. The initial 10-meter opening was in the early morning hours local time, and a secondary opening occurred at approximately 0700Z. The 15-meter openings were slightly later, beginning at about 1700Z and again at 0900Z. Signals were extremely loud to Europe on both bands on most occasions. On 20 meters, there was a morning opening to Northern Europe that was excellent, and an evening opening at approximately 0500 that was also good; however, the QRM was extensive. Excellent openings to A51, JT1, Southern Africa, the Indian Ocean, South America, etc., occurred at these times as well. During the evening opening at 0700Z, both long and short path to Europe were possible on 20 meters. 15 meters was the most reliable band by far, and approximately 60% of the QSOs were made on that band.

40-meter and 80-meter propagation was impeded by a tremendous amount of static crashes; however, 41 states were worked on 40 meters including all of the W1s, 2s, 3s, and 4s. The 80-meter opening was also good and the W1s were worked with no difficulty. No foreign stations other than JAs, VKs, ZLs, etc., were worked on 40 and 80 meters. There seemed to be persistent openings to JA, VK, ZS, etc., at all hours of the day and night.

All in all, it was a wonderful trip with 125 countries, Worked All Zones, and 12,180 QSOs.

Stand by for the next big one! — K6LPL.

Call	Via	W5TIY/TI2	N5IO
AH8A	WB6FBN	TI2AV	W2MIG
AP5HQ	NØRR	TI9CC	TI2CF
A22GD	SM3CXS	TL8JM	W5RU
A35JL	K9AUB	TL8WH	W5RU
A35PF	K9LSA	TN8AJ	WB9TTM
A4XIH	G4BWP	TU2DP	N4BZV
A4XGY	K2RU	TU2GA	K9KXA
A7XO	K4PHY	TU2HS	DJ9HD
A7XE	DK3GI	TU2IF	HB9APF
A7XM	DJ9ZB	TU2IN	K3HBP
CI3LSS	VE3LSS	TZ4AQS	ON6BC
CK8MB	KØBJ	T3LA	W7OK
CN8CW	WA3HUP	U2Q	UK2GCF
CR9AK	VS6AG	VK9NM	DJ5CO
CT2QN	W2KF	VK9NV	Box 27, Norfolk
CX5RV	G5RV	VK9RV	Box 97, Norfolk
WB8CSH/C6A	K8CW	VKBKH	VK5WV
DU1POP	JA3UB	VP1HE	DL1JW
KP4KK/DU2	WA3HUP	VP2AZG	WB4SXX
EA6GB	WB1DQC	VP2KAH	YASME
EC9AA	EA1QF	VP2KAJ	WB8LDH
EP2TY	JR3WRG	VP2MDG	W6FDG
FGØAYS/FS	W2KN	VP2MFC	K1ZZ
FHØFLP	DK9KD	VP2MFJ	K1RIF
FH9FLR	DK9KD	VP2MOC	W2KF
FK8AU	IØPQR	VP2SK	W8PSD
FK8CR	W7OK	VP2VEZ	W5HF
FK8DD	WB3JUK	VP2VFT	K1IJU
FK8DJ	JH3XCU	VP2VGB	K7SE
FK8PQ	IØPO	VP2VGF	WA1GXE
FKØBW	DJ5CQ	VP8WA	WA4JQS
FMØFJE	F5VU	VQ9DM	K1BZ
FO8DP	N7RO	VQ9TT	KB5MZ
FP8AQ	N2AMK	VQ9WE	WA6IJZ
FR9ACB	DK9KD	VR1PE	WB6UBX
FRØACC	DK9KD	VS5KV	N2OO
FRØFLO	F6CVI	VS5OO	N2OO
HH2VP	N4XR	VU2LQA	W2YTO
HI6XOL	YASME	XT2AU	WA1ZEZ
HI8IARU	HI8LC	XT2AW	KN1DPS
HKØBKX	WB4OFH	YA1OS	SMØDJZ
HL9KE	K4WSB	YB9ADA	W5SVN
HL9TO	WB8GYS	YB9ACL	W4QQ
HL9UG	N4CPR	YB9PG	WA2DWE
HS1AMT	W2TK	YC1BZ	JA9YJA
HS4AMI	VE3DPB	ZK1BD	ZL1SZ
HV3SJ	IØDUD	ZK1CD	AD1S
HW3ITU	F6BFH	ZK2DD	VE3FRA
HZ1AB	K8PYD	ZK2DX	JA1BK
H5AA	ZS4MG	ZM7AA	4Z4TT
JW7FD	LA5NM	ZP5GLS	W3HNK
JY3ZH	DJ9ZB	3B6CD	3B8CF
J28CB	I8JN	3B9DX	3B8DX
J3AE	K1EM	3D2DB	JA1BK
J6LGK	WB4SXX	SM9AGD/3D6	SM3CXS
J6LGL	WB4SXX	4S7DX	WB2VFT
J6LKY	N6NK	4S7OL	W9JRN
KA6WW	AJ8M	5B4EZ	OE1EPW
N4ADJ/KH2	WB4CCT	DF5FM/5NØ	DF3FN
WA4BVB/KH2	WA4GLE	5N8DOG	W4FRU
K6LPL/KH3	K8LPL	5U7BE	DK2OC
K6LPL/KH5	K6LPL	5Z4NG	DK9KH
KC6HC	KG6JHH	5Z4OS	N1NA
KH6GKD	WB6UBX	7X5AH	AO1S
KH9AC	K7ZA	8P6NX	WØSA
KX6PP	WD4NVH	8P8OH	W2FLO
LA5YJ	WB1DOC	8Q7AR	K2TJ
OD5LX	SMØGMG	8Q7AW	DJ2BW
P29DP	W7OK	9A1ONU	M1C
P29JA	WA7OPZ	9G1AP	IØLCJ
P29NLB	WB2FLB	9H1BR	WA2MFV
DJ1US/ST3	DF2RG	9H3AK	DL1SV
SVØAA/9	N2OO	9K2DX	W6LV
SVØAT	AF4B	9K2EP	SM9DJZ
S79CP	KA2AKE	9M6MU	N2CW
S79GM	WA4JIL	9N1MM	N7EB
S79MC	N4NW	9Q5GB	W7KTI
TG9ML	K5BDX	9VITK	JA6RIL
TG9XGV	K4CLA	9VITX	N5FN

QSL Managers—Lists of QSLing information are available everywhere, and we do mean everywhere. We have tried to make this list useful in a special way by listing stations actively worked on the bands during the month of May. This is a regular part of this DX *column in* 73. *You will note some listings which are the same as they have been for years. The idea is to provide you with useful information for your recent DXing.*

Last stop in May for John Ackley KP2A was at the home of Father Marshall Moran 9N1MM, in the Himalayan mountains of Nepal. John's first morning there (evening in the US) was May 22, when band conditions *were* outstanding, if not phenomenal. He was as loud on 15 meters as the woodpecker! John's Nepal visit followed operating at 8Q7 Maldives, VS5 Brunei, HS Thailand, and preceded his final stop at CR9 Macao in early June. All sponsored in part by the International DX Foundation.

Several operations took place from Cocos Island, with a virtual flotilla of boats from Costa Rica arriving with hams nearly every weekend. TI9CF, TI9XXX, TI9FAG, TI9PN, and TI9CC were all heard. Their favorite haunt appeared to be the low end of the 20-meter phone band (14200-210) in the early evening hours.

Operations which did not take place included the YVØ Aves Island operation, originally scheduled for the *CQ* WPX Phone Contest in April, postponed once, then cancelled. It was rumored they arrived by boat at the wrong Aves Island, there being two near Venezuela. VE3FXT did *not* come on from Burma, the rumored Bajo Nuevo activity in late May did *not* happen, and *none* of the China callsigns heard on the bands were anything but bogus. A "CEØZJ" on Juan Fernandez was worked by many in April and May but is disowned by the Chilean government authorities. And ZS2MI on the bands is a figment of your (or someone's) imagination after June 10; Johann left then and his replacement on Marion Island is not a ham.

QSL cards out in quantity in May gladdened DXers' hearts: 3C1AA, 3CØAB, TZ4AQS, TN8AJ, 8Q7AL, and more. Glorioso cards are supposed to have come out in early July, as are WA2FIJ/Kingman Reef confirmations. The accompanying list of managers for May actives should help you get what *you* need. KL7IRT was notified by the post office that a bundle of QSLs headed for the ARRL outgoing bureau in Newington was lost without a trace. These were for Europeans and Japanese worked during the 1979 *CQ* WPX Phone Contest. ET3PG cards can be most easily obtained by ensuring you ask the operator for *his* full name and his PO Box

in Addis Ababa; each station operator handles his own confirmations separately.

Jim Smith P29JS reports further progress in arrangements for an operation from VKØ Heard Island late this year or early in 1981 (see letter in this column last month). Finances will be considered; the boat ride is ten days each way and Smith envisions a 14-day stay on Heard. We are encouraged by his admonition of "two contacts only per station, one phone and one CW." Now that's planning.

TN8AJ continues active from the Congo Republic when circumstances permit. One of those circumstances is the availability of electric power. Approval for sending his card for DXCC credit was finally obtained from Newington in late May. WB9TTM handles the cards *only* for when he has handled a list operation for TN8AJ; otherwise, the cards come from DM2XLO.

TL8WH, at an embassy in Bangui, Central African Republic, expects to be stationed there at least two years. He is primarily active on 20-meter SSB. W5RU is the QSL address.

VK3OT's Christmas Island VK9XT operation in March, 1980, netted 15,000 HF contacts in 150 countries, plus 1700 6-meter contacts with eleven Asian countries. Steve has answered over 5000 direct QSLs plus another 3000 via bureaus. Steve also operated VK2ATZ Lord Howe in the 1979 *CQ* WW Phone Contest for 10,000 contacts, but has been surprised to receive only about 3000 cards for that one.

Dave Gardner K6LPL received the Southern California DX Club's annual "DXer of the Year" award at the Fresno DX Convention in April. Dave became a ham-shack/household name in January as part of the K6LPL/KH5 operation from Palmyra and clinched it by making over 12,000 contacts singlehandedly from Johnston Island in April. The story in his own words accompanies this column.

Hugh Cassidy WA6AUD, publisher of the *West Coast DX Bulletin* from 1968 to 1979, was inducted into the *CQ* DX Hall of Fame in April, also at the Fresno Convention. Cass and his wife Virginia put out the bulletin every week by themselves without a miss for over 600 issues.

All of the information for this column came from *The DX Bulletin*, a weekly publication out of Vernon CT. Please send your photos and comments to the editor at the above address. Thanks to SM6AFH and K1RIF for the photos this month.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

is no way in the world for mankind to do without this important way of life.

I pointed out that it was a Frenchman who had the concept and got things started towards the European Economic Community and that the logical extension of this concept was one Europe, with a common language, common money, and a single government. This had worked out well in the United States, I mentioned, with the best parts of each culture being preserved.

With the communications and travel systems we have now, resistances toward a world melting pot concept will only slow the eventual process, not prevent it. It is just too simple for me to travel to the Netherlands, bringing my little envelope of English with me and thus chilling, to some degree, the use of the Dutch language. Our exported movies and television programs put even more of a chill on resistances to English. I sat in Delft, spending a good part of an evening watching a special program on television. They were playing a full day of American TV so the Dutch could see what it was like. I have never bothered to watch "The Ropers" at home, but in Delft I watched them and enjoyed them. Ditto a Sinatra special which went on into the early morning hours.

Next, the scene shifts to home and a segment on "60 Minutes," I think. It was recorded while I was away and had to do with the gradual change of the US to a bilingual nation. Spanish is slowly being accepted as a second language in our country. The pressure is on from the millions of Mexicans who have come to our country . . . from the Puerto Ricans, who have come here to escape the poverty of their country . . . and the hundreds of thousands of Cubans seeking to get away from Castro.

One of the things which has helped to make America strong has been the melting pot syndrome and I think we should all fight to keep that going for us. I don't know if you know this or not, but English used to be the official language in Puerto Rico. That got changed some thirty years ago as a result of a visit there by Eleanor Roosevelt . . . who put the pressure on to get it changed to Spanish . . . with obvious success. That is what I was told when I first visited that country, back in 1955. They had been having problems at that time with the Spanish speaking people getting into fights with the Americanos . . . stoning our military buses.

English is the most common language in the world and I think we should keep the pressures on to make it the world language. I think we should do this particularly at home, pushing back the tide of signs in Spanish and French which are infiltrating our society.

The common language of amateur radio worldwide is English. Indeed, thousands of people learn English through their interest in amateur radio and their contact with the almost universal English speaking community we have on our DX bands.

But if we acquiesce to the pressures to let children who are being brought up in this country stick to their non-English tongues, we will be starting to unravel the melting pot concept which made our country so strong and into such a single society. Sure, it is more difficult on children who hear nothing but Spanish at home to learn English and deal with it in their schoolwork. But we've been through that for quite a few generations as the Germans arrived in large numbers, the French, the Polish, the Irish, and so forth. The first generation was the most difficult for them, the second had very little problems, and by the third generation the melting had been completed. But suppose we had arranged for whole towns to speak German in Minnesota and other towns to speak Swedish in Wisconsin, Spanish in Texas, French in Louisiana, and so forth? Out in Pennsylvania they would be talking Dutch . . . and it would be a mess.

WHERE IS HALLICRAFTERS NOW?

A recent article in the *Miami Herald* welcomed Hallicrafters to Miami. It is just getting started there, with about 120 employees at present making products for the telephone field.

In the 1930s through 1950s, Hallicrafters was the number one firm in the world in communications receivers. Few hams did not cut their teeth on a Hallicrafters receiver during this period. Many of their WWII SX-28 receivers are still in use in the backwaters of the world.

What happened to Hallicrafters? Well, they were doing fine until the early 1960s, despite a growing number of disappointing receivers being produced. This slippage in quality had a lot to do with the design philosophies of the Halligan family, where new sets would emerge from the advertising department and then engineering would have to do the best they could to live up to the ad claims and the pictures of the dummy sets appearing in the ads. Hammarlund and several other firms began to take advantage of this weakness.

The big blow came when in 1964 amateur equipment sales dropped over 85%, responding to the ARRL petition to the FCC to take away most of the phone bands from most amateurs unless they passed a much stiffer ham exam and code test. The bottom dropped out and it was at this time that Hammarlund, National, Harvey Wells, and most of the other firms making ham equipment faded away.

Hallicrafters got a shot In the arm making military equipment

for the Korean war and turned out more for the Vietnam war, but it was gone from its old preeminence in amateur radio and shortwave. They tried other approaches, but eventually were taken over by a CB firm in Dallas. As Interest in CB died down, Hallicrafters was reduced to nothing much more than a name and the contents of a few packing crates.

One of the CB owners bought out the name and the assets, fired *everyone* still involved, and moved the works to Miami to start over. The assets were further reduced by three substantial thefts of the stuff shipped to Miami. Still, they are back in business and the name will continue.

The name flared into visibility a couple years ago when an employee of Hallicrafters wrote a letter to Baldwin complaining about the ARRL. The chap reported that the League response was to try to get him fired rather than answer the complaints. Later the chap reported that Baldwin had been successful and that he had indeed been fired as a result.

Hammarlund was a most successful producer of superb receivers for many years. The 1964 crunch hit them hard. Not long after they got caught by this sudden stop in sales, they were *selling off their* capacitors and parts. National responded to the stop in demand for receivers by putting their money in military contracts . . . and it didn't take much of a miscalculation in that field to put them into bankruptcy.

All three major firms had been weakened considerably by getting into the sideband field late. By 1957 I was trying, as the editor of one of the two ham magazines, to convince the management of these firms that sideband was going to completely replace AM. They wasted several years of valuable product development time, allowing Galaxy and Central Electronics to grow on sideband equipment. They were just really getting into sideband with strength when the 1964 blow came, not only finishing off Hallicrafters, National, and Hammarlund, but also doing in Zenith, Galaxy, Johnson, B&W, and everyone else. Only Drake, which was just getting started in the receiver field, survived the debacle. Their sales of TVI filters kept them going.

UFOS AGAIN

The lack of hard news seems to have thrown the world of UFOlogists on hard times. A few years ago there were several organizations which were actively following up on UFO reports and publishing monthly newsletters. The oldest and biggest of them, NICAP, seems to have disappeared, with reports that someone took over and took the money. I don't even see any current references to APRO, which took over as number one when NICAP began to go downhill. Now there is a MUFON in Texas, but their newsletter has little excitement in it.

I've been following the UFO news from the first, trying to fit reports together into some sort of pattern. We have had amateur radio UFO nets which were started and then faded away, but they have never accomplished anything of substance. Indeed, if I thought that amateur radio could help to throw some light on the subject, I'd be pushing for whatever I thought would help.

At one time it seemed like it might be possible to take advantage of UFO reports to alert teams ahead of them so a better effort could be made to investigate the phenomena. If people only had early warning, they might be able to get out telescopes, cameras, electrostatic sensors, and other equipment to help us learn more about UFOs. Amateur radio seemed like the best approach to such a warning system . . . but somehow ham nets never really clicked and nothing came of the idea.

After reading several thousand UFO reports and just about every book published on the subject, I began to suspect that there was more than accident involved in the lack of really substantial evidence that UFOs exist. With many reports telling of their instant appearance and disappearance, there was a strong suggestion that some sort of time travel might be involved. This would answer a lot of questions which otherwise involved impossible to accept data.

What other reasonable explanation for the cave paintings from 17,000 years ago which depict the same saucer-like objects which have been reported right on down through history? No civilization is going to make the same model travel unit for 17,000 years. But if anyone were to invent time travel, you can bet that teams would be going back to write an authentic history of our planet. We don't know the rules of time travel yet, although some recent theorizing about Einstein's equations has persuaded many scientists that time travel may one day be practical.

One of the main worries has to do with what happens if you go back through time and kill your own grandfather. What then? This either can't happen or else it is possible to change events . . . neither of which concepts can be grasped with any clarity. More likely is that time travelers have some rules which they damned well better follow if they are going to ever return to their starting point. If so, it may be that the rules will cover making changes in the past which could affect the future . . . such as leaving evidence behind of their visit (such as we have been looking for).

There are a lot of reports of fake government agents who have confiscated the better UFO pictures which have been taken. There are hundreds of reports of people who have met the UFO travelers, but the surprising thing is the almost total lack of consistency in their reports of what they were told. Of course, if time travelers have a need to create confusion so as not to change the future, this would explain it.

Once you remove the concept of time as a barrier in travel, you can go anywhere you want, so the prospect of some other civilization visiting our planet becomes not merely possible, but virtually inevitable. And once they arrive, they will surely want to check back over the history of the planet. This would hold for all visitors . . . which might help explain the variety of beings reported by contactees. Some short, some tall, some fat, some thin.

If this is an even close guess to what has been happening, our trying to get more accurate data on the UFOs would obviously be doomed to failure. Thus, even if we were able to get a ham net working to help gather more data on the UFOs, the end result would be nothing more substantial than we have at present . . . or else the future might be changed . . . or the time traveler might go pffft.

I do appreciate getting newspaper clippings of UFO reports, so keep 'em coming. And if there are any serious organizations in the field, I'd like to know about them, too. In the meanwhile, I'll keep enjoying the swamp gas and plasma explanations for UFOs.

6000 WORDS PER MINUTE?

One of the projects that I am working on with the microcomputer industry has to do with promoting the concept of electronic mail. A number of large firms are working on the project, but I think it will be possible for the microcomputer industry to pull an end run and beat out Ma Bell, ITT, and any other firms interested in cornering EM communications. And that should even include the post office.

If the microcomputer industry can come up with a slick system which will enable any microcomputer user to send messages to any other user, all automatically and via the telephone wires, I think we'll have a working service before even IBM can do anything about it.

The basic idea is to have a box which will plug into a microcomputer and also into the telephone lines. This would allow you to write a message via a word processing program, and then it would ask you for the phone number to which the message is to be sent. From there on it would be all automatic. The box would disconnect your telephone so you would not be able to pick it up and screw up the communications. It would then dial up the desired number . . . and keep at it every minute or so if the number is busy the first time around. When the connection is made, it would cause the telephone on the other end to be disconnected and turn on the receiving computer. Then it would send the message, along with a verifying system which would make sure the message was received correctly. Once the message was completed, it would disconnect . . . unless the other person pushed a hold button to hold the circuit for an immediate answer.

The incoming message would be stored on a disk and perhaps a light would indicate the presence of a message. Naturally it would be simple to have the

receiving system automatically forward the message to any place you want, all automatically. This would enable you to have your "mail" delivered to you both at the office and at home. You might even be able to get it in your car, if you want.

Okay, how does this tie in with amateur radio? Well, remember that we are talking about sending the messages over phone lines . . . and the bandwidth of these lines is about the same as we are used to with amateur radio. Thus, any message system we can use over the phone lines we should be able to use with amateur radio.

The present standard for telephone computer communications is 300 baud, the same speed we are presently authorized to use for amateur radio. I think this is pitifully slow and I hope that many amateurs will join me in trying to get this lid taken off our restrictive ASCII rules. I've had word from some readers that there are systems presently in use which are sending ASCII over the phone lines at 9600 baud. Now that's more like it!

For those of you who are not sure how fast or slow 300 baud really is, let me decipher this term for you. A baud is a single bit of information per second. Our ASCII code normally has eight bits to send the character plus one start bit and two stop bits, for a total of eleven bits. Thus at 300 baud we would be sending about 27 characters per second. That's 1636 characters per minute. That translates into 272 words per minute . . . which is about the speed of a slow reader. Anyone with some speed reading training can whip along at double to four times that rate.

If they are able to send 9600 baud over phone lines, then we should have little trouble in shifting to 1200 baud for our ham communications . . . and without exceeding the bandwidths allotted for voice channels. That would give us a throughput of 1000 words per minute, which is more like it. There is no reason why an amateur should have to use a channel every second that he is in contact. At that speed, we could get our messages across quickly and have the channel open for others to use while we are reading and getting ready to respond.

Getting back to the electronic mail, I'm working in the direction of the 1200 baud standard at present. If it is really practical to step that up to 9600 baud, fine . . . that would be great. But we do want a system which will function over crummy phone lines and make it so a very high percentage of our calls are handled without error.

Now comes the crux of the idea. Studies of the words used for ordinary mail show that only 200 English words constitute over 80% of the words used. If you think about that for a moment, you'll see that we could set up a simple dictionary of 250 words and represent them by one byte of information. We could put this dictionary on a little ROM chip and greatly speed up communications by having our computer look up the byte to represent each word . . . transmit that byte of information and then the process would be reversed on the receiving end.

The next step is to set up a larger dictionary . . . perhaps 30,000 words . . . which would be represented by two bytes. We could have specialty dictionaries for certain interests and businesses for another thousand words. Words not in the dictionaries would be sent one character at a time via the usual ASCII.

The net gain of such a system would be to permit messages to be sent at an effective rate of about 6000 words per minute, even though the transmission speed is only 1200 baud.

Once we have such a system working for electronic mail use with microcomputers, we could then use the same shorthand communications via amateur radio . . . over the shortwave bands, via satellites, and even through repeaters.

One interesting aspect of the system would be the ease with which it could be made confidential for business communications uses. By changing the bits around . . . a simple matter for a computer . . . the incoming messages would be almost impossible to decipher because the wrong words would be looked up in the dictionary ROMs.

Oh, and one other possibility . . . once you have your dictionary set up in a ROM, it would not be difficult to change these ROMs for translations into different languages. You could send English and have it come out in Arabic or Italian! You'd have to be careful of some slang phrases, which would translate oddly, but most of the messages would come through well enough. This would not hurt amateur communications at all . . . and would greatly increase interest in many foreign countries where our present dependence upon English is a problem.

If any amateurs are interested in getting started working with any parts of the ideas described here, you may be sure that *73* is interested in getting articles on the results of this work . . . the circuits evolved, etc.

MORE RADAR JAMMING

There have been some rumors of actual communications use of the 10.5-GHz rigs designed as radar jammers but marketed as ham transceivers as a stratagem to avoid FCC censure. If anyone has had any success in legal use of these rigs, we'd like to get information on it.

Dave W4OXC sent me a copy of an article in *Law & Order* magazine (June, 1979) on a new system for generating radar jamming signals. In this one, a series of tiny antennas tuned to 10.5 GHz are attached to the ignition wires of the car and thus radiate powerful broadband signals at that frequency. The article points out that this also tends to make the use of your car radio and CB (also ham rigs) impossible. It's an interesting approach and probably within the law. I don't think there are any standards for maximum ignition noise radiation . . . otherwise, my Datsun 280Z would have been removed from production.

No one seems to have yet come up with a legal radar jammer which is better than the one we published by Sterling Olberg W1SNN in the 1976 Holiday issue of *73 Magazine*. You know, at the time the article came in I was so enthused by it that I contacted a manufacturer and interested him in making the unit. I couldn't see why they couldn't sell tens or even hundreds of thousands of smoke detector/nullifiers. Then I contacted Olberg and he said, no, he had another firm which was interested. I think it all died about then, so the world never benefited from the brilliant concept and Olberg lost out on maybe a million or more in royalties.

The idea was simple. The Olberg detector worked on the principle of using a tuned antenna horn, just like the kind smokey uses. This, being tuned to the frequency of the radar, reflects back a much stronger signal than the car. A second diode in the antenna, fed by an audio oscillator, modulates the reflected signal, returning it with the tone (and speed indication) of *your* choice.

Despite a continuing flow of laws from states trying to regulate radio reception, the FCC has so far remained steadfast in protecting the right of any citizen to tune to any frequency he pleases. The restriction is that most radio signals may not be used for personal gain. This is contrary to the laws of states trying to restrict the use of scanners which will receive police signals or outlaw the use of radar detectors. It is also a pain in the butt for the MDS and satellite television people, who would like to have the government protect their transmissions so they won't have to encode them. My hope is that they be as successful with the FCC as amateurs have been.

The recent Florida attempt to outlaw radar detectors on the basis of saving gas is just another illustration of the blindness and stupidity of many legislatures. Study after study has shown that the 55 mph speed limit has so little effect on saving gas that it is ridiculous. It has had no demonstrable effect on saving lives either. It has had a wonderful effect on raising money via speeding tickets, which I think is more to the heart of the matter. A one pound increase in tire pressures would save far more gas than the speed limit. Replacing just 5% of the stoplights of the country with stop signs would save five times as much gas as the government even claims the speed limit has saved. And having all stoplights change to blinking lights late at night would save about a half million gallons of gas a day!

I see no sign that there is any seriousness about saving energy. The highways are still brightly lit all night and many government buildings leave their lights on all night. Sports

cars generally use *less* gas at higher speeds than at 55 mph, since they are designed and tuned for the higher speeds.

In the meanwhile, the electronic warfare continues, with the public getting more and more fed up with the lying and harassment. The police are wondering why people think of them as the enemy instead of helpful friends. Now that they have made most of us into criminals, we *are* the enemy . . . unless you are one of those people who are holding up traffic on the parkways by insisting on poking along at 55.

27% IMPORTS

The continuing debacle of Chrysler and the mounting losses to foreign car sales has come as a surprise to Detroit. I am not sympathetic with the problem.

To get into a situation like this, the car manufacturers have had to be deaf and blind to what has been going on. Obviously they don't read the car magazines, whose editorials for the last twenty years have been exhorting Detroit to provide cars which are fun to drive and as economical as those from Europe.

My first foreign car was a Porsche. I started driving with a '40 Ford and then stepped up to a '41 Ford. These lasted me until I got out of school and started to make some money, which brought about my first new car in 1954. I tried a Dodge and brought it back after one weekend . . . it drove like a truck compared to my old Fords. I settled for a new Ford, but I was not a happy person. It was big and clumsy and nowhere near the fun to drive of the pre-war Fords.

In 1957, a good friend of mine, Ken Grayson W2HDM, got involved with an MG sports car and car rallies. I looked over the sports car field and decided on a Porsche Speedster for $3,300. Ken tried my Porsche and then quickly got rid of his MG and got a Speedster. This was like the old Ford, only infinitely better. It could go 120 mph and still be safer to steer and drive than most American cars at half that speed. The handling was incredible and so was the fun.

In no time at all, I got involved in car rallies and began to build up a bunch of trophies, even placing well in some of the Nationals. In 1958, I was made president of the Porsche club and made a club trip to the factory in Stuttgart, where I picked up a car for a friend in New York. After picking it up I drove it all over Europe, even getting some practice at racing with it on the Solitude race track in Stuttgart. Now that's an exciting sport, but far too expensive and time consuming for my life-style.

In the New York area, there was no problem in going on from one to three rallies on a weekend, interspersed with some of the three-day national rallies put on by the Sports Car Club of America. At first I went as a navigator, working on a system which would simplify that chore. I worked it out and then taught it to a few people . . . some to navigate for me while I did the driving and some just friends. I didn't want too many to know about it because it gave a tremendous edge in winning.

For those readers who have never been on a car rally, perhaps I should explain about them. Normally you are given your route instructions about one minute before you start on the drive. Short rallies run perhaps 100 miles and the long ones often 500 or more. You are supposed to always drive within the posted speed limits and to stay exactly on time according to your instructions, which include the average speeds you are to drive. The fun comes in when some of the instructions are a bit vague or you make a wrong turn and then have to play catch up.

In 1959, I got enthused by the newly released Porsche Convertible D and bought one for delivery at the factory. I saved enough on the purchase to pay for the trip to Europe, so it was a good deal. After driving the car for a year, I decided I didn't like it as well as the Speedster, so in 1962 I shipped the old Speedster back to the factory and had it refurbished. They put in the latest and hottest engine and made it just like new . . . which was exciting because they had stopped making that particular model and I liked it. I kept the car until 1972, when I sold it to a dealer. It was rusted out a bit in the floor, but otherwise I'd kept it like new. It had over 200,000 miles on it, probably 50,000 of that on rallies.

Since that time, I've had a number of VWs . . . two vans, both rolled over and demolished by *73* employees . . . a couple of bugs whose engines were burned out by our employees, a Volvo, a Mercedes 300 sedan, some more VWs (hatchback models, both still running from '67 and '68), a Rover 2000TC, probably the finest driving sedan I've ever had, a Datsun 240Z and now a 280Z, a Mazda RX-7, etc. A couple of years ago, I decided to get a van to use as a mobile office and made one of my poorer decisions . . . a Dodge. Not only did the dealer cheat us, but Dodge also refused to do anything about it, saying that their dealers were not their responsibility. The van didn't run much for the first year and a half. Finally, we found a Dodge dealer who could get the engine to run, but it still dies now and then, not encouraging any real confidence in the thing.

Detroit saw sales of VWs and other foreign cars building up over the years and they laughed and ignored it.

Recently, we needed a small sedan for the business. We looked over the market carefully and it came down to a Datsun, Toyota, VW, or Mazda. Nothing made in the US was even in the ball park. Oh, I'm quite familiar with American cars, since these are what I have to rent when I'm on trips to hamfests and conventions. We got a VW Rabbit and it's been perfect.

It isn't a question of the price of the cars as much as it is the handling. Detroit makes nothing like the RX-7 at *any* price. I've visited several American car plants and the difference in worker approach between these and the Porsche plant was vast. The Porsche workers put great pride into every car they worked on. There were no ill-fitting doors, no missed spots of paint, no glue on the upholstery. Everything had to be absolutely first class every inch of the way. Both used production lines for assembly, but in one case the workers had their hearts in their work and in the other they were there for the paycheck and little more . . . getting by.

The result was a Porsche which I used for 15 years and eventually sold for nearly what I paid for it new . . . and which was still running perfectly, even after 200,000 very tough miles. There wasn't a rattle. We'd be using that Rover today if a handyman hadn't totaled it, racing it in our driveway while I was on a trip.

Why is it that virtually all of the improvements in car design have to come from abroad? And why, once they are made, can't Detroit pay attention and at least get there second best . . . instead of last? I think it was the Maserati which inspired the Datsun people to design the 240Z car and mass produce it. This, in turn, brought on the 260Z and 280Z . . . followed by the Porsche 924 look-alike and the Mazda RX-7. You see a lot of all these cars on the roads today, and still Detroit is making nothing comparable . . . at any price.

When was the last time there was anything innovative from Detroit? We are *still* seeing them trying to dump gas guzzlers by offering rebates when there is a serious need for really fuel-efficient cars. I think they could develop a 100-mile-per-gallon car if they wanted to do it. I suspect that such a vehicle would be a combination gas/electric car, with a constant speed engine generating the current. Once you stop asking an engine to provide power over a wide range of speeds, you greatly simplify its design. You also are able to get it to run on almost anything from kerosene to olive oil. The engine becomes simpler and less costly.

By using a battery to store the energy from the engine, you have the power needed to start up the car or to accelerate. On braking, you use the motors which drive each of the wheels as generators and put the current back into the battery instead of wasting all of that work in heat through the brakes. Oh, you don't get very good zero-to-sixty times with such a system, but you do get very dependable transportation and the fuel economy we've been seeking. Not that the car would be too draggy . . . remember that trolley cars have electric motors driving their wheels and they can throw you around pretty well when they start up, with all four motors in parallel across the battery . . . shifting to a series condition for cruising. We have some small, lightweight, solid-state controllers these days which should be ideal for controlling such a system.

Are we ready for a car which can run from gas, diesel fuel, alcohol, or any other common fuel . . . and get over 100 miles per gallon? I think it might sell.

Awards

from page 26

13 North American countries; South American award—work 12 South American countries; European award—work 12 European countries; Oceanic award—work 12 Oceanic countries; Asian award—work 12 Asian countries; African award—work 12 African countries.

5. To apply for any of the six continental awards, prepare a separate list of claimed contacts for each continent, listing all callsigns in prefix order. Include date and time in GMT, and the band and mode of operation.

6. If you are submitting the sixth award application, please emphasize this fact to speed processing of your ultimate WTW award.

7. Do not send QSL cards! Have your list(s) verified by two amateurs, a radio club secretary, or a notary public.

8. Each continental award has an award fee of $3.00 or 8 IRCs. Send your application(s) and fee(s) to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

WTW DX LISTING

Over the past year, reference has been made to the new WTW (Work the World) DX listing. In order to avoid the impossible task of having to decide what is and what is not a country for DX purposes, the awards editor and *73 Magazine* staff decided to accept the decisions of the many amateur radio societies of the world. In doing so, special care was taken to ensure that no single organization would dictate the criteria used; instead, the accumulative opinion of all concerned societies would be recognized.

It should be mentioned also that the callsign prefixes shown do not represent all prefixes assigned each country. Listed are only the more common prefixes heard on the band. Naturally, other authorized prefixes will be recognized as well.

NORTH AMERICA

C6	Bahamas
CO	Cuba
FG	Guadeloupe
FG, FS	Saint Martin
FM	Martinique
FO	Clipperton Is.
FP	St. Pierre & Miquelon
HH	Haiti
HI	Dominican Republic
J3, VP2G	Grenada & Dependencies
KC4, KP1	Navassa Is.
KG4	Guantanamo Bay
KL7	Alaska
KP4	Desecheo
KP4	Puerto Rico
KS4, KP3, HK0	Serrana Bank and Roncador Cay
KV, KP2	Virgin Islands
OX, XP	Greenland
PJ6, 8	Saba Is.
VE	Canada
VE1	Sable Is.
VE1	St. Paul Is.
VO	Newfoundland, Labrador
VP2A	Antigua, Barbuda
VP2D	Dominica
VP2E	Anguilla
VP2K	St. Kitts
VP2L	St. Lucia
VP2M	Montserrat
VP2S	St. Vincent & Dependencies
VP2V	British Virgin Islands
VP5	Turks and Caicos Islands
VP9	Bermuda
W, K, N, A	United States of America
XE	Mexico
XF4	Revillagigedo Islands
ZF	Grand Cayman Islands
6Y	Jamaica
4U	HQ, United Nations
8P	Barbados

SOUTH AMERICA

CE	Chile
CE0A	Easter Is.
CE0X	San Felix
CE0Z	Juan Fernandez
CP	Bolivia
CX	Uruguay
FY	French Guiana
HC	Ecuador
HC8	Galapagos Is.
HK	Colombia
HK0	Bajo Nuevo
HK0	Malpelo Is.
HK0	San Andres & Providencia
HP	Panama
HR	Honduras
HR0	Swan Is.
KZ	Canal Zone
LU	Argentina
OA	Peru
PJ	Bonaire
PJ	Netherlands Antilles
PY	Brazil
PY0	Fernando de Noronha
PY9	St. Peter & St. Paul
PY8	Trinidade & Martim Vaz Is.
PZ	Surinam
TG	Guatemala
TI	Costa Rica
TI9	Cocos Is.
VP1	Belize
VP8	Falkland Is.
VP8, LU	South Georgia Is.
VP8, LU	South Orkney Is.
VP8, LU	South Sandwich Is.
VP8, LU	South Shetland Is.
VP8W	South Grahamland
YN	Nicaragua
YS	Salvador
YV	Venezuela
YV0	Aves Is.
ZP	Paraguay
8R	Guyana
9Y	Trinidad and Tobago

EUROPE

C3	Andorra
CT	Portugal
CT2	Azores
DA-DL	Federal Republic of Germany
DM, DT	German Democratic Republic
EA	Spain
EA6	Balearic Islands
EI	Republic of Ireland
EJ0	Aran Is.
F	France
FC	Corsica
G	England
GD	Isle of Man
GI	Northern Ireland
GJ, GC	Jersey
GM	Scotland
GM	Orkney Islands
GM	Shetland Islands
GU, GC	Guernsey
GW	Wales
HA	Hungary
HB	Switzerland
HB0	Liechtenstein
HV	Vatican
I	Italy
IC	Ischia
IA	Tuscan Archipelago
IS	Sardinia
IT	Sicily
JW	Bear Is.
JW	Svalbard Is.
JX	Jan Mayen
LA	Norway
LX	Luxembourg
LZ	Bulgaria
M1	San Marino
OE	Austria
OH	Finland
OH0	Aland Is.
OJ0	Market Reef
OK	Czechoslovakia
ON	Belgium
OY	Faeroe Islands
OZ	Denmark
PA	Netherlands
SM	Sweden
SP	Poland
SV	Greece
SV	Crete
SV	Dodecanese
SV	Mount Athos
TF	Iceland
UA, UK1, 3, 4, 6	European RSFSR
UA1, UK1	Franz Josef Land
UA2, UK2F	Kaliningradsk
UB, UK, UT, UY5	Ukraine
UC2, UK2	White RSFSR
UO5, UK5O	Moldavia
UP2, UK2B, P	Lithuania
UQ2, UK2G, O	Latvia
UR2, UK2R, T	Estonia
YO	Romania
YU	Yugoslavia
ZA	Albania
ZB	Gibraltar
3A	Monaco
4U	ITU, Geneva
9A	(See M1)

ASIA

A4X	Oman Is.
A5	Bhutan
A6X	United Arab Emirates
A7X	Qatar
A9X	Bahrein
AP	Pakistan
BV	Taiwan
BY	China
CR0	Macao
EP	Iran
HL, HM	North Korea
HL, HM	South Korea
HS	Thailand
HZ, 7Z	Saudi Arabia
JA-JR	Japan
JR6, KA6	Okinawa (Ryukyu Is.)
JD, KA1	Ogasawara
JT	Mongolia
JY	Jordan
KA	US Military in Japan
OD	Lebanon
S2	Bangladesh
TA	Turkey
UA, UK, UV, UW9-0	Asiatic RSFSR
UD6, UK6C, D, K	Azerbaidzhan
UF6, UK6F, O, Q, V	Georgia
UG6, UK6G	Armenia
UH8, UK8H	Turkoman
UI8, UK8I	Uzbek
UJ8, UK8J, R	Tadzhik
UL7, UK7	Kazakh
UM8, UK8M, N	Kirghiz
VS6	Hong Kong
VS9K	Kamaran Is.
VU	India
VU7	Andaman & Nicobar
VU7	Laccadives
XU	Khmer Republic
XV	Vietnam
XW	Laos People's Dem. Rep.
XZ	Burma
YA	Afghanistan
YI	Iraq
YK	Syria
1S	Spratly
4S	Sri Lanka
4W	Yemen
4X, 4Z	Israel
5B4, ZC	Cyprus
7O	People's Dem. Rep. of Yemen
8Z4	Neutral Zone Saudi Arabia/Iraq
9H	Malta
9H4	Gozo & Comino
9K	Kuwait
9M2	West Malaysia
9M6	North Borneo
9M8	Sarawak
9N	Nepal
9V	Singapore
	Abu Ail, Jabal Attair

OCEANIA

A3	Tonga Republic
CR8	Portuguese Timor
C2	Republic of Nauru
DU	Philippines
FK	New Caledonia
FO	French Polynesia
FW	Wallis & Fortuna Islands
H4, VR4	Solomon Islands
JD, KA1	Minami Torishima
JD, 7J1	Okino Torishima
KB, KH1	Baker, Howland, American Phoenix
KC6	Eastern Carolines
KC6	Western Carolines
KG6, KH2	Guam Island
KG6R	Rota
KG6S	Saipan
KG6T	Tinian
KH6	Hawaiian Islands
KH7	Kure Island
KJ, KH3	Johnston Island
KM, KH4	Midway Island
KP6, KH5K	Kingman Reef
KP6, KH5	Palmyra
KS6, KH8	American Samoa
KW, KH9	Wake Island
KX	Marshall Islands
P2	Papua, New Guinea
T2, VR8	Tuvalu Island
VK	Australia
VK	Lord Howe Island
VK9	Willis Island
VK9	Christmas Island
VK9	Keeling, Cocos Island
VK9	Mellish Reef
VK9	Norfolk Island
VK0	Macquarie Island
VR1	British Phoenix Islands
VR1	Gilbert Island
VR1	Ocean Island
VR3	Christmas Island
VR6	Pitcairn Island
VR7	Line Island, South and Central
VR0	(See T2)
VS5	Brunei
YB, YC, YD	Borneo
YB, YC, YD	Celebes
YB, YC, YD	Java
YB, YC, YD	Sumatra
YB, YC, YD	West Irian
YJ	New Hebrides
ZK1	North Cook Island
ZK1	South Cook Island
ZK2	Niue Island
ZL	New Zealand
ZL	Auckland & Campbell
ZL	Chatham Island
ZL	Kermadec
ZM7	Tokelaus
3D2	Fiji Islands
5W	Western Samoa

AFRICA

A2	Botswana
C5	Gambia
C9	Mozambique
CN	Morocco
CN2	Tangier
CR3	Guinea Bissau
CT3	Madeira Is.
D2, 3	Angola
D4	Republic of Cape Verde
D6	Comoros
EA8	Canary Islands
EA9	Ceuta and Melilla
EA9	Ifni
EA9	Rio de Oro
EL	Liberia
ET2	Eritrea
ET3	Ethiopia
FB8W	Crozet
FB8X	Kerguelen Is.
FB8Z	Amsterdam & St. Paul
FH	Mayotte
FR	Glorioso Island
FR	Juan de Nova, Europa
FR	Reunion
FR	Tromelin
H5	Bophuthatswana
IG	Lampedusa Island
IH	Pantelleria Island
J2, FL8	Djibouti
S7	Seychelles
S8	Transkei
S9	Sao Tome and Principe
ST	Sudan
ST0	South Sudan
SU	Egypt
TJ	Cameroon
TL	Central African Empire
TN	Congo
TR	Gabon
TT	Chad
TU	Ivory Coast
TY	Benin
TZ	Mali
VK0	Heard Island
VQ9	Aldabra Island
VQ9	Chagos (Diego Garcia)
VQ9	Desroches
VQ9	Farquhar
XT	Upper Volta
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Gough Island and Tristan da Cunha
ZE	Rhodesia
ZS1, 2, 4, 6	South Africa
ZS2	Prince Edward Island
ZS2	Marion Island
ZS3	Southwest Africa (Namibia)
3B6, 7	Agalega & St. Brandon
3B8	Mauritius
3B9	Rodriguez Island
3C	Equatorial Guinea
3D6	Swaziland
3V	Tunisia
3X	Republic of Guinea
3Y	Bouvet Island
5A	Libya
5H	Tanzania
5N	Nigeria
5R	Malagasy Republic
5T	Mauritania
5U	Niger
5V	Togo
5X	Uganda
5Z	Kenya
6O	Somali
6W	Senegal
7P	Lesotho
7Q	Malawi
7X	Algeria
8Q, VS9	Maldive Islands
9G	Ghana
9J	Zambia
9L	Sierra Leone
9Q	Republic of Zaire
9U	Burundi
9X	Rwanda

LETTERS

from page 22

socialism, but I can't believe that the average Canadian is any better or worse than the average American. After all, the US has already gone a long way down the road to socialism, without calling it by that name. Since most of Mexico wants to be American, we can just open the gates wide and let the majority come up here; then we can send them back south to annex the territory they left. No sweat.

By the way, are you really sure that the NATO countries are "on our side"? Lots of luck.!

The subject of the draft vs. an all-employee military establishment is almost too much for me to tackle this late in the afternoon. That gets all involved in the aims and will of the American people. I see two possible options you may have not considered: (1) make the DOD entirely a contractor operation, and (2) just disband the whole thing and devote those resources to other things. How about a guaranteed annual wage for everyone, working or not? Free medical and dental care for all? Free lunch???

Several years ago, I concluded that the American Empire had reached its peak sometime in the late forties or early fifties and had entered the Decline and Fall period. Given this premise, what the hell difference does it make whether we have a draft-based citizens' military or an all-employee military or none at all? (I discarded the contract operation due to the huge requirement for purchasing and contracting officers to negotiate and administer the thing.)

What does all of this have to do with amateur radio? Not much. It's an interesting hobby in many ways, but I get the impression that you believe that most of the ills of man can be overcome by spreading it throughout the world. Sorry, can't go along with you on that. Hams are just a microcosm of the population at large, unfortunately. So keep up the good magazines and don't forget the words of the famous philosopher who said "You'll never go broke by underestimating the intelligence of the American people!"

Irv Hamlin WD4CKA
Sevierville TN

Well, thanks somewhat, Irv, for a good deal of heat but little light on a wide variety of matters. Having been a member of the League for some 42 years, I am not about to tar myself as a member with my own brush. But then the problems with the ARRL have very little to do with any of the membership, nor are they such that the members can do much about them. That still is no reason to sweep these problems under the table and try to pretend that they don't exist, which seems to be your mood. Amateur radio is no world panacea, nor has anyone ever suggested such a thing . . . but it can be of tremendous value to the lesser developed countries to help them improve their communications capabilities at low cost.—Wayne.

PROGRESS

I would like to comment on Wayne's remarks in the April, 1980, issue of *73* on how the "new ASCII rules are asinine." First, the good news. I agree that we should be allowed to transmit data with any digital code (perhaps filing a sample copy with the FCC) as long as we properly identify in Morse or by some other standard means. I haven't seen the complete FCC ASCII ruling yet, so I don't know if they are going to allow that much latitude or not. (That's it for the good news.)

The preliminary information on the new FCC ASCII rules that I read in *QST* for March looked very reasonable, in my opinion, regarding the ASCII data rates to be authorized in the various bands. I disagree very strongly that W2NSD should be allowed to run 9600 baud or greater in any band he desires. The last thing I want to hear on 20 meters is splatter from W2NSD on top of all the other QRM and QRN. I think the future holds more and more stations desiring to use the limited frequencies that are available, and under those circumstances, allowing unlimited bandwidths is not very responsible. If he'd like to run over 9600 baud below 420 MHz where it will be legal, wouldn't he also like to run about 25 kW also? That ought to help get him through all that QRM better.

In his remarks he asserted that by allowing the very wide bandwidths one would be "trading off bandwidth for time." I think that is humorous. Do the SSB stations occupying the 75m phone band accomplish their communications and then go off the air in one-tenth the time an 80m CW station spends transmitting? I think not. With the possible exception of well organized and run traffic nets, I seriously doubt that increasing the "data rate" of the medium will reduce the time spent on occupying spectrum space. We would just find it practical to send 16 k-byte high resolution TV images instead of SSTV. We'll still spend all Saturday morning on the air to one station or another. Now, one might want to argue that these new exchanges are desirable—but that is different from trying to convince someone that the transmitters will spend any less time on the air.

I think "progress" is in a direction where we learn to make better use of our limited spectrum space. By "better," I mean higher speed and more highly reliable communications between stations, per unit of occupied bandwidth and per unit of radiated power. I don't think W2NSD at 19.6 kilobits per second and 10 kW all over the 20-meter band is progress.

Jerome T. Dljak W9JD/DA1FE
APO New York

Jerome, readers advise me that, using compression and expansion techniques, it is practical to send ASCII at 9600 baud over the telephone lines. The bandwidth involved is less than we have available for the normal ham voice channels. So much for your straw man splatter from W2NSD on 20m . . . baloney. And just because we "have always" communicated in real time doesn't mean that there is no other way. The fact is that ham RTTY operators often allow considerable lapses between transmissions so they can read the copy and think about it before replying. If we are able to communicate via a narrowband channel at a rate of 5,000 or more words per minute, I suspect that most of the time the channels will be quiet and that several contacts will be practical on single channels. But if we are able to send information at even higher rates, the amount of time we need for transmission will again go down and the efficiency of use of a given bandwidth . . . no matter what it is . . . will be satisfied. We will find ourselves limited, as we are now, by the rate at which we are able to assimilate information and respond to it, not so much by the slowness of the medium of transfer.—Wayne.

MEETING CHALLENGES

Your May, 1980, editorial provided a very interesting look into some of the possibilities of the future. I would like to add some comments and observations of my own.

One of the most interesting challenges facing us will be efficient use of spectrum to cope with the growth we hope and need to experience in the coming years. You mentioned time-saving new modes of communication. Let us hope we can acquire the cooperation we need from the FCC to freely develop new modes of communication. In addition to spectrum efficiency, we desperately need the shot in the arm that our image will receive from our contributions to the state of the art. These new modes could give a real boost to traffic handling and other public service duties involving information exchange.

However, we must not lose sight of the importance of that idle personal contact which is best achieved on good old SSB and CW. With the combination of CW's inherent narrow bandwidth and some of the excellent audio techniques for separating the signals, few modes would be more spectrum efficient. But more importantly, CW and SSB remain excellent ways for the ham on a tight budget to be an active member of the ham community.

About those new bands—

don't be too quick to write them off. Too many of us pick a favorite band and just sit there. After a few years, our bandswitch is hopelessly frozen on, say, 14 MHz, and the vfo won't turn above or below a range of a couple hundred kilohertz. We have an excellent opportunity to improve our communications capability by making better use of HF propagation characteristics. Too many newcomers aren't aware of the basic principles involved in efficient HF frequency selection. Maybe, as some of the new bands open up in the coming years, we can have some articles on this aspect of operating and oil up the old bandswitch. The increased circulation will give the vitality of youth our hobby needs in order to grow.

And about those small countries—the sooner we get ham radio started there, the better. We mustn't wait until just before the next WARC. In these times of international turmoil, the international goodwill of amateur radio is more important than ever, but it can't work where there are no hams. In addition, these countries will benefit from the technology—technology which could help them peaceably take their place in our modern world. Isn't that what we all want?

We face a serious challenge—grow or die. We need growth in numbers, technology, activities, and public service. Each of us can make contributions, even if it's only in the perfection of our on-the-air habits and attitudes. One of the greatest strengths of amateur radio is that meeting such challenges is not drudgery, but part of the fun.

Jim Glover WB5UDE
Ruston LA

RATIONAL

I have been wanting to write to you concerning the March issue of *73 Magazine*. I really enjoyed the two articles by I. M. Gottlieb!

In the article "Ham Shack Numerology," those "irrational" constants become so "rational" when W6HDM dealt with them! Wonder what he could do with logarithms!

Also, I hope he'll treat us to another phase-velocity escapade with Madame Z!

H. M. S. Richards, Jr. WD6BDZ
Glendale CA

PROSPECTS

Wayne has come a long way since I met him here in Phoenix nearly 20 years ago.

Having lost all my hearing in one ear and 80% in the other, communicating with the public has been a problem. Mine is "nerve deafness," in which all words are garbled.

Enter Joe Grahn W7AH, who some 25 years ago introduced me to amateur radio. Since the CW signals are mechanical, with the volume turned up I was able to communicate with over 6000 hams.

Then in 1960 Joe told me about RTTY, and I now have no need for a hearing aid or interpreter to "see-talk" with other hams.

I have been spending a lot of time in gathering information on hearing and speech impairment. With this thought in mind, I want to start a non-profit association for hearing- and speech-impaired amateur radio operators. If amateurs or individuals who have this problem would send me their names and addresses, along with suggestions as to what is needed to get started, I would appreciate it. 27 million people in the United States have a hearing or speech impairment and 7.2% of the population is totally deaf. Those are a lot of prospects for ham radio to look into.

Ed Truxal W6TUO/7
3925 E. Nisbet Rd.
Phoenix AZ 85032

THE WATCH

The other Saturday morning I was working a little nice DX, and I was blown into my wastebasket by the dreaded woodpecker. I swore revenge. Recent articles about over-the-horizon HF radars suggested that a string of dits, timed to be roughly the same rep rate as the bugger's pulses, might give him QRM. I had a vision of hum-bars dancing in Ivan's scope as I adjusted the keyer and let fly.

Wonder of wonders! He was gone! As I tuned around, I found I was wrong. He had only moved up 100 kHz. Was I the reason he moved or was I kidding myself? I listened to see if he would move again. I noticed that he operates on two frequencies with a string of pulses on one, and then another string on a different frequency separated by about 25 kHz. (Perhaps to resolve inconsistencies in the first scan by using a slightly different wavelength, and comparing the two scans in a micro and keeping the common elements.)

I satisfied myself that he was on this new frequency to stay—and then I zapped him. He moved. I found him again. I just listened for a while. He stayed put. I zapped him. He moved!

I chased the bastard up and down 15 meters for about 20 minutes. As long as I left him alone, he stayed put. As soon as I sent him a 5- to 10-second string of dits, he moved. *Every time*!

I was using the 400-Hz filter in the AM mode on my Drake twins to locate the center of his signal, and had the transmitter slaved to the receiver vfo. That means I was within his passband and on top of him immediately every time he moved. Then he went QRT.

I would like to call for OPERATION PECKERWATCH to begin immediately. Anyone can play. Mission: Find 'em . . . chase 'em . . . zap 'em.

There's not much we can do about SW broadcasters invading our bands, but it looks like he have the power to make Moscow change the channel on the HF radar. Score one for the little guy!

Name and address
withheld by request

THE MS EXPEDITION

In celebration of its 50th anniversary, campers and staff members of Camp Hy-Lake, a summer camp for boys and girls in Quebeck, Tennessee, are planning a canoe trip down the Mississippi River. Hailed to be the first such event attempted by a summer camp, the 1039-mile trip will see two 26-foot, 25-year-old war canoes en route from St. Louis, Missouri, to New Orleans, Louisiana.

This ambitious event, named simply "The Mississippi Expedition," will begin on August 11 and end on August 29. The canoeists will spend a total of 19 days on the Mississippi, averaging 54.7 miles per day at a speed of about 8 miles per hour, paddling some seven hours per day.

As part of our extensive safety plan designed for the expedition, we have chosen to utilize not only the normal Marine Radio Service, but also the Amateur Radio Service. By having these services available to us on the river, we will maintain a consistent source of communications with families and other parties at destination sites.

In order for this plan to be successful, we need assistance in procuring necessary equipment, supplies, and the attention of radio operators along the proposed course. We need to alert ham radio operators who may be willing to serve as contacts at pre-scheduled times and locations during the expedition.

Please contact me if you can help us in our venture. Your assistance will be most appreciated and we will make every effort to gain exposure for your participation. Thank you for your cooperation.

Ward C. Akers
Director, Camp Hy-Lake
Quebeck TN 38579

SPOTS

When I looked at the sun on May 22nd with my six-inch telescope, I found it to be loaded with spots . . . this increase after dropping off for the past three months. What happened to the 84- and double-84-year *low* sunspot cycles that 11 of the 15 cycle-21 forecasters were depending on . . . including myself?

I mentioned this recently to a cycle expert and he said, "Don't sell the 84-year cycle short; the 1980s are young yet."

For my part, I would not care to attempt to predict another sunspot cycle because the sun is too whimsical. I'll stick to predicting conditions and frequencies, my specialties.

John Nelson
Whiting NJ

HATS OFF

I have just finished reading the June, 1980, issue of *73* and would like to comment on a couple items. With regard to the "Leaky Lines" column concerning S-meters, hats off to Dave for a great piece. Maybe if more people read it we all can get some good reports (honest reports). Next, I have been reading your magazine steadily for 3

years and off and on for 15 years. I have really enjoyed the articles and projects and look forward to many, many more. Thank you. My current subscription expires in '81 and I do plan on renewing.

Thomas C. Huber WD0BFO
Omaha NE

OLD QSLS

First, let me say thanks to *73* for printing my letter in the December, 1979, issue, listing some old QSLs I have. I purchased them from a stamp and coin dealer who'd bought them at an estate sale. If any of the following are still active, they can send their names and QTHs and I'll send the card. None of the following was in my December letter.

NU1WV – '28
W2JC – '30
U2RD – '27
W3AWU – '30
3BPP – '25
3DD – '26
3TR – '24
4AV – '27, "J.M.(4QN)OPR."
4JR – '25
5ADE – '25
5AJJ – '24
5FT – '24
5IQ – '22, "1 kW Spark"
W6AFV – '31
7AKU – '28
W8AUV – '29
U8BGW – '26
8BWK – '24
W8GGX – '32
9AIG – '21, "1 kW Rotary Gap"
9BDR – '22, "¾ kW 'Rotorery' Gap"
W9BNR – '31, "The Sleepless Wonder"
9EJY – '25
9PN – '22
W9VVM – '37, "Davenport's First es Only Blind Opr."
G8IP – '49
KH6AJP – '51

Also, I'd like to locate a source for copies of reproductions of "ARRL List of Stations – First Edition, 1914" that were made around 1964. I believe copies of volumes 2 and 3 were also printed at the same time.

Gary Payne WD6BJK
1347 E. Dakota
Fresno CA 93704

DIRTY LAUNDRY?

I would just like to congratulate you, the editors of *73*, on a superb May issue. This particular copy now sits in an honored place next to my dirty laundry.

If only I had had this issue last summer when I set up my shack, I could have saved the 80 bucks I spent on a trap vertical. The next time I need an antenna, I'll check *73*.

May's issue also gave me a chance to agree with Wayne Green—there's a first time for everything. We should refurbish the CIA with, perhaps, Mr. Green, a closet mercenary, at its helm.

Dave Mihelcic KA9EKW
Belleville IL

BACK ISSUES

I recently offered 115 lbs. of back issues of *73* to the first club or individual to get a message to me.

The first contact was from Minot ND. To date, I have received 76 letters and over 55 phone calls regarding the back issues. Six included SASEs for information regarding the issues. One guy named Jack failed to include his call or return address and the post office failed to cancel his letter, so I don't know where it came from!

I was surprised at the response and am sorry that I couldn't send issues to all who contacted me.

David D. Blackmer WA6UNK
Nipomo CA

New Products

from page 31

The unit's power supply and speaker are included in this cabinet, and a massive heat sink spans the full length of the rig's rear panel. A number of RCA-type phone jacks below the heat sink provide input/output connections for external items such as speaker, phone patch, linear amplifier control, transverters, etc., while an SO-239 connector is used for external antenna connection. The KWM-380's front panel is uncluttered and functional; there's "finger room" between the knobs, and the main tuning knob measures a surprising 2¼ inches in diameter. There are 5 positions of selectivity in the KWM-380, with optional filters providing selectivity to 140 Hz as desired.

A microprocessor-controlled frequency synthesizer is used for all frequency determinations. A set of front-panel pushbuttons thus selects tuning rates of 9 MHz, 170 kHz, 18.7 kHz, or 1500 Hz per dial revolution. It's quite an experience to use the 1500-Hz rate and turn the main tuning dial a full half turn without losing a specific station! The two completely independent frequency registers in the KWM-380 provide extensive flexibility for the serious amateur. One register (vfo), for example, can be used for operation on the SSB portion of 15 meters, while the other register (vfo) can be used for operation on the CW portion of 20 meters. Switching the front-panel vfo selector then permits full operating capabilities on each of these bands as desired. If it's desired to bring both vfo's onto the same band and frequency, one merely presses the "sync" button while the desired frequency is displayed.

The KWM-380's bandpass tuning is quite effective in both rejecting adjacent channel interference and in tailoring audio response according to received signals. A pleasant side benefit of this tuning is the control's wide range and noncritical adjustment. The combination of bandpass tuning and five i-f bandwidths is extremely effective in combatting high interference levels experienced on the high frequency amateur bands.

Inside, the KWM-380 reflects quality construction and advanced design which should maintain its status for many years. PC boards are connected by lengths of ribbon cable to permit in-circuit checks without the use of extender boards. Board placement in the KWM-380 resembles microprocessor layouts, with ample room to permit airflow for internal cooling. A massive transformer and 5-inch speaker are mounted in the transceiver's right inside area.

The KWM-380 is one of the most pleasing and enjoyable rigs I've used on the air. Its instant-on capabilities, coupled with its two independent vfo's, permit maximum use of available "on-the-air" time. In a thirty-minute period, for example, I worked DX on 20 CW, checked into the Saturday SSTV nets on 20 and 10 SSB, chased some DX on 15 meters, and checked the WWV propagation bulletins at 18 minutes after the hour.

The i-f fillers definitely reflect Collins influence, as their skirts are quite sharp. Half-clear SSB signals can be copied smoothly with the 8-kHz bandpass—and the quality is extremely good. When the usual 2.2-kHz bandpass is used, it's possible to hear voice characteristics and microphone response which other rigs miss. The 1700-Hz filter provides a fine "DXer's edge" for pulling weak signals from the mud, and it substantially decreases atmospheric noises. The KWM-380, with its optional filters, is a particularly outstanding 160-meter DX rig. Obviously, the narrow CW filters and continuous bandpass tuning provide superb CW DXing capabilities.

Frequency stability of the KWM-380 is another direct reflection of Collins influence. During several checks, the unit didn't drift over ten cycles during the first three hours after a cold turn-on. What else could one ask!

Power output of the KWM-380 measures between 105 and 110 Watts on all bands, and it drives my L4B amplifier to exactly the same output as my Yaesu FT-901DM.

The main tuning assembly is somewhat "light" compared to other Collins systems. The lack of flywheel action and a counterbalanced tuning knob reflect, in my opinion, the Rockwell influence on this classic product. All aspects considered, the KWM-380 is an outstanding unit which reflects its heritage and stands worthy of its name. It should be with us for a number of years, thus protecting its owners' initial investment in the true Collins manner. While the rig may lack some of the presently popular "bells and whistles" included in import gear, its contemporary nature can be appreciated by amateurs desiring long-range consistency

and quality. I compare the KWM-380 in this respect to a contemporary suit versus "mod" or "fad" clothes, the former maintaining its style and appeal long after the latter has "bloomed" and disappeared.

Thanks to Ack Electronics in Birmingham for lending me the rig for review. For further information, contact *Collins Telecommunications Products Division, Rockwell International, Cedar Rapids IA 52406.* Reader Service number 483.

Dave Ingram K4TWJ
Birmingham AL

KENWOOD R-1000 GENERAL COVERAGE RECEIVER

With the profusion of new general coverage receivers now coming on the market, the selection may become bewildering to the prospective buyer. But one cost-effective receiver stands out above the crowd: the Kenwood R-1000.

Compactly packaged (12¾" x 4½" x 8½"), the handsome styling of the R-1000 is in keeping with the entire Kenwood communications line. The ruggedly-built receiver has a carrying handle which doubles as a tilt bracket. Plastic feet are also provided for flat tabletop operation. The well-built receiver weighs 12 pounds, and may be operated from 100-240 V ac mains, 50/60 Hz. An optional 12 V dc power cable is available as the DCK-1 for about $6.

The R-1000 tunes continuously from 200 kHz (and below) to 30 MHz, with AM or switch-selectable sideband modes.

Frequency readout is announced by a brilliant fluorescent display accurate to 1 kHz (3 decimal places). Additionally, a backlighted fiducial dial provides secondary frequency indication. Bandswitching is done in one-megahertz increments; because tuning is self-tracking, no additional preselector peaking is required!

Both thermal and mechanical stability are excellent. In our particular sample, there was no noticeable drift at turn-on; this feature alone makes the receiver an outstanding value for single-sideband reception. The printed specifications allow the receiver 300 Hz per half hour drift after initial warm-up. Tuning "feel" is velvety-smooth; a finger hole on the main tuning knob permits rapid frequency selection. Selectivity is 2.7 kHz @ −6 dB, and 5 kHz @ −60 dB on SSB/CW; an internal jumper allows AM selectivity of either 6/12 kHz or 2.7/6 kHz. An inexpensive conversion kit is available from Kenwood dealers to update the improved selectivity on older models. Agc release time is much improved over early models.

The digital display doubles as a 12-hour clock; AM/PM is also shown. An integral timer permits remote activation of a tape recorder, or simply provides for the receiver to be used as an expensive alarm clock!

To reduce strong-signal overload, a step attenuator switch is provided with increments of 0, 20, 40, and 60 dB. This feature is very useful for reduction of intermod products which may occur under certain strong-signal conditions.

A concentric tone control mounted on the volume control shaft provides moderate "treble" reduction. A built-in speaker affords excellent audio quality without introducing vibration instability to the receiver's performance.

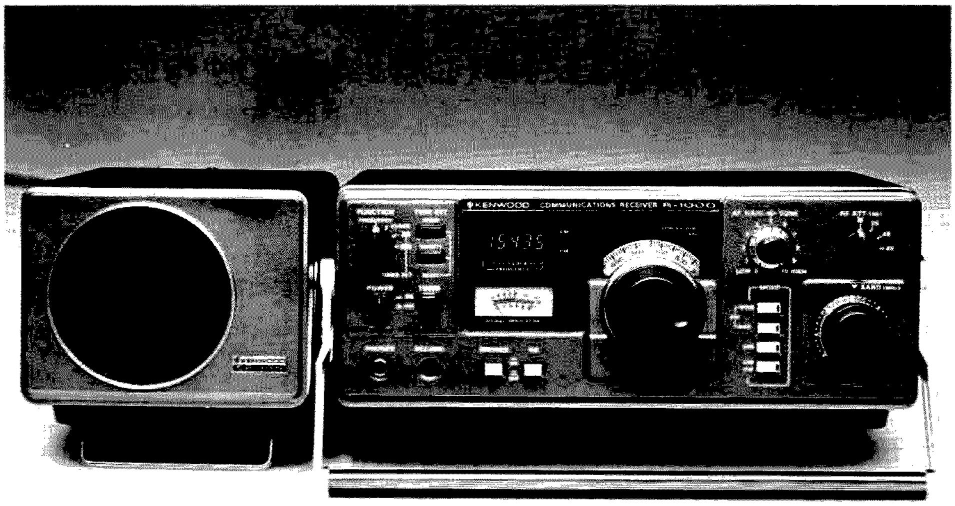
The noise blanker in the R-1000 deserves special comment. It is not merely another audio noise limiter. It is a complex pulse-noise eliminator capable of totally removing sharp electrical interference without degrading signal intelligibility in the slightest.

The rear apron allows a choice of antennas from coaxial-cable-fed (SO-239 connector provided) to random wire (spring-loaded terminals also provided). No ridiculous attached ferrite loop or built-in whip!

Internally, the PC board is a study in clean layout. Components are clearly identified, and the board itself is held securely in place by nine screws on nylon standoffs.

The circuit board is interconnected to the rest of the receiver by mating connectors and wiring harnesses.

The liberal use of Murata filters provides the i-f selectivity skirts which make reception on the cluttered shortwave bands much easier.



Kenwood's R-1000 general coverage receiver.

Spring-loaded mating gears prevent tuning mechanism backlash, and an all-brass gear mechanism lends more than a touch of professionalism to the mechanical design.

The use of subchassis modules divides functional portions of the circuit for easy troubleshooting and repair should it ever become necessary.

Additional plugs and jacks allow the use of an external speaker, headphones, tape recorder, and tranceive operation.

The R-1000 is accompanied by an excellent owner's manual. It is well-written, highly instructional, liberally illustrated, and quality-printed.

In sum, the new Kenwood R-1000 general coverage communications receiver offers low cost with no compromise. To quote a concerned competitor of Kenwood, "The R-1000 is the one to beat!" We couldn't agree more.

For further information, contact *Trio-Kenwood Communications, Inc., 1111 West Walnut, Compton CA 90220.*

Bob Grove WA4PYQ
Brasstown NC

SOFTWARE FROM THE PERIPHERAL PEOPLE

Radio amateurs will be interested in three new programs that have just been announced by The Peripheral People.

The first, called CODEFILE, permits transmission of data stored on diskettes by means of Morse code. The user specifies the sending speed (up to 50 wpm) and the file name to be transmitted. The program then converts the file contents to Morse code and transmits it as MCW out the cassette CSAVE jack.

While manual copy of long programs and text can be somewhat tedious, CODEFILE can be used in conjunction with CODECOPY, which translates the incoming code to screen display and hard copy printout. No hardware is required, although the user may wish to construct a simple VOX circuit to translate the audio tones into keying pulses in HF operation. CODEFILE is available on diskette only and works with either 32K or 48K systems.

Written for the TRS-80, HAMCALL is a disk-based sequential

access program that will easily maintain club, net, or individual records. It can be used with one or more disk drives and 32-48K of memory.

In addition to the usual name and address information, HAMCALL allows each record to be individually coded by interest, bands of operation, equipment, or any other codable information. Records can be selectively displayed or printed out using these codes. The printout can be a tabular listing or in the form of labels (1-4 across). HAMCALL also has the ability to sort by call letters (prefix or suffix), last name, or zip code.

MORSECOPY, also written for the TRS-80, translates incoming code (applied to the cassette CLOAD plug) and displays it on the screen. No hardware is required for VHF-modulated CW transmissions. Audio which exceeds the threshold level of the TRS-80 cassette input is passed for translation and screen display or hard-copy printout. A simple audio filter (using either 88-mH toroids or an operational amplifier) is required to separate interfering signals on the HF bands. Either circuit can be easily constructed by radio amateurs.

MORSECOPY will translate and display transmissions up to 35 wpm if the cassette load modification has not been incorporated by Radio Shack. The installation of this modification will slow the translation speed slightly. The program can cope with minor changes in speeds and has "catch up" provision if the sending speed is significantly increased or decreased.

For additional information, contact *The Peripheral People, PO Box 524, Mercer Island WA 98040; 206-232-4505.* Reader Service number 480.

KLM's 40-10V MULTIBAND VERTICAL

KLM's 40-10V multiband vertical uses a series of lossless linear loading and efficient hi-Q air capacitor sections on 20, 15, and 10 meters similar to those on the highly successful KT-34A and KT-34XA tribanders. Old-style power-robbing coils and capacitors have been completely eliminated.

The 40-10V provides broadband coverage. *All* of 40 meters is accessible (with no tuning adjustment) at 1.51:1 vswr and better. Optimized tuning is also possible using the adjustable element tip. And, just two settings on each band provide complete coverage of 20, 15, and 10 meters at 1.51:1 vswr and better.

The 40-10V is self-supporting and no guying is necessary. It is designed for mast, stake, or sidewall mounting. All the aluminum tubing is the strong, weather-resistant 6063-T832 alloy, and all electrical hardware is stainless steel. Nominal feed impedance is 50 Ohms and wind load is 2 square feet. For more information, contact *KLM Electronics, PO Box 816, Morgan Hill CA 95037.* Reader Service number 477.

RSGB WORLD PREFIX MAP

Are the walls of your shack dull and drab? You can add some excitement with a multicolored world prefix map from the Radio Society of Great Britian (RSGB). Its large size (approximately 46 x 32 inches) and uncluttered layout make it a useful operating aid for the DXer. Prefixes for nationalities *and* domestic districts can be easily read. The recent callsign changes have been accounted for, making the map up-to-date. The colorful format includes time zones and geographic highlights. This map was designed with the active ham in mind and may be purchased for £2.21 (including postage worldwide)—approximately $5.25—from *RSGB, 35 Doughty St., London WC1N 2AE.* Reader Service number 479.

Tim Daniel N8RK
***73* Staff**

✓ Reader Service—see page 195

OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80TM microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR AUGUST

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
26125	1	0108:14	89.1
26137	2	0007:32	73.9
26150	3	0101:48	87.5
26162	4	0001:06	72.4
26175	5	0055:22	86.0
26188	6	0149:37	99.5
26200	7	0048:56	84.4
26213	8	0143:11	98.0
26225	9	0042:30	82.8
26238	10	0136:45	96.4
26250	11	0036:03	81.3
26263	12	0130:19	94.9
26275	13	0029:37	79.7
26288	14	0123:53	93.3
26300	15	0023:11	78.1
26313	16	0117:27	91.7
26325	17	0016:45	76.6
26338	18	0111:00	90.2
26350	19	0010:19	75.0
26363	20	0104:34	88.6
26375	21	0003:53	73.4
26388	22	0058:08	87.0
26401	23	0152:23	100.6
26413	24	0051:42	85.5
26426	25	0145:57	99.1
26438	26	0045:16	83.9
26451	27	0139:31	97.5
26463	28	0038:50	82.3
26476	29	0133:05	95.9
26488	30	0032:24	80.8
26501	31	0126:39	94.4

OSCAR 8 ORBITAL INFORMATION FOR AUGUST

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
12267	1	0042:29	63.8
12281	2	0047:17	65.0
12295	3	0052:04	66.3
12309	4	0056:51	67.5
12323	5	0101:39	68.7
12337	6	0106:26	69.9
12351	7	0111:13	71.1
12365	8	0116:00	72.4
12379	9	0120:48	73.6
12393	10	0125:35	74.8
12407	11	0130:22	76.0
12421	12	0135:09	77.2
12435	13	0139:56	78.5
12448	14	0001:31	53.9
12462	15	0006:17	55.1
12476	16	0011:04	56.3
12490	17	0015:51	57.5
12504	18	0020:38	58.8
12518	19	0025:24	60.0
12532	20	0030:11	61.2
12546	21	0034:57	62.4
12560	22	0039:44	63.6
12574	23	0044:30	64.8
12588	24	0049:17	66.1
12602	25	0054:03	67.3
12616	26	0058:49	68.5
12630	27	0103:35	69.7
12644	28	0108:22	70.9
12658	29	0113:08	72.1
12672	30	0117:54	73.4
12686	31	0122:40	74.6

OSCAR 7 ORBITAL INFORMATION FOR SEPTEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
26513	1	0025:57	79.2
26526	2	0120:12	92.8
26538	3	0019:31	77.7
26551	4	0113:46	91.2
26563	5	0013:05	76.1
26576	6	0107:20	89.7
26588	7	0006:39	74.5
26601	8	0100:54	88.1
26613	9	0000:12	73.0
26626	10	0054:28	86.5
26639	11	0148:43	100.1
26651	12	0048:01	85.0
26664	13	0142:16	98.6
26676	14	0041:35	83.4
26689	15	0135:50	97.0
26701	16	0035:09	81.9
26714	17	0129:24	95.4
26726	18	0028:43	80.3
26739	19	0122:58	93.9
26751	20	0022:16	78.7
26764	21	0116:31	92.3
26776	22	0015:50	77.2
26789	23	0110:05	90.8
26801	24	0009:24	75.6
26814	25	0103:39	89.2
26826	26	0002:57	74.0
26839	27	0057:13	87.6
26852	28	0151:28	101.2
26864	29	0050:46	86.1
26877	30	0145:01	99.6

OSCAR 8 ORBITAL INFORMATION FOR SEPTEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
12700	1	0127:26	75.8
12714	2	0132:12	77.0
12728	3	0136:58	78.2
12742	4	0141:43	79.4
12755	5	0003:17	54.9
12769	6	0008:03	56.1
12783	7	0012:49	57.3
12797	8	0017:34	58.5
12811	9	0022:20	59.7
12825	10	0027:06	60.9
12839	11	0031:51	62.1
12853	12	0036:36	63.4
12867	13	0041:22	64.6
12881	14	0046:07	65.8
12895	15	0050:52	67.0
12909	16	0055:38	68.2
12923	17	0100:23	69.4
12937	18	0105:08	70.6
12951	19	0109:53	71.8
12965	20	0114:38	73.1
12979	21	0119:23	74.3
12993	22	0124:08	75.5
13007	23	0128:53	76.7
13021	24	0133:38	77.9
13035	25	0138:22	79.1
13049	26	0143:07	80.3
13062	27	0004:40	55.7
13076	28	0009:25	56.9
13090	29	0014:09	58.2
13184	30	0018:54	59.4

FCC

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47 CFR Part 97

[PR Docket No. 79-285; RM-3207; RM-3313; FCC 80-286]

Amateur Radio Service; Deleting Restriction Which Limits The Allowable Bandwidth of Frequency Modulated (FM) Voice Emissions in the 50-54 MHz Band

AGENCY: Federal Communications Commission.

ACTION: Final Rule.

SUMMARY: In the Amateur Radio Service, the Commission is deleting the restriction which limits the allowable bandwidth of frequency modulated (FM) voice emissions in the 50-54 MHz band. The restriction is technologically obsolete. The effect of this action is to allow the use of conventional land-mobile FM voice emission between 50.1 MHz and 52.5 MHz.

EFFECTIVE DATE: July 14, 1980.

ADDRESSES: Federal Communications Commission, Washington, DC 20554.

FOR FURTHER INFORMATION CONTACT: Maurice DePont or Jay Jackson, Private Radio Bureau (202) 254-6884.

SUPPLEMENTARY INFORMATION: In the matter of amendment of § 97.65(c) of the Commission's rules and regulations governing the Amateur Radio Service, PR Docket 79-285, RM-3207, RM-3313. See also 44 FR 64442, November 7, 1980.

Report and Order

Adopted: May 29, 1980.

Released: June 10, 1980.

1. Our Notice of Proposed Rule Making in this proceeding was released on October 31, 1979, and published in the Federal Register on November 7, 1979 (44 FR 64442). In the Notice, we proposed to amend § 97.65(c) so that the frequency modulated (FM) voice emission bandwidth limitation contained therein would no longer apply to the 6 meter amateur band (50-54 MHz). We further proposed to delete the phrase "* * * and the purity and stability of emissions shall comply with the requirements of § 97.73." since it is redundant.

2. Section 97.65(c) currently limits the maximum allowable bandwidth of an FM voice emission, transmitted between 50.1 and 52.5 MHz, to that of an amplitude modulated (AM) voice emission having the same audio characteristics. At the present time, most amateur rario operators who use FM use the FM emission which is standard in the commercial land-mobile radio services. Because this emission has a wider bandwidth than an AM voice emission having the same audio characteristics, it may not currently, under the rules, be transmitted between 50.1 and 52.5 MHz. Removing the restriction, as proposed, would allow the use of this conventional land-mobile FM voice emission between 50.1 and 52.5 MHz.

3. We received forty-nine comments and reply comments in this proceeding. Fourteen staunchly supported the proposal and urged that it be adopted as presented. Eleven favored the proposal, but had reservations about it which found expression in counterproposals of various sorts. These counterproposals generally offered alternative frequency segments where conventional land-mobile FM voice emissions should not be permitted. The remaining twenty-four flatly disagreed with the proposal and

requested that the rule remain unchanged.

4. The issue in this proceeding is whether or not a technologically obsolete restriction should be retained in a portion of the 6 meter band. However, the comments focused on the question of whether or not conventional land-mobile FM voice emissions can co-exist with single sideband voice emissions. Opponents of the proposal were concerned that FM users would take over the entire 6 meter band and preclude its use by single sideband users. Proponents of the proposal, on the other hand, believed that amateur radio operators could and would successfully resolve any problems by voluntarily developing sharing arrangements and band-plans which would accommodate most, if not all, of the various operating interests.

5. We agree with the proponents of the proposal. We expect that the experience which amateur radio operators have gained through developing successful sharing arrangements in the 144 MHz, 220 MHz, and 420 MHz bands will be brought into play, and that frequencies in the 6 meter band will continue to be used in a manner that is satisfactory to all concerned. We believe that the inherent flexibility in this approach outweighs any difficulty which amateur radio operators might have in reaching sharing agreements. Therefore, we are removing the FM voice emission bandwidth restriction from the 6 meter band.

6. We are also deleting the phrase in § 97.65(c) which refers to § 97.73. That latter section, which deals with the purity and stability of emissions, applies to all amateur radio transmitters, regardless of the type of emission used. Thus, the reference to it in § 97.65(c) is unnecessary.

7. Accordingly, it is ordered, that, effective July 14, 1980, Part 97 of the Commission's rules is amended as shown in the Appendix attached below. Authority for this action is found in Sections 4(i) and 303(r) of the Communications Act of 1934, as amended. It is further ordered, that this proceeding is terminated and the docket is closed.

8. For further information on this rule change, contact Maurice DePont or Jay Jackson, (202) 254-6884.

(Secs. 4, 303, 48 Stat., as amended, 1066, 1082; (47 U.S.C. 154, 303))

Federal Communications Commission.

William J. Tricarico,
Secretary.

Appendix

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended, as follows:

In § 97.65, paragraph (c) is amended to read:

§ 97.65 Emission limitations.

* * * * *

(c) On frequencies below 29.0 MHz, the bandwidth of an F3 emission (frequency or phase modulation) shall not exceed that of an A3 emission having the same audio characteristics.

* * * * *

[FR Doc. 80-17933 Filed 6-12-80; 8:45 am]
BILLING CODE 6712-01-M

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47 CFR Part 97

[Docket No. 21135; FCC 80-285]

Simplification of the Licensing and Call Sign Assignment Systems for Stations in the Amateur Radio Service

AGENCY: Federal Communications Commission.

ACTION: Third Report and Order.

SUMMARY: In the Amateur Radio Service, the Commission is authorizing modification and renewal only of existing club and military recreation station licenses. Likewise, in the Radio Amateur Civil Emergency Service (RACES), only modification and renewal of station licenses will be permitted. New station licenses for these types of stations will not be granted.

EFFECTIVE DATE: July 14, 1980.

ADDRESSES: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: Maurice J. DePont, Private Radio Bureau, Rules Division, (202) 254-6884.

SUPPLEMENTARY INFORMATION: In the matter of the simplification of the licensing and call sign assignment systems for stations in the Amateur Radio Service, Docket No. 21135, see also 43 FR 15325, March 13, 1979.

Third Report and Order

Adopted: May 29, 1980.
Released: June 10, 1980.

1. Our Notice of Proposed Rule Making in this proceeding was released on March 11, 1977, (42 FR 15438). In it, we proposed to simplify the amateur licensing structure by discontinuing the issuance of all station licenses other than primary and space station, i.e., we would no longer issue secondary, special event, club, military recreation, RACES, repeater, auxiliary or control station licenses. Our goal was to simplify our application processing system in order to provide an efficient licensing service to the public, within our manpower and resource allocations.

2. The comments received in response to the Notice showed how deeply concerned amateur licensees were about our proposal to eliminate club, military recreation and RACES station licenses. Accordingly, the Commission issued a Further Notice of Proposed Rule Making on February 23, 1978, (43 FR 7332), proposing to license these stations in a way that would conserve staff resources. The Further Notice proposed that distinctive call signs be assigned these stations. The prefixes WK, WM, and WC would be assigned to club, military recreation, and RACES stations, respectively. In addition, expiration dates for these types of stations were to be staggered in order to reduce the Commission's workload. Eligibility for club station licenses was to be revised to require new and existing licensees to demonstrate a compelling need for such licenses. No trustee was to be required for a club station. Comments to the Further Notice were due on or before June 2, 1978, with reply comments due on or before June 30, 1978.

3. Approximately 150 comments and reply comments were received in response to the Further Notice. Most of the comments dealt with the proposal to assign a WK prefix to club stations. The opponents felt that presently licensed club stations should be allowed to retain and renew their licenses, keeping their present call signs. They did not want a distinctive club prefix that would identify club stations as a class. It was felt that the present club call sign fostered a sense of identity among club members and created good will in the community for the club. The present club licensees who commented also believed that a club should not have to show a compelling need in order to obtain a license. The proposal to eliminate club trustees likewise met with a negative response, since present licensees felt it was desirable to have someone in charge who would be responsible for the proper operation of the station.

4. The comments showed how much amateur operators want to have a familiar club call sign when they participate in field day activities and when they operate their stations to assist in times of emergencies. The Enid Amateur Radio Club, Inc., Enid, Oklahoma, brought out the economic hardship for clubs, if they were assigned new call signs: "There is much sentimentality attached to this call sign. All our records, our stationery, our publicity signs, QSL cards, equipment, our clubroom—these all are emblazoned with our call sign. Every magazine in the club library has been stamped with (the club call sign) for identification of ownership."

5. With respect to military recreation and RACES stations, the comments filed by the Department of Defense (DOD) supported the continued issuance of a separate RACES license with a distincitive call sign to each civil defense organization. DOD also wanted separate licenses for military recreation stations, with a call sign that would preserve the historical identity of the station, arguing that such stations are unique and contribute to the morale and welfare of military personnel.

6. We have reviewed carefully all the comments filed in response to the Further Notice in this proceeding. We appreciate the investment, both emotional and financial, that amateur operators have in their call signs. Therefore, we believe that the public interest will be served by accommodating present licensees of club, military recreation, and RACES stations by granting modification and renewal of existing licenses. In this connection, a change in the trustee of a club, person in charge of the military recreation station, or responsible civil defense official will be treated as a modification to the existing station license. In addition, a change in the station location or a change in the name of an existing station will be construed as a license modification. No new call signs would be assigned.

7. We would anticipate that the desire for a new license would arise most often in connection with club stations. We would expect that the members of a club would select a licensed amateur radio operator as trustee for the station and then use the trustee's primary station call sign as the club's call sign. Moreover, there would be no objection, after the station had identified with the primary station call sign, to the control operator's adding-on the club's name as further identification. We believe that there is merit in limiting the proliferation of call signs and that it comports with our efforts to deregulate the Amateur Radio Service. Further, the tradition for self-regulation by Amateur radio licensees assures us that full responsibility for a station's operation will be borne by the primary station licensee.

8. Accordingly, it is ordered, that, effective July 14, 1980, Part 97 of the Commission's rules is amended as shown in the Appendix attached below. Authority for this action is found in Sections 4(i) and 303(r) of the Communications Act of 1934, as amended. The disposition of the question concerning the licensing of club, military recreation, and RACES stations is the sole remaining issue in this docket. Inasmuch as our action herein resolves the matter, this proceeding is hereby terminated and the docket is closed.

9. For further information on these rule changes contact Maurice J. DePont, (202) 254-6884.

(Secs. 4, 303, 48 stat., as amended, 1066, 1082; (47 U.S.C. 154, 303))

Federal Communications Commission.

William J. Tricarico,
Secretary.

Appendix

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended, as follows:

1. The present text of § 97.37 is designated as paragraph (a) and a new paragraph (b) is added to read as follows:

§ 97.37 General eligibility for station license.

(a) An amateur radio station license will be issued only to a licened amateur radio operator, except that a military recreation station license may also be issued to an individual not licensed as an amateur radio operator (other than a representative of a foreign government), who is in charge of a proposed military recreation station not operated by the U.S. Government but which is to be located in approved public quarters.

(b) Only modification and/or renewal station licenses will be issued for club and military recreation stations. No new licenses will be issued for these types of stations.

2. The present text of § 97.171 is designated as paragraph (a) and a new paragraph (b) is added to read as follows:

§ 97.171 Eligibility for RACES station license.

(a) A RACES station will only be licensed to a local, regional, or state civil defense organization.

(b) Only modification and/or renewal station licenses will be issued for RACES stations. No new licenses will be issued for RACES stations.

[FR Doc. 80-17931 Filed 6-12-80; 8:45 am]
BILLING CODE 6712-01-M

Ham Help

I need a schematic and operating instructions for the AN/USM-81 oscilloscope made by Hickok. I also need a parts list and schematic for a Honeywell Model 782 strobe. I will be happy to pay for any copying and shipping charges. Thanks.

Carl F. Antone W6OZA
4540 Lawrence Drive
Castro Valley CA 94546

I need a tech manual and schematics for the Signal Corps receiver/transmitter BC-1000.

K. E. Davidson
Box 85
APO NY 09305

I need information, a schematic, etc., on a Truetone Radio, Model D2663.

Richard W. Randall K6ARE
1263 Lakehurst Rd.
Livermore CA 94550

I am looking for a schematic or information on the Friden Flexowriter Programatic Typewriter. I have a Model FPC-5P which has a 5-level Baudot paper tape punch/read assembly. I would like to interface this for computer use or RTTY.

Robert G. Gilman
Box 103
Hellertown PA 18055

Corrections

Those who built my "Cheapy Scanner for the Memorizer" (April, 1980) may wish to add another feature to it.

In the article, I stated that one should be able to add an auto-reverse feature by simply decoding the 4 and 8 of the 144-148. By adding two chips and one resistor, you can build this circuit in one evening. Follow the same procedure as for the scanner. Follow Fig. 1, work slowly, and double-check your wiring. Happy scanning.

Steve Laufer WA2ORU
Fair Lawn NJ

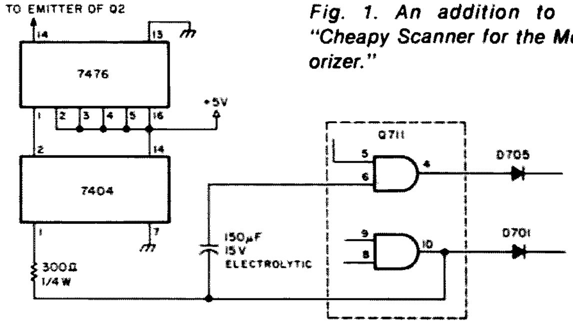
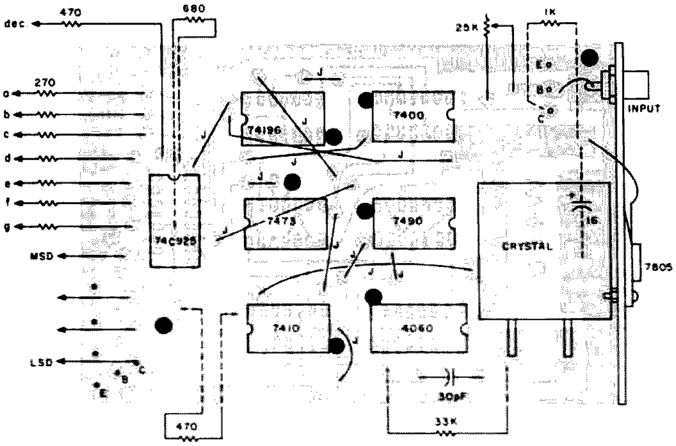


Fig. 1. An addition to the "Cheapy Scanner for the Memorizer."



Revised Fig. 3, "Down with Interpolation."

There are several corrections to my article "Down with Interpolation," which appeared in the June issue.

First, in Fig. 1, the readout schematic, the ground pin on the 7473 should be labeled 11, not 7. The pins at the bottoms of the LEDs should be labeled 4 or 12. The 7400 series TTL ICs can be replaced by 74LS types with a slight reduction in current consumption.

Also, in Fig. 3, the parts placement, one jumper was shown incorrectly and one omitted. A corrected version is shown here.

I have been advised by O. C. Stafford, 427 South Benbow Road, Greensboro NC 27401, that he will supply the PC board for $7.50 postpaid. Finally, the patterns shown in Fig. 4 are not to scale and cannot be used as templates.

Brooks Carter W4FQ
Irmo SC

Some corrections for my article "Electronic Dice—A Family Pleaser" (June, 1980): U2 and U4 should be labeled 4522; U3 should be labeled 4511; and U7 should be U5 and is a 4511. All pin connections shown on all ICs are correct.

Howard F. Batie W7BBX
Herndon VA

My article "The Stolen Rig Retriever" appeared in your June issue. Your readers may wish to know that although Intel Electronics has discontinued the manufacture of the no. 3622 PROM, Fairchild Electronics has a direct replacement, no. 93446.

A kit of parts, including the PROM programming, is available from Alpha Electronics Laboratories, 2302 Oakland Gravel Rd., Columbia MO 65201.

Harlan C. Curtis WB6KBM
Diamond Bar CA

Ham Help

I need an operator's manual for a Tequipco Model 3 in-circuit transistor and diode checker. The manufacturer was Test Equipment Corp., Houston TX. I will pay for copy or original.

E. W. Lambert
2227 Center Terrace
Grand Island NY 14072

Does anyone out there recognize any of the following computer circuit cards? These are all hamfest specials bought to build a cheap computer. Any photocopies of condensed manuals or schematics would be appreciated. I will pay for the favor. I've included all identification I could find. Thanks.

1. Datamedia 8080A CPU card. 2DAAA005, 9.36 MHz xtal, dated April 21, 1978, 2 2101. 2 empty 2101 slots, about 50 TTL, 2 28-pin sockets, all chips TI, 100-pin edge connector (not S-100). I got 2 for $5.00 each. Maybe it goes to a Datamedia smart terminal.

2. Small, unknown 6503 card. 6503, 6530, 6532 chips, 3.579 xtal, 36-pin connector on one side, 38-pin connector on other side, paper tag says "P/A model µP7-1, Rev. C C11-80139" on card. I paid $25.00. Maybe a video processor?

3. Big Univac memory card. ID numbers 7318-2-73 (1973?), 38-75, BE-3, Assy. 4161700-05. 72 Intel 4915636 MOS, B7720A chips (18-pin, 256 × 4 RAMs?), 2 100-pin connectors on one side, "3534009-01 Rev. G 127" stamped on other edge connector. I paid $5.00.

4. Small RAM cards. I was told they go to "Accukeyer." "Memory Bd. 1769-25" stamp. 24 Intel C1101A 256 × 1 RAMs, 2K × 3, 44-pin connector. I got 4 for $2.50 each.

Charles Gerbino
1831 Stanley Place
Falls Church VA 22043

I would like to obtain the schematic and service manual (will reproduce and return, if desired) for a Victor Company (Japan) 5" B&W TV, Model 4T-2OU and companion power supply, Model AC 21.

Joe Hustak WA5ZNQ
6821 NW 27th Street
Bethany OK 73008

I have a Hallicrafters SX-62A and need an operator's manual, schematic, alignment instructions, etc. (original or copies). I will pay for postage and copying. Please send a postcard.

Del Ogren WD9DNU
565B Lynn Ct.
Glendale Hts IL 60137

I am looking for a Mars vfo RX-2 or RA-2 which was part of the Galaxy transceiver line. Any help would be appreciated.

Louis Sila
1085 W. 27th St.
San Bernardino CA 92405

I am looking for a schematic for the Spectronics digital display Model DD-1. I will pay for copying and postage.

Francis J. Wittlinger K4QCO
4271 Pine St.
West Palm Beach FL 33406

Ham Help

I recently bid on a Collins KW-1 unit. As a schoolteacher, I would like to sponsor an amateur radio club—if I can obtain information on how the Collins KW-1 can be converted to SSB. I need to know how to bias the circuits and final amplifier to class AB1 operation from class C. Any information on using a Central Electronics phasing exciter to drive the KW-1 would be appreciated.

Stan Moraski N8BOH
7681 Fairmont Rd.
Russell Twp.
Novelty OH 44072

I desperately need one set of front-panel handles for a R-390 receiver.

Terry Simonds WB4FXD/1
PO Box 1558
Edgartown MA 02539

I would like to borrow or buy information and manuals on the following recently acquired surplus equipment: AM 3203/TRC 24; AM 914/TRC; Polarad Receiver R-B1; Polarad MSG-2, RS-T, RX-T; Polarad STU 4W/TSA-W, C-Band.

John Spigel WB2PAZ
1166 Middletown-Lincroft Rd.
Middletown NJ 07748

I need a schematic and instruction manual for a Hallicrafters SX-100 general coverage receiver.

Robert Bunn WA0LKE
Rt. 3, Box 565
West Plains MO 65775

I need a manual for a Midland 13-520 HT. I will copy and return promptly, or buy copy.

Jung Y. Lem KB6BO
5222 Coringa Dr.
Los Angeles CA 90042

I need the complete article and schematic on the "5-Band 50-Watt CW Transmitter" using a 12BY7 oscillator and 6DQ6B final which was in the 1968 or 1969 ARRL *Handbook*. I will be happy to pay for copying and mailing costs for a copy of the article or for the complete handbook at a reasonable price.

Bill Graham N8BMK
Box A 233A Rt. 5
Paris KY 40361

I need a service and operating manual and schematics for a Hammarlund HQ-150 receiver. I will copy and return *pronto*, or pay for same.

Wm. Ryan
163 W. Peterson
Brighton MI 48116

I would like to get in touch with hams who will be attending the Phoenix Institute of Technology in September in hopes of starting a club.

Rick Todd KA8AKL
14470 Basslake Rd.
Newbury OH 44065

Greenpeace, the anti-whaling organization, is in need of a San Francisco Bay area site for its ham station. The site must be able to accommodate a tower, a large log periodic antenna and high power. Those with a site or suggestions should contact me at the address below.

Dick Dillman N6VS
435 Utah Street, No. 4
San Francisco CA 94110
Phone: (415)-864-6320

I am most anxious to acquire acknowledgement cards from the ham radio station CE0AE on Easter Island (possession of Chile) which operated between 25 Nov 1968 and 31 Jan 1971. I wonder if any of your readers can help me out.

R. P. Alexander
4507 Van Ness St. NW
Washington DC 20016

I need a schematic and/or circuit information for a suitable noise-blanker circuit to use in a Hammarlund HQ-180A receiver.

Robert F. Cann W4GBB
1606 Lochwood Drive
Richmond VA 23233

I need any information on hints, kinks, and modifications for the Yaesu FT-101E. I am willing to pay.

Brian Stoll N8AFX
3025 Brockman
Ann Arbor MI 48104

✓ Reader Service—see page 195

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propagation

by
J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14	14	7A	7	14	21	21A	21A	21A	21A
AUSTRALIA	21	14	14	7B	7B	7B	7B	7B	7B	7B	14A	21
CANAL ZONE	21	14A	14	14	7	7	14	21	21	21A	21A	21A
ENGLAND	14	7	7	7	7	14	14	14	21	21	21	14A
HAWAII	21	14	14	7	7B	7B	7	14	14	14	21	21
INDIA	14	14	7B	7B	7B	7B	14	14	14	14	14	14
JAPAN	14A	14	14	7B	7B	7B	7	7	7	14	14	14
MEXICO	21	14	14	7	7	7	7	14	14	14	21	21
PHILIPPINES	14A	14	14B	7B	7B	7B	7B	7A	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	14	7B	7B	14	14	14A	21	21	21A	21A	14A	14
U. S. S. R.	7A	7	7	7	7	14	14	14	14	14A	21	14
WEST COAST	21	14	14	7	7	7	7A	14	14	14A	21	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14	14	7A	7	14	21	21A	21A	21A	21A
AUSTRALIA	21	14A	14	14	14	7B	7B	7B	7B	7B	14A	21
CANAL ZONE	21	14A	14	14	7	7	14	21	21	21A	21A	21A
ENGLAND	14	7	7	7	7	7	14	14	14	14	14A	14
HAWAII	21	21	14	14	7	7	7	14	14	21	21	21
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	14A	14	14	14B	7B	7	7	7	7	14	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14A
PHILIPPINES	14A	14A	14	7B	7B	7B	7B	7A	14	14	14	14
PUERTO RICO	21	14A	14	14	7	7	14	14	14A	14A	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	14B	14A	21	21	21	14A	14
U. S. S. R.	7A	7	7	7	7	7B	14	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14	14	7A	7	7	14	21A	21A	21A	21A
AUSTRALIA	21A	21A	21	14A	14	14	14	14	7B	7B	14A	21
CANAL ZONE	21	14A	14	14	7	7	7A	21	21	21A	21A	21A
ENGLAND	14	7	7	7	7	7	7B	14	14	14	14	14
HAWAII	21A	21A	21	14	14	14	7A	14	14	21	21	21
INDIA	14	14	14	14	7B	7B	7B	7B	14	14	14	14
JAPAN	21	14A	14	14	14	7	7	7	7	14	14	14A
MEXICO	21	14	14	7	7	7	7	14	14	14	21	21
PHILIPPINES	21	21	14A	14	14	14B	7B	7A	14	14	14	14A
PUERTO RICO	21	14A	14	14	7	7	7	14	14	14A	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	14	14	14A	14A	14A	14
U. S. S. R.	7A	7	7	7	7	7B	7B	14	14	14	14	14
EAST COAST	21	14	14	7	7	7	7A	14	14	14A	21	21

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

august

sun	mon	tue	wed	thu	fri	sat
					1 G	2 G
3 G	4 G	5 G	6 G	7 G	8 F/SF	9 P/SF
10 F	11 G	12 G	13 F/SF	14 P/SF	15 F	16 G
17 G	18 G	19 G	20 G	21 G	22 G	23 G
24/31 G/G	25 G	26 F	27 G	28 G	29 G	30 G

September 1980 $2.95

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COMING NEXT MONTH: OUR GALA 20TH ANNIVERSARY ISSUE!

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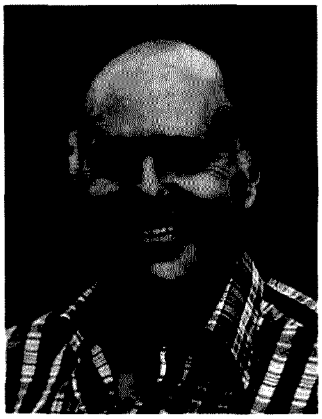
W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



AUTOMATIC IDENTIFICATION

Just a few years ago, it was a big deal to build a circuit which could allow a car horn to send "hi." The best way to send any repeated code signal was to make a code wheel out of metal and have it operate a microswitch. One long-forgotten firm even had such a device on the market.

When amateurs were first permitted to send frequency-shift Teletype™ signals on the low bands, the rules called for identification in Morse code as well as on RTTY. Lacking any simple way to do this mechanically, amateurs installed hand keys on the sides of their printers and signed on and off each transmission with hand-set code . . . hating it.

I think it was around 1951 when I got involved with a beacon station for six meters. I set it up on the standard beacon frequency of 50.1 MHz and had a converted BC-624 (SCR-522 transmitter) perking away (832 final). It was keyed by an aluminum disk on a slow-turning motor. My call letters were hacked out of the periphery of the disk and operated the microswitch, which in turn keyed the transmitter.

Six meters was not very populated in those days and thus beacons were quite helpful. It made it possible to leave your receiver on one channel and spot band openings quickly. A government-sponsored project to investigate six-meter propagation, the Radio Amateur Scientific Observations (RASO), was being run by a chap named Perry Ferrell from down in New Jersey. I got a nice certificate for participating in that project.

Later Perry became the editor of *CQ* magazine and this paved the way for my *CQ* column on RTTY. I started a monthly RTTY newsletter in 1951—Perry liked that and thought more hams should be exposed to RTTY. The *CQ* column led to my taking over the editorship of *CQ* in 1955 when Perry moved on up to edit *Popular Electronics*.

In those days, I was the only active amateur in all of New York City on six meters! There were a few pioneers out in New Jersey and some up in Westchester, but no one else in New York.

Today, with digital electronics, it is simple to put together an identifier. Indeed, several thousand repeaters have them. I've been a bit surprised that phone ops have not added a small Morse identifier to their station to take care of the ten-minute identification requirements, sending the call softly in the background.

Now, with the authorization of ASCII coding, the door is open for a radical step forward in amateur operating. I first began to think about this when I was mulling over some possible solutions to the crowding which was expected to develop through the Phase III ham satellite. If we were going to try to use our decades-old techniques of pileups to work through the narrow band available, we could look forward to increasing frustrations and jamming. Something new was badly needed.

This will hold, too, for the eventually coming new DX bands, which are very narrow and will be epics in interference unless new modes of communications are devised.

Speaking of the recently demised satellite, I suspect that the taking over of AMSAT by the League may turn out to be a serious problem. While many amateurs still implicitly trust the ARRL, a large percentage of the amateurs are not so easily convinced that it is much different from any other similar bureaucracy. The AMSAT-ARRL connection may give the impression that satellite funding will be coming from the League and thus discourage donations from amateurs interested in helping ham growth. I'd like to see more written about this so that we can get AMSAT moving again.

Getting back to identification, suppose all ham rigs had a continuous identifier going in the background, sending your call

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in subaudible tones with ASCII coding. With this you would be able to tune in a station, whether on sideband or FM, and read out the call letters immediately on your receiver. Being in the audio spectrum below the passband of your receiver, you would not normally hear the ID, but it would continuously read out for you.

For starters, this would make tuning the DX bands a lot more exciting. You would know quickly what station you are copying. But there would be some far more important benefits to this relatively simple system. The subcarrier tones would permit a receiver to tune automatically to each station and zero in on it. Automatic tuning would not be difficult to build into receivers.

The next step is obvious. . . a microcomputer system to check each station tuned, looking for the station or prefix of your choice. You wouldn't miss those DXpeditions any more, and, with proper programming, your receiver would let you know instantly when *any* unworked prefix was being received.

Skeds? You could set your receiver to tune a segment of the band or check a certain few repeaters looking for a signal from your friends.

The next step beyond that would be simple, too. . . automatic contact with a desired station, with the whole works recorded for you. In this way, you could work DX without even being home. By getting these automatic contacts down to the bare minimum requirements for certificates, contacts could be made in a second or two. . . perhaps even including the swapping of the QSL over the air!

But, I hear you say, the rules . . . the rules. . . they say you have to be in control of your station. Sure they do. And, if your station is programmed by you to operate in a certain way and has appropriate fail-safe measures, are you *not* in control? No one else is. The rules are suitably vague and should be left alone.

Perhaps, by reducing the value of some certificates and "honors," we will be able to change amateur radio enough so that operators in rare spots around the world will actually be able to sit and chew the rag, without being driven up the wall by DX hunters. You may enjoy being in the rare DX seat for a few days while on a DXpedition, but after a few weeks of the screaming and pileups, you'd go the route of most other rare DX operators. . . QRT.

Those obsessed with certificates could work toward faster and faster six-band DXCC. Or even DXCCC. . . why think small?

MAKING IT HAPPEN

Hypothesizing and dreaming is one thing. . . and making it happen is something else. In this case, we are not talking about very much in the way of technical breakthroughs, but mostly of the need for some experimenting and pioneering to make this all happen.

Those of you who have been around amateur radio for twenty years will remember the part *73 Magazine* played in getting sideband firmly entrenched. I started this push back when I was editor of *CQ* and then followed through with it in *73*. More recently, just a bit over ten years ago, I decided that FM and repeaters were just too much fun for the handful of pioneers who were experimenting with it. With no help whatsoever from any other ham magazines, I plunged into promoting FM. . . with hundreds of articles, books, FM symposia, and even a monthly newsletter.

Within two years, FM took hold and we began to see commercial equipment for it. . . even commercially-made repeaters. The frequencies were standardized and the usual bunch of fast-buck artists driven out of the field. Today, there are more hams active on 2m than on any other ham band.

With the solid backing of *73*, I think we can develop an automatic identification system and make it universally accepted. The equipment for the transmitter is simple, probably using a programmable memory (PROM) with the call in it and a second chip to generate the subaudible tones.

The receiver circuits can be simple, too, at least for starters. I'm sure we will be seeing ever more complex circuits to get more and more out of the system. This will mean opportunities for amateurs who are into being entrepreneurs.

To get started, I'd like to see articles on the subject and simple technical construction projects. I'd like to see a hundred articles. . . a thousand articles. Eventually we'll have much of it built into chips, but at first we'll have to work with gates and microprocessors.

PROTOCOLS

Since we are already authorized to send ASCII at 300 baud, perhaps we should start with that and try later to step up that speed, if possible. Even so, for identification, 300 baud is not bad. In case you are having any problem translating that into more familiar terms, 300 baud means that 300 bits per second are sent. If we use the normal ASCII system of eight bits for each character, one start bit and two stop bits (or one parity bit and one stop bit), we end up being able to send 27 characters per second. If we figure the normal call to be six characters and add a seventh as a space, we come up with about one quarter of a second to send a call.

With a little cunning, we could do a better encoding job and get the call down to four eight-bit groups (32 bits), but the time saved would not be significant and the system would not be compatible with other uses such as sending messages and intercomputer communications. Let's get going with standard ASCII and see what we can do.

At first, I expect we'll be seeing add-on equipment for our stations, but eventually the manufacturers will be building in the digital identification (DI) circuits.

Who will be first with articles on this?

UNIVERSAL SLOW SCAN

Slow scan television never really caught on with amateurs. Oh, we've had hundreds active at many times in the past, but in general the pattern has been for the enthusiasm for this mode to blow over after a few months of excitement. Pity, because I think slow scan has some valuable uses in amateur radio. . . but has never really had a chance to seek its rightful place.

The normal pattern, which I went through, along with several thousand other amateurs, was to first get interested. . . then buy a camera and monitor. It's easy to get set up and the first few contacts are truly exciting. But after a while, the

Continued on page 155

Looking West

Bill Pasternak WA6ITF
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Newhall CA 91321

Have you ever thought of writing a book? I mean a real, honest-to-goodness book about something you felt you knew something about? I had never given this idea much thought until about two and a half years ago, when I received a rather unexpected phone call. It was from Ken Sessions K6MVH. Those of you who have been around the FM scene for any length of time will remember Ken. He was one of the mode's pioneers. Ken wrote the first *FM and Repeater Handbook* published by TAB books back in 1969, a book that was for many years the bible of FM and repeater operation. Ken is a truly prolific writer in his own right, as any of you who have read his work will attest. His *Chronicles of .76* is a classic.

As I said, I had never given any thought to writing a book of any sort. Writing Looking West and other assorted articles for *73* and *Worldradio* was more than enough to keep my busy. Anyhow, Ken called and asked if I wanted to write a book about amateur FM and repeaters. At that point I could not readily make a decision, so I asked for a few days to think things over. A few days passed, and along came a follow-up letter from Ken on the same matter. Finally, I said to myself: "Why not? Others have done it—why not me?" I called Ken and told him to arrange things with TAB. The book was to be a new version of his original *FM and Repeater Handbook*. At least that was the original intent.

Some 30 months have gone by, and last week a box arrived at my home from TAB. In it were a dozen copies of the new book, aptly titled *The Practical Handbook of Amateur Radio FM and Repeaters*. The original contract called for 300 pages. The published text comes to 538, and weighs almost three quarters of a pound! Writing the book was another of those experiences of a lifetime; I rank it second only to working on the "World of Amateur Radio" film with Dave Bell and Roy Neal. Actually, I worked both projects at the same time. This was done while I was also working a 5-day-a-week normal job and still devoting a lot of time to producing this column. For the record, I have to state that I have the world's most understanding and supportive wife. I know of very few XYLs who would put up with someone as devoted to amateur radio as I am. She kept me going, and the book, film, and everything else are accomplishments that she has had a quiet but important part in.

I said earlier that the original intent of the book was to update Ken's book. As things progressed, a totally different tack developed. Rather than an update, I wound up with what appears to be an almost entirely new book. There are three very good reasons that this happened. In order, they are Mike Morris WA6ILQ, the book's chief technical advisor, Ray Thill WA9EXP/6, its second chief technical advisor, and—most of all—the overall amateur VHF/UHF population of this country. When input or information was needed, it was always forthcoming. Because of this, certain items that most people thought would never reach print are now there for the taking. These include such items as Joe Domke W2MNN/6's simplex autopatch and probably the best touchtone decoder ever designed, that of WA6AWD. In essence, *The Practical Handbook of Amateur Radio FM and Repeaters* is a book for the VHF/UHF FMer derived from national input. Over a hundred individuals, clubs, organizations, and equipment manufacturers provided material for it, and when we finished pre-editing prior to shipment to the publisher, we had enough material left over to begin a second volume.

However, I digress. My purpose in writing about the book is not to get you to buy it. If you need a book of that type, then I think you will find it of value. What's interesting is that I now believe that anyone can write a book on a given topic, given the time and motivation. In my case, it was simple. For years I have been collecting data about VHF, UHF, FM, and repeaters, much of it from first-hand experience. For a long time, I wondered what to do with this data. How could my experiences benefit others? This couldn't happen unless I could find a way to get this information to those who might need it most. That was the reason I took on the project, and the reason that Mike and I have decided to continue writing books on this and allied topics. We have developed a good working relationship. He handles anything of a technical nature and I do the historical, biographical, operational, and all other peripheral work. The best part is that we can work together for hours at a clip without getting on one another's nerves.

Anyway, I think we have accomplished something with this book, but only you can be the judge. I want to hear from you. I want your opinions and input and your suggestions on future works of this type. I enjoyed writing the book and hope you will enjoy reading it.

SIX-METER DEREGULATION

As of July 14th, 16F3 and other wide bandwidth modes could operate on the entire six-meter band. This was a result of a change to the regulations announced in late May. The only restricted area is 50.0 to 50.1, which is still CW only. This deregulation is a double-edged sword in that it calls for some judicious planning to protect interests already established on that band, as well as further deregulation to permit a truly viable relay band plan to be established.

Since the day I became an amateur, I have been a devotee of six meters. I went through its DX era in the early 60s, made the switch from AM to SSB in the mid-60s, and have watched its unfortunate deterioration since then. When I first got onto 6 meters, rag-chew sessions were commonplace. Most of us ran 5 to 10 Watts AM in those days, and all-night QSOs were common. With the coming of SSB, QSOs became shorter as DXing grew a bit easier. Then, in the late 60s, the nation went 2-meter-FM happy, and six was all but left to rot. I must admit having been caught up in the FM craze myself, and along about 1970 I abandoned six. There was one very good reason. Though I had one of the best SSB stations on the air from New York, there were very few stations to talk with any more. For the record, my last big-league six-meter station consisted of a Swan 250C SSB transceiver and a Hammarlund HQ-110A VHF back-up receiver (with a good product detector installed) fed by a Telco low-noise converter. For added kick, the 250C fed a pair of 4-400As in grounded grid configuration, and on the roof were a pair of stacked 6-element Hy-Gain full-size wide-spaced beams. I had my dream station, but with only a handful of people to talk with, my personal interest waned. Remember, that was the low ebb of the DX cycle. By 1968, I was already spending more time on 2, and by 1970 the station was but a memory.

When I moved to California in 1972, I put up antennas not only for two meters, but for six meters as well. Even with a 3-element beam and 100 Watts of AM, contacts were virtually non-existent. I still had the HQ-110 in those days, and listening around 50.110 I counted about as many people using six out here as there were back in New York. Today, the only radio I have that operates on the 50-MHz band is a Polycomm 6. Remember them? Back in the early 60s, having a Polycomm on 6 was akin to owning a Collins S-Line on HF. How things change. I purchased this one mint at a Mt. Wilson Repeater Association swap meet for $20 about three years ago. It's used only to listen to a local 6-meter repeater using slope detection. Once in a while, I tune it to the low-end and hear some SSB, but not all that much. Six, by and large, is still a deserted band, but it has been far from forgotten by the at least 3700 amateurs who comprise an organization known as SMIRK.

I recently had an opportunity to talk on the telephone with SMIRK's chief officer, Ray Clark K5ZMS (7158 Stone Fence, San Antonio TX 78227). I had called Ray to discuss the recent deregulation with him, and we agreed that judicious planning at this time is essential to the redevelopment of six meters. If our feelings differ at all, it's in where a repeater subband should begin.

While it's now permitted to operate FM below 52.5, repeaters are still restricted to the existing subband. For years, controversy has raged about the best six-meter band plan. In

Continued on page 162

DX

Jim Cain K1TN
306 Vernon Avenue
Vernon CT 06066

If you read this spot in July ("DXing in the Eighties"), you are probably anxiously awaiting our obvious next move, which would be advocating free radio for all, peoples' rights to the airwaves, and so on. Breathe again, because you won't see that from this writer. Actually, we may already be there with the Novice test now merely code "recognition" and the license lasting five years.

The latest periodical added to the several dozen which we subscribe to was *Mother Earth News*, which started a few years ago as a very small, struggling magazine published by a bunch of hippies in the backwoods of North Carolina. Today, *MEN* is a highly polished, slick magazine with a large circulation published by a bunch of hippies in the backwoods of North Carolina. Their masthead says *MEN* places "heavy emphasis on alternative energy and lifestyles, ecology, working with nature, and doing more with less."

And what do you know, there's a column in *Mother Earth News* entitled "New Directions Radio," written by Copthorne Macdonald VE1BFL, one of the pioneers of slow scan television for amateurs back in the early sixties.

Cop says that "New Directions Radio" is "an international network of radio amateurs concerned with those ways of using ham radio (and related modes of communicating) that promote our own growth as individuals, and which we perceive as helping to create a more aware, more caring, and more responsible human society." Cop's column dealt with the various license classes and methods of getting the knowledge necessary to qualify for them. Particularly intriguing was the tone of the article, which did not make light of the requirements for amateur licensing. Cop says that anyone of reasonable intelligence can do it, but not without some effort. *MEN*'s serious readers, those heating with solar power, growing most of their foodstuffs, and sharing responsibilities in communal living arrangements in some cases, probably aren't attuned to having much handed to them on the old silver platter.

Which brings me to the letter printed in the accompanying box, in which K8DB expresses the view of perhaps a large percentage of the amateur population. Not that we exactly agree with his views entirely, but the point he makes is well taken. It might be added that the new "list and net" DXers on the bands seem to be not the youngsters, in our experience, but rather those getting on toward middle age. On ARRL's Field Day recently, the operators making the hay with expertise were by and large younger hams; not that the old-timers can't do it, too...we can all learn something by watching a master like W1BIH, for example. But the kids are still coming up through the ranks of *real* traffic nets and the like to develop their operating skills, and many of those kids are reading magazines like *Mother Earth News*. It is reassuring to know that we have hams like VE1BFL introducing normal people (non-hams) to amateur radio in magazines like *MEN*. Unlike the authors of certain "training programs," Macdonald has no vested financial interest or bogus political reasoning behind his desire to encourage would-be hams. Phenomena such as this are not only going to be interesting to watch through the eighties, but interesting to listen to on our bands as well.

Who knows...someday a hippie group from the USA touring Albania may include a licensed radio amateur, and he or she might get permission to operate some radio where the establishment hams have failed. It just could happen!

HM1PW can most often be found "Snoopying" around 15- and 20-meter CW from his Seoul shack. (Photo courtesy of W1GWA)

DXCC

We have received two "official" reasons for the change in endorsement stickers for DXCC mentioned last month. One says that cost was the factor, due to the general unavailability of the material necessary for producing the transparencies, while the other reason goes like this: "When you take the sticker off your DXCC lapel pin to put a higher numbered one on it, the glue removes some of the enamel coating on the pin. Thus, by switching to an opaque sticker, you can cover up the damage to the pin done by the previous sticker, something you could not accomplish with a transparent sticker."

If you have sentimental attachment to your original DXCC certificate (and who doesn't?), you are going to be very sad when you add the first oddball, out-of-place, opaque sticker to your award.

On the other hand, the folks doing the day-to-day work down at DXCC are pretty efficient and are surely dedicated. The 1979 annual report of the League has some facts and figures on DXCC hinting at the size of the task: Last year, they processed almost 400,000 QSL cards on the way to issuing 2,570 new DXCC certificates, a hundred 5-Band DXCC awards and almost a half-million credits to us already having the basic DXCC membership. And there were *no* disqualifications in 1979! The long-awaited new batch of 5-Band DXCC plaques has arrived, also, and they are hardwood instead of the previously used Naugahyde backing. Much nicer, like the life member plaques.

CONVENTIONS

Worldradio featured an extensive report on the Fresno DX Convention which was held in April. The affair is 31 years old and is alternately sponsored by the Southern and Northern California DX Clubs. This year, over 400 DXers registered, including many dignitaries and overseas hams. K6LPL was voted "DXer of the Year," and Hugh Cassidy WA6AUD was inducted into *CQ*'s DX Hall of Fame for his eleven-year toil as publisher of the *West Coast DX Bulletin*.

The east coast's answer to Fresno is DXPO 80, which will be held September 27 and 28 at Tysons Corner, Virginia, sponsored as usual by the National Capitol DX Association. Full particulars are in the Social Events column. John Kanode N4MM is NCDXA president and Stu Meyer W2GHK is DXPO 80 chairman.

The other big September event is W9DXCC. The W9DXCC convention is always in the suburban Chicago area and normally falls on the first weekend of September. It is a Friday night/Saturday gathering and has grown over the past quarter century to about 300 registrants.

At the W9DXCC banquet, a feature has always been the "DX Countdown": Everyone stands, the master of ceremonies starts counting up from one hundred in steps of ten, and when your DXCC total is reached you sit down. For as long as we have been going, the last DXer standing has been Ross Hansch W9BG, of Madison WI. Sadly, someone else will take his place this year, as Ross passed away in late June. When the countdown was completed, you always knew that somewhere there in the back of the banquet hall was Ross, every year just a little red-faced at knowing the entire room was looking for him.

JUNE HAPPENINGS

Gee, what a dull DX month. Merely operations from Libya,

Wallis Island, Macao, Sudan, southern Sudan, Aland Islands, Cocos-Keeling, Guinea, and the start of a seven-country expedition in Africa. Americans continued to play less and less a role in expeditions, as only three of these were Yanks.

A. E. Howell G3JKI came on from the British Embassy in Tripoli, Libya, in late June, working with F6CYL on 20 and 15 meters SSB. He left on June 27 with no apparent plans to return soon. Documentation is awaited in Newington before DXCC credits will be issued for G3JKI/5A. QSLs should be sent to Anne Koloboff F6CYL, 3 R. De l'Etang, 78430 Louveciennes, France.

Ian Ridpath ZL1BCG operated FW0DD June 22-27, after a short stop in Samoa and some air time as 5W1CR. 5W1CR cards should be sent to J. I. Rid-

Continued on page 154

Austrian old-timer OE1UO (first licensed in 1919) mobiles with a vengeance: That's a 20-meter quarter-wave atop his auto. (Photos courtesy of W1GWA)

AN OPEN LETTER TO DXERS

A new breed of DXer has emerged in the past few years which has been very detrimental to the art of DXing. For various reasons, a mania has been instilled into DXing which has caused many DXers to sense that there is no tomorrow. It is perplexing to realize that very many amateurs have worked 250 to 275 countries in a relatively short period of time.

If you consider this a noteworthy feat, take a closer look. In years gone by, the idea of making DXCC, 5BDXCC, WAZ, 5BWAZ, and the Honor Roll, etc., involved a dedicated ham with infinite patience, good operating practice and technique, and above all, an excellent station. The responsible and truly competitive DXer was looked upon in a manner similar to the way in which one would view a big game hunter. The tougher the prey was to bag, the more rewarding the win.

By comparison, the new breed of DXer is making a mockery of DXing's most treasured honors by utilizing patently unethical and/or illegal practices to short-cut the process. They are impatient and don't want to "waste time" in pileups. Their motto is "work them any way you can get them," or "let your conscience be your guide." Unfortunately, most of their consciences are so warped, compromised, and otherwise self-rationalized that they have trouble distinguishing right from wrong.

My concerns do not involve DX lists or net operations per se. I have no real gripe with such operations as long as all those who ultimately make the list did it fairly by openly competing with fellow DXers on the HF bands. The honest nets and list operators include a W7 and a DK2. I would like to know of others. In contrast, though, most list and net operations are tainted with political-type favors, prearrangements, phone-ins, etc. Thus, good amateur practice, technique, and station quality take a strong second place to whom you know and your favors-given vs. favors-taken ratio.

All DXers should ask themselves what glory comes from working a rare DX station when their only competition was breaking through a busy signal or accessing a repeater. As a parallel, imagine the big game hunter receiving much acclaim and praise only to find out that he killed his prey in a cage. Tainted accomplishments reap hollow honors.

This brings me to the most serious problems prevalent in the DXing arena today which I believe are the root causes of the QRMing and bad manners so prevalent on the bands. These problems are: 1) rude, unethical, and/or outright illegal practices and 2) the emergence of the DX barons or captains who dole out their DX with partiality so as to reinforce their own importance.

Many of the unethical or illegal practices are easily recognizable by the deserving DXer. They include lists partially or completely taken on a prearranged basis with an on-the-air facade that a list is being taken at that time. In addition, some DXers dump their friends' calls in on a list and/or work the DX station using their friends' calls.

It is my feeling that any time responsible hams hear of these practices, which have a serious impact on amateur radio's image, they should speak up and be heard. In addition, the DX captains and their nets or list operations, if questionable, should be ignored. We as hams have permitted them to come into power, so we should correspondingly be able to defrock them.

Fellow DXers, there are no politics in big game hunting or sport fishing, hobbies which are closely akin to DXing. Let us begin to rid ourselves of this growing political-type malignancy and as a result reestablish the meaningfulness of DX honors. — Dennis M. Burgess K8DB.

RTTY Loop

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

About a year and a half ago, I received an announcement from Gilfer Associates, Inc., of a forthcoming new book which would be of interest to the RTTYer. Well, several months down the line, due to illness of the author, the book has been published – it looks rather interesting.

Entitled *Guide To RTTY Frequencies*, the book, by Oliver P. Ferrell, represents itself as a complete guide to press, wireless, government, and other assorted RTTY signals in the high-frequency spectrum. It is all that and more.

An introduction, written by Webb Linzmayer, goes into a brief description of RTTY and the mechanics of sending the code over the air. Standard Baudot code is covered, along with looks at some of the more unusual codes which may be found, such as Cyrillic and Arabic. Although Hebrew transmission is also mentioned, no key to recognition is offered, as are keys to the former two languages. Encryption is also discussed, with some clues to decoding more common forms which may be encountered on the air.

Then comes the meat of the book. Over fifty pages contain more than 3000 entries describing RTTY stations heard reliably on the air. The stations are broken down by frequency band, beginning at 4 MHz and running the spectrum up to 27 MHz, and service, whether fixed, mobile, or whatever. For each station, the frequency, callsign, location, service, shift, speed, and transmitter power is supplied, whenever possible. At the least, the frequency, shift, and speed information will allow reception, and these are sometimes all that is available, together with an approximate location.

In summary, then, this book appears to be a gold mine for the person looking for interesting print on his (or her) RTTY machine. The *Guide To RTTY Frequencies* costs $8.95 and is available from Gilfer Associates, Inc., PO Box 239, 52 Park Avenue, Park Ridge NJ 07656. If you drop them a line, be sure to mention *73*'s RTTY Loop, OK?

The "circuit-of-the-month," if there is such an animal, this month comes from New Jersey, where Joseph A. Maillet K2ODG found RTTY Loop so interesting that he subscribed to *73*! Anyway, Joe was playing with some of the demodulator circuits featured a few months ago and lamenting the lack of some kind of tuning indicator. The solution he devised is a simple tuning device that monitors the state of the mark signal and lights two LEDs, one for presence and one for absence of the mark (assumed space). The circuit is shown in Fig. 1 and should be straightforward for anyone but the most severe thumb burner to build. The transistors are specified as 2N2222s, but almost any general purpose NPN should work. The LEDs are the common ten-for-a-buck kind, any color you like. To use the device, feed the decoded mark signal at TTL data levels to the bases of the transistors. With a signal consisting of roughly fifty percent mark, such as an "RY" test, the LEDs should light to about equal brilliance or flicker. Simple!

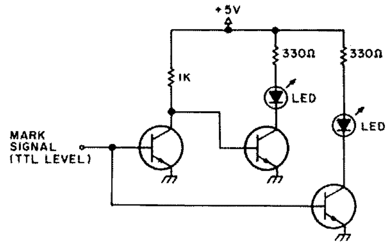

Fig. 1. A simple tuning indicator.

Hey, all you RTTYers in the northwest, a not-yet-Novice has requested help in completing his station, complete with RTTY gear. Charles McCleary relates that he is disabled and unable to "make order out of this chaos!" If you can help him, drop a line to 5625 N. Campbell Street, Portland OR 97217. I'm sure he will appreciate all the help he can get.

I haven't talked much about computers lately. I'm told it turns some of you off, but as long as we are on the west coast, let's drop down south a bit and see what's happening in California. Well, will you look at that! There are a couple of nets which may be of interest to RTTY/computer types. On 14250 kHz or thereabouts, a group meets on California Sundays (that's really early Monday in GMT) at 0100 in the summer and 0200 in the winter. Up a bit, around 21260 kHz, I am told that ASCII RTTY has been tossed around. They meet around the same time on Friday and Saturday nights (or Saturday and Sunday mornings, if you prefer).

As more of us get on ASCII or other "computer" RTTY, the search for components will become more intense. That is why more and more manufacturers, I suppose, are introducing peripherals priced to appeal to the hobbyist. Continuing our critical look at equipment, let's take a look at a keyboard available from Jameco Electronics, San Carlos CA 94070. The JE-610 ASCII keyboard kit has been featured in ads in *73*, *Microcomputing*, and other magazines. At $79.95, the keyboard represents a good alternative to "surplus specials."

Assembling the kit is not very difficult. Seven integrated circuits stretch across the top of the printed circuit board. The sixty-two-key assembly is received as a unit and slips into place nicely, all pins aligning. Several options are available, such as key-pressed strobe positive or negative, and parity. Two user-defined keys are provided for custom applications. A repeat key is also provided which repeats any key pressed, even control characters, after a brief pause.

There are, however, several problems. There is a "CAPS LOCK" key which, when depressed, forces uppercase for all letters. Numerals and punctuation operate normally, with the shift key, and the shift key has no effect on the already capital letters. However, several non-alphanumerics, such as the brackets, " – ", and backslash, are forced into uppercase characters, preventing their use. Also, a key labeled "DELETE" actually sends an underline or delete, depending on CAPS LOCK and shift. And although the ads state "60 keys generate the full 128 character, upper- and lowercase ASCII set," one character, "US", hex IF, cannot be generated. As some printers use this character for internal functions, this may be a problem. When this defect was brought to the attention of Jameco, the letter of reply stated "The ASC II (sic) keyboard kit was intended to have all 128 characters and codes as shown. . .The US function as well as the underline function was omitted in error. This was brought to our attention after the units were out." The modification, which is not included with information in the kit, is to change the matrix position of the DELETE key to one which would provide all of the functions. A minor point? Not if you bought the kit and tried to send that *one code* that your device needed.

LETTERS

EXPLORING

This letter is a letter of thanks to two very special persons I have become acquainted with. This is not a letter thanking someone for helping another person on a certain class of license, but it's just a vote of thanks for a lot of time and dedication. These two very special persons are Chris W4WRJ and Jay WA4RQP. Last March, these two came to a Boy Scout meeting (which I was a part of) to talk to interested persons about amateur radio and forming an Explorer Post specializing in ham radio. Well, to make a long story short, a month and half or so after that meeting we had our charter, with seven boys and five advisors registered. It's now been well over a year since then. We have had many activities, from going to hamfests to camping and working portable (I imagine someone will recognize the calls W4WRJ/4, KA4EPE/4, WA4RQP/4, W4LFO/4, KA4LOX/4...) since starting this Explorer Post; we have been contacted just recently about providing communications for the Boy Scout National Jamboree next summer to be held at Fort A. P. Hill here in Virginia.

Exploring is probably the most unknown part of Boy Scouts today (I had to explain what it is many times over the air); that's sad, because it could help so many young people in trouble. To summarize this letter, I would like to thank Chris and Jay and all the other advisors we have for their time and devotion. They spend every Thursday evening with us instead of their families, and then there are all of those weekends.

Well, thanks Chris and Jay, Chuck, Tony...you are what make Exploring and amateur radio go.

Scott C. Mellott
President of Post 1159
Sponsored by St. James
Episcopal Church
Leesburg VA

Exploring and ham radio go hand in hand in Leesburg VA.

JEDDAH REPORT

Just a few weeks ago, in the spring of 1952, I went to the home of a schoolmate to find out why he didn't want to participate in a beach party with the rest of our class. When I entered his house, I heard weird sounds coming from the next room. Being the curious type, I asked what it was. I have never quite recovered from the experience of that day and find myself eagerly anticipating going home from work to listen to my own weird sounds: CW and RTTY.

After 28 years of ham radio, I, like Wayne, occasionally reflect upon the glorious past and the changes that have been wrought since that fateful day for me in 1952.

Several times I went the 6L6 + 6L6 route and even tried 117L7GTs and 6V6s with chassis of foil-lined cigar boxes, Mom's baking pans, and even a piece of 2" x 4" with the components nailed down. I worked stations for several miles around with an old Heathkit signal generator, keying the antenna directly. My favorite, though, was the battery-powered 1U4/1R5 combo in a pie pan with another pie pan on top that looked like a flying saucer. That was in 1956. I stood on the roof of a four-story apartment building in Newport News, Virginia, and worked PY7EE in Pernambuco, Brazil, with a 50-foot wire draped across the roof and a clothespin CW key screwed to the top pie pan.

Soon after that, I obtained my first store-bought rigs, a Heathkit DX20 and a Hallicrafters S40A, from a local pawn shop, both for $35.00. At about three-year intervals, I upgraded through horsetrading for a DX40, a Viking Ranger, a National NC125, a Hammarlund SP600, and a Gonset G76 transceiver. Finally, around 1960, I settled on a Johnson 200 W Invader and Collins R388, still hanging on to the SP600 to use with the Kleinschmidt TT119 Teletype™ setup. After 20 years with those, I traded the Invader for a newfangled transistor rig, the Triton IV by Ten-Tec. Just between you and me, I still like the old bottle rigs, but there just might be something to these transistors and integrated circuits after all.

I've been into 2 meters for about ten years now and have worn out several Motorola boat anchors. I still use one for a base station but have the Amcom 2-25 in the motor home for mobile operation. I have driven all over the United States and 2 meters really makes for some enjoyable conversation anywhere I go.

I tried 6 meters for awhile with an old Gonset "Gooney Box" AM rig with dual vfo's. I lost interest in 6 meters, though, because it seemed that everyone else did, too. At least the long silent periods made it seem that was the case. Most of the 6ers moved to 2 meters.

Back in 1965, I happened into a QSO with old K or W -5BLB —don't recall the prefix offhand—up in Midwest City, Oklahoma. We got to talking about how some Connecticut pressure group was trying to take away the operating privileges that we had worked so hard for and had enjoyed for so many years, the good DX part of the CW frequencies and a healthy chunk of the voice frequencies. All to promote something they called incentive licensing. In a very few minutes, there was quite a roundtable going as more and more hams dropped into the QSO. The general attitude was the same as if the police had

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Contests

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

WORLDWIDE RTTY ART CONTEST
September 1 through November 30

All worldwide licensed radio amateurs and members of their immediate families (except as otherwise provided in the rules) are eligible to participate in this contest. Sponsored by the Southern Counties Amateur Teleprinter Society of Southern California, the contest rules are as follows:

Entries must have been originated by means of manual inputs to a teleprinter using a standard communications keyboard and may be submitted only by the originator of the art or by the amateur on behalf of a family member. Submitted art may be of any subject suitable for transmission via amateur radio. Entrants may submit as many entries as desired. Each entry shall be given a short title. Submitted art may contain overline shading.

Tapes of entries shall be formatted to permit a reasonably short running time and to be compatible with machines which do and do not downshift on space. Compatibility with machines which interchange the bell and apostrophe is not required. At least three functions must be used between each line, normally: carriage return, line feed, and letters.

Each line of the art shall be limited to a maximum of 72 characters (Including spaces). Prints must be in one single part, with no splices. Tapes must be limited to a maximum running time of 40 minutes at 60 words per minute for the art itself, exclusive of any other information on the tape, and contain no splices.

Each entry must have been transmitted the first time via amateur radio after September 1st and must be accompanied by a confirmation of at least one receipt of its transmission, identifying the title of the art and the call letters of the receiving and transmitting stations. All confirmation must be in writing (not by RTTY transmission) and must have been obtained by the entrant from the receiving station. Entrants may obtain necessary transmission of their entry by any amateur radio station.

The tape and prints of each entry shall carry the full name of the author, call letters of the submitting station, and mailing address. This information shall be both written upon a beginning leader of the tape and also punched in the tape to appear on page copy when reproduced. Entrants must submit one five-level paper tape and five prints of each entry and by such submission agree that the tapes and prints may be used, duplicated, or published for any purpose. Tape submissions shall be of the 11/16th inch width only. Tape, prints, and transmission confirmation information should be securely packaged and sent to: RTTY Art Contest, c/o Norm Koch K6ZDL, PO Box 1351, Torrance CA 90505. Entries must be postmarked on or before November 30th. Entries will not be acknowledged after the closing date. Since mail-damaged tapes will be of little value, it is suggested that tapes be wound tightly upon a hard core.

Entries will be judged on the originality of the author in selection of subject matter, on excellence of technique in producing the art and formatting the tape, on overall appearance of the art from a distance, on suitability for publication, and on the entrant's compliance with the rules. If an individual is the first place winner in a given year, he will not be eligible for nor considered for first place in the immediate following year. This does not preclude a station from entering and being considered for second, third, or honorable mention places.

A committee of judges, made up from those amateurs who have exhibited an interest in RTTY art, will select first, second, third, and honorable mention winners. Winning entrants will receive a plaque for their places. Winning entries will be published in various amateur radio journals. The decisions of the judges shall be final, and no correspondence will be entered into regarding their decisions.

Officials and judges of this contest and members of their

Continued on page 150

Calendar

Sep 1-Nov 30	Worldwide RTTY Art Contest
Sep 13-14	European DX Contest—Phone
Sep 13-14	ARRL VHF Contest
Sep 13-14	Pennsylvania QSO Party
Sep 13-14	CAN-AM Contest—Phone
Sep 13-15	Washington State QSO Party
Sep 14	North American Sprint
Sep 27	DARC Corona 10-Meter RTTY Contest
Sep 27-28	Delta QSO Party
Sep 27-28	CAN-AM Contest—CW
Sep 27-28	Ex-KZ5 Reunion
Oct 4-5	California QSO Party
Oct 4-5	VK/ZL/Oceania DX Contest—Phone
Oct 11-12	ARRL CD Party
Oct 18-19	ARRL Simulated Emergency Test
Oct 18-19	VK/ZL/Oceania DX Contest—CW
Oct 18-19	Scouting Jamboree
Oct 18-20	QRP October QSO Party
Oct 25-26	CQ Worldwide DX Contest—Phone
Nov 1-2	ARRL Sweepstakes—CW
Nov 8-9	European DX Contest—RTTY
Nov 8-9	IPA Contest
Nov 9	International OK DX Contest
Nov 15	DARC Corona 10-Meter RTTY Contest
Nov 15-16	ARRL Sweepstakes—Phone
Nov 29-30	CQ Worldwide DX Contest—CW
Dec 6-7	ARRL 160-Meter Contest
Dec 13-14	ARRL 10-Meter Contest
Jan 18	FRACAP Worldwide Contest
Mar 7-8	1981 SSTV Contest

Results

1980 SPRING CONTEST RESULTS
BRITISH AMATEUR RADIO TELEPRINTER GROUP

Single Operator Section

No.	Call	Points	Total QSOs	Countries
1.	W3FV	592012	325	37
2.	F9XY	506456	314	32
3.	I5FZI	498456	284	32
4.	K7BV	454940	258	32
5.	SM6ASD	417648	252	29
6.	W4CQI	413354	249	35
7.	I2OLW	410416	270	32
8.	I2WEG	389850	248	30
9.	KØPJ/6	385556	254	32
10.	G3HJC	351430	199	23

Multiple Operator Section

No.	Call	Points	Total QSOs	Countries
1.	9A1ONU	644160	408	32
2.	G3ZRS	490048	288	31
3.	I5MYL	456246	305	30

Shortwave Listener Section

No.	Name/Call	Points	QSOs	Countries
1.	H. Ballenberger	403862	259	45
2.	OK1 11857	382506	227	36
3.	IV3 13018	309430	251	32

Awards

Bill Gosney WB7BFK
2665 North 1250 East
Whidbey Island
Oak Harbor WA 98277

This is the second of our two-part series featuring the *73 Magazine* awards portfolio; we now learn of the six domestic awards being sought by award seekers the world over.

These awards were not meant to be an overnight venture nor were they designed to duplicate any in existence today. Each offers its own degree of difficulty and creates a sense of accomplishment among those who are happy recipients.

WORKED ALL USA AWARD

Sponsored by the editors of *73 Magazine*, the Worked All USA Award is available to licensed amateurs throughout the world. To be valid, all contacts must have been made on or after January 1, 1979. There are no band or mode restrictions; however, single band and single mode accomplishments will be recognized.

If you're looking for an award with challenge, this definitely is one. To qualify, applicants must work each of the *50 US states within the same calendar year* (January 1 through December 31). Annual endorsements will be awarded applicants who can verify their claim.

To apply, make a self-prepared list of claimed contacts in alphabetical order by US state, beginning with the state of Alabama. List the state, the callsign of the station worked, the date and time in GMT, and the band and mode of operation.

Do not send QSL cards! Have your list of contacts verified by two amateurs, a local radio club secretary, or a notary public.

The fee for the basic award is $3.00 or 8 IRCs. Endorsements are $1.50 or 4 IRCs. Send your application and award fee(s) to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

The Worked All USA Award, with its 12-month limitation, separates the men from the boys. To date, only a few have mastered the 80-meter band, while 10, 15, and 20 have become the more popular bands accomplished. Only one applicant has mastered all states on 6 meters and 160 meters has yet to be conquered. Does your station have what it takes to WORK ALL USA in a calendar year?

THE Q-5 AWARD OF EXCELLENCE

If you frequent the American Novice bands, we are pleased to announce an exclusive award for these bands. Sponsored by the editors of *73 Magazine*, the Q-5 Award of Excellence is offered to amateurs worldwide who meet the requirements this Novice band award dictates.

To be valid, all contacts must have been made on or after January 1, 1979. All contacts must have been made in the CW mode on those frequencies assigned the American Novice. Applicants are cautioned that the power limitation is 250 Watts input. There are no band restrictions; however, applicants may request special band endorsements on the award if the request is made at the time of application.

To qualify, applicants must work all ten (10) US call districts and receive no less than a Q-5 report. A valid RST might be 559, 539, 579, etc., while an RST of 449, 349, or 479 would not qualify the applicant for this award.

This award is not meant to be an overnight accomplishment. Stations meeting the challenge of these requirements will be proud to display this unique award depicting the excellence and superiority of their transmitted signal.

To apply, prepare a list of claimed contacts, logging each contact in order of the US call district. Include the station callsign, date and time in GMT, the frequency utilized, and, most important, the RST as noted on your confirmation card. Also required is a brief description of the station equipment and antenna system utilized to complete this award.

Do not send QSL cards! Have your list verified by two amateurs, a local radio club secretary, or a notary public. Send your application with $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

SPECIALTY COMMUNICATIONS ACHIEVEMENT AWARD — CLASS A

A significant number of amateurs throughout the world find their primary interest in the operation and development of specialty-type communications. It is the efforts of these many pioneers in their respective fields which have created many state-of-the-art improvements which we know in technology today. The editors of *73* wish to recognize those amateurs who make positive steps toward expanding the use of their respective mode or type of amateur operation. As a result, in the paragraphs to follow, learn of our latest communications award, dedicated to "communicator specialists."

To be eligible for the Specialty Communications Achievement Award, all contacts must have been made on or after January 1, 1980. In addition, only communications via SSTV, RTTY, EME (Earth-moon-Earth), and/or OSCAR will be recognized for this award. Contacts between stations on OSCAR or EME may be made using any authorized mode allowed in your country. Applicants are cautioned, however, that mixed mode contacts are not valid.

To qualify, applicants must work and confirm contact with each of the 50 US states. There are no band requirements; however, specific band accomplishments will be recognized if requested at the time of application.

To apply, applicants must prepare a list of claimed contacts in alpabetical order by state. Include the date and time in GMT, the band and mode of operation, and a signed description of equipment and antenna system utilized.

Do not send QSL cards! Have your list verified by two amateurs, a local radio club secretary, or a notary public. Send your application with a $3.00 award fee or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

DISTRICT ENDURANCE AWARD

If any of our readers feel our awards are too soft, they should take a hard look at this one. It was designed to appear fairly simple at first glance, but will drive you right up the wall with frustration as it is pursued. Known as the District Endurance Award, in order to get it you'll need to find yourself an accurate timepiece, as you'll have exactly sixty (60) minutes to work all (10) ten US call districts. Simple, huh? Can you beat the best time to date — 45 minutes?

Sponsored by the *73 Magazine* editors, the District Endurance Award is offered to licensed amateurs throughout the world. To be valid, all contacts must have been made on or after January 1, 1979. There are no band or mode restrictions; however, if you are fortunate enough to work these requirements on a single band, we would be happy to recognize this feat when processing your award.

One of the most important rules applicable to this award is that all contacts must be made independent of nets of any kind and not while any contest is underway.

To qualify, applicants must work all ten US call districts in one hour or less. The time will commence the moment the first contact is established and end with the time logged for the last district required.

To apply, applicants must prepare a signed declaration that all contacts were independent of net or contest operation. Applications should also include a list of stations worked in callsign order by district, the date and time worked in GMT, the band and mode of operation, and the state.

Do not send QSL cards! Have your list of contacts verified by two amateurs, a local radio club secretary, or a notary public. Forward your application along with a $3.00 award fee or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

TEN-METER 10-40 AWARD

What would an awards program be like without a QRP incentive? With 10 meters at an all-time high, the editors of *73 Magazine* take pride in announcing the Ten-Meter 10-40 Award.

Continued on page 158

Leaky Lines

Dave Mann K2AGZ
3 Daniel Lane
Kinnelon NJ 07405

This may cause the eggs to hit the fan, but so be it. And if I get my head handed to me, I've got to say it anyway.

Just as driving a car was once a pleasure but has now become a harrowing and tedious bore and a task to be avoided, so have repeater operations on 2 meters become an onerous and disagreeable jejune. It is not merely that the band, like our highways, has become overcrowded and impossibly congested, but that like many drivers, some ham operators display such immaturity and thoughtlessness. There is hardly a repeater you can name that doesn't have its own resident bore. . . a guy or group of guys who can be found at almost any hour of the day, holding forth with an endless stream of unremitting, meaningless drivel.

Just as brevity is the soul of wit, is it also the hallmark of courtesy and tact. In a situation where the facility must be fairly shared among thousands who are entitled to its use, what is this strange compulsion that causes certain people to push the mike switch whenever they are behind the wheel, whether they're driving a hundred miles or just down to the corner drugstore? Why must some people find it so necessary to access a repeater fifteen or twenty times a day whether they have something to communicate or not?

Every repeater, it seems, has its own long-playing big mouth . . . a fellow who delivers endless monologues with the monotony and regularity of Old Faithful! He can be found holding forth for hours on end. This can be highly intimidating to those who are newly licensed or inclined toward unaggressiveness. They would rather just listen than try to compete with the self-assured marathon talker who seems to dominate at all hours, day or night. But it is not only the newcomers who feel intimidated or turned off. Many old-timers are also repulsed at this arrant hoggishness. I know scores who just don't bother to transmit at all any more, and it is likely that they avoid it because they don't want to get trapped in a long, ear-bending encounter with these resident big mouths.

If you live in a large metropolitan area, check this out for yourself. You will find that the simplex frequencies are being used more and more each day, for increasing numbers are finding repeaters unsatisfactory. In less congested areas of the country, of course, things are much better.

Strangely enough, in crowded places where repeaters have memberships of hundreds, you are likely to hear the nonstop monologuist, but out in the hinterlands where club rosters don't compare in size, it is rare to encounter one.

There are those who place the blame squarely on the repeaters themselves, but I disagree. This is like blaming the victim for enticing the rapist. It makes very little sense. Perhaps those in charge of repeater operations are responsible for dealing with such problems when they arise, but that is after the fact. They are no more culpable for the excesses of the garrulous member than for the occasional jammer who fouls up the works. It is what is done to deal with the problem that counts. I have attended many a repeater club meeting, and invariably the subject of the jammer will be raised. But I've never heard anyone broach the matter of the member in good standing who never shuts his @#$%¢&* mouth and who monopolizes the machine to the utter disgust of all other members.

Unlike the characters in that famous cigarette commercial, many repeater members would rather switch than fight! The first stage is a gradual reduction in their activity, and ultimately they just leave for less annoying, more fruitful frequencies. This is not always noticed because new members come in to keep the total membership figures fairly constant in level. But a great number of stalwart, steadfast members are now leaving repeater clubs because they feel a real sense of frustration about the way two or three guys with long-playing mouths have taken over the machines.

Many people are rediscovering the fact that round tables, rag chews and net-type QSOs properly belong on other frequencies. . . not on repeaters. And if they must be conducted on 2 meters, there are more than enough simplex channels to accommodate them.

Hams, who ought to know better, seem to think that the FCC can solve all the problems of amateur radio. The fact is that our service lies at the very bottom of the Commission's priority list. No matter who our spokepersons and representatives happen to be—the ARRL or whomever—the Amateur Service is not of prime concern to the agency.

There are times when this fact is acknowledged so openly that it boggles the mind. I was watching a TV interview with a certain member of the FCC some time ago. When the interviewer asked him to summarize briefly his duties, he answered to the effect that his sole function was to try to get as many radio and television stations licensed to minority people as he could. To say that I was shocked at his candor is a rank understatement. But I was even more astonished at the realization that he regards his post not as one of service to the Commission so much as an opportunity to further his own political and social hopes and ideas.

I believe that one of the most important goals for those involved in communications and committed to its future within the framework of a free nation should be to strive to influence the selection of FCC Commissioners from among those who are best qualified by virtue of experience, competence, and commitment. It is an outrage when persons are awarded such posts as a reward for political favors or their work in election campaigns. Certainly no FCC Commissioner should be chosen who is not at least somewhat conversant with the complex nature of communications in today's world.

If the President of the United States wishes to reward some politician with a post in some bureau or agency, let it be one in which his lack of expertise does not result in such fiascoes as the ban on the manufacture of linear amplifiers for 28 MHz or the apparent unwillingness of the present Commission to deal in any way with the illegal commandeering of unassigned frequencies by unauthorized users in that same section of the radio spectrum.

How can amateurs possibly rely upon any administrative agency which displays such inability to enforce its own rules and regulations? It is pathetic—and it is absurd!

Ham Help

It is with deep regret that I inform you of the passing of my beloved husband of 45 years, Robert H. Kastle K4TQW, on March 19, 1980.

Please note that I have a complete library of *QST* starting from 1974. I also have *73*s (all of 1977 through current), as well as numerous other amateur books. I would like very much to find a worthwhile club or library that could take them all and use them as a memorial to Bob.

Mrs. Robert H. Kastle
3896 46th Avenue North
St. Petersburg FL 33714

I am looking for a crystal-controlled mobile 220 rig at a good price.

Kenneth Hunt
6519 Valhalla
Klamath Falls OR 97601

I need a boat-anchor tube-type 2-meter rf amplifier—the bigger, the better. I need to saturate all the canyons and gullies in order to break a repeater over in the valley.

Mickey McDaniel W6FGE
940 Temple St.
San Diego CA 92106

I have a Teletype™ in a rack and need to locate manuals for this or similar equipment. The units are marked:

Data Prep Set DOD Model 35

1) AN/GGC 15(V)1; Typing unit in which is UA28 printer (code LK806ATN, also marked LP821TM/ATX);

2) Tape punch;

3) Switch and code wheel set.

Alan H. Nielsen K3GRO
22 Woodland Place
Pompton Plains NJ 07444

OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR SEPTEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
26513	1	0025:08	79.1
26526	2	0119:23	92.7
26538	3	0018:41	77.6
26551	4	0112:56	91.2
26563	5	0012:14	76.0
26576	6	0106:29	89.6
26588	7	0005:47	74.5
26601	8	0100:02	88.0
26614	9	0154:17	101.6
26626	10	0053:35	86.5
26639	11	0147:50	100.1
26651	12	0047:08	84.9
26664	13	0141:23	98.5
26676	14	0040:41	83.3
26689	15	0134:56	96.9
26701	16	0034:14	81.8
26714	17	0128:29	95.4
26726	18	0027:47	80.2
26739	19	0122:02	93.8
26751	20	0021:20	78.6
26764	21	0115:35	92.2
26776	22	0014:53	77.1
26789	23	0109:08	90.7
26801	24	0008:26	75.5
26814	25	0102:40	89.1
26826	26	0001:59	74.0
26839	27	0056:13	87.5
26852	28	0150:28	101.1
26864	29	0049:46	86.0
26877	30	0144:01	99.6

OSCAR 8 ORBITAL INFORMATION FOR SEPTEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
12700	1	0133:36	77.3
12714	2	0138:25	78.6
12727	3	0000:02	54.0
12741	4	0004:51	55.2
12755	5	0009:40	56.4
12769	6	0014:29	57.7
12783	7	0019:18	58.9
12797	8	0024:06	60.1
12811	9	0028:55	61.4
12825	10	0033:44	62.6
12839	11	0038:33	63.8
12853	12	0043:22	65.0
12867	13	0048:10	66.3
12881	14	0052:59	67.5
12895	15	0057:48	68.7
12909	16	0102:36	70.0
12923	17	0107:25	71.2
12937	18	0112:13	72.4
12951	19	0117:02	73.6
12965	20	0121:50	74.9
12979	21	0126:38	76.1
12993	22	0131:27	77.3
13007	23	0136:15	78.5
13021	24	0141:03	79.8
13034	25	0002:40	55.2
13048	26	0007:28	56.4
13062	27	0012:16	57.6
13076	28	0017:04	58.9
13090	29	0021:52	60.1
13104	30	0026:40	61.3

OSCAR 7 ORBITAL INFORMATION FOR OCTOBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
26889	1	0043:19	84.4
26902	2	0137:34	98.0
26914	3	0036:52	82.8
26927	4	0131:07	96.4
26939	5	0030:25	81.3
26952	6	0124:39	94.9
26964	7	0023:58	79.7
26977	8	0118:12	93.3
26989	9	0017:30	78.2
27002	10	0111:45	91.7
27014	11	0011:03	76.6
27027	12	0105:18	90.2
27039	13	0004:36	75.0
27052	14	0058:51	88.6
27065	15	0153:05	102.2
27077	16	0052:24	87.0
27090	17	0146:38	100.6
27102	18	0045:56	85.5
27115	19	0140:11	99.1
27127	20	0039:29	83.9
27140	21	0133:44	97.5
27152	22	0033:02	82.3
27165	23	0127:16	95.9
27177	24	0026:35	80.8
27190	25	0120:49	94.4
27202	26	0020:07	79.2
27215	27	0114:22	92.8
27227	28	0013:40	77.7
27240	29	0107:55	91.2
27252	30	0007:13	76.1
27265	31	0101:27	89.7

OSCAR 8 ORBITAL INFORMATION FOR OCTOBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
13118	1	0031:28	62.6
13132	2	0036:16	63.8
13146	3	0041:04	65.0
13160	4	0045:52	66.2
13174	5	0050:40	67.5
13188	6	0055:28	68.7
13202	7	0100:16	69.9
13216	8	0105:04	71.1
13230	9	0109:51	72.4
13244	10	0114:39	73.6
13258	11	0119:27	74.8
13272	12	0124:14	76.0
13286	13	0129:02	77.3
13300	14	0133:50	78.5
13314	15	0138:37	79.7
13327	16	0000:13	55.1
13341	17	0005:00	56.3
13355	18	0009:47	57.6
13369	19	0014:35	58.8
13383	20	0019:22	60.0
13397	21	0024:10	61.2
13411	22	0028:57	62.5
13425	23	0033:44	63.7
13439	24	0038:31	64.9
13453	25	0043:18	66.1
13467	26	0048:06	67.4
13481	27	0052:53	68.6
13495	28	0057:40	69.8
13509	29	0102:27	71.0
13523	30	0107:14	72.2
13537	31	0112:01	73.5

New Products

SWAN'S ASTRO 102BX TRANSCEIVER

The best single-word description of Swan's new HF transceiver, the Astro 102BX, is that it is *different*. Swan does not attempt to give you a radio that is a carbon copy of those coming from overseas. Instead, they have packed this rig with an unusual set of features, unlike those found in any other amateur transceiver, domestic or foreign.

The Astro 102BX offers solid-state no-tune-up SSB and CW operation on the 160- through 10-meter amateur bands. It is packaged in a black wrinkle finish with silver trim cabinet that is 6.4" high, 14.25" wide, and 13.75" deep, and weighs in at 23.5 pounds. Designed for both mobile and base station use, the 102BX requires a 12 to 14 V dc supply capable of providing 20 Amperes. The PSU-6 serves as a matching power supply and contains an external speaker and headphone jack.

Receiver Versatility

One of the Astro 102BX's distinguishing features is the two permeability-tuned oscillators (PTOs), each with a large tuning knob on the front panel. This amounts to having an external vfo built right in. You can operate using either oscillator "A" or "B" exclusively or you can select one PTO for receive and the other for transmitting. This is not a digital tuning arrangement. Frequency coverage is continuous and the digital display is based on a frequency counter. Thus, if the RIT (receiver incremental tuning) feature is used, the display will show the shift in frequency.

The PTO circuitry may be a throwback to earlier days, but the band switching uses a state-of-the-art phase-locked-loop circuit. The bandswitch acts as an address selector for a read only memory that sets a ÷ N counter used by the PLL. With a bit of imagination and some retuning, this rig could probably be put on the new ham bands.

The Astro 102BX, in keeping with Swan tradition, uses a single conversion receiver. Eight of the 19 front panels are devoted solely to receiver functions. Included are the standard rf and af gain controls, RIT, and a noise blanker. Among the unusual features are passband tuning, an i-f gain control, continuously variable agc decay, and an audio notch filter.

The passband tuning sets the i-f bandwidth. The user can select either high- or low-pass action. Anyone who has operated on a crowded phone band will find this helpful. When someone starts a QSO one kHz up, all you have to do is shift the passband so that the upper portion is cut off. The resulting passband is shown by eight LEDs located below the frequency readout. If you are a CW fan, you'll like the 300-Hz bandwidth filter that can be tuned across the 2.4-kHz i-f bandwidth.

The notch filter becomes very useful when some lid decides to spend half an hour tuning without using a dummy load. Since the filter is narrow, the control must be turned slowly or you're likely to pass right over the offending signal.

Perhaps I am not enough of a receiver fanatic to appreciate the i-f gain function. I found myself turning it to the maximum level and then leaving it alone. In normal operation, the i-f gain and agc decay don't need to be adjusted often. If, however, you like operating when conditions are noisy or the other station's signal doesn't fall in the normal category, then these two controls can be helpful. You need to spend some time experimenting with various combinations of settings before the Astro 102BX's flexibility becomes apparent.

Transmitter Features

The Astro 102BX, like just about any other new radio worth its salt, does not need to be tuned up before you transmit. There are preset output networks for each band. If the swr is greater then 1.7:1, the power output is automatically reduced, protecting those expensive final transistors. I found that the two MRF458 finals produced 100 Watts on all bands, just as advertised. However, if you want to operate SSTV or RTTY at full power, an external fan will be needed to cool the heat sink.

Rather than providing metering for a bunch of transmitter functions as some rigs do, the 102BX has provisions to read only forward and reflected output power and the ALC voltage. It doesn't take long to gain an intuitive notion of what your swr is by using the FWD and REFL power positions. Just keep in mind the fact that the meter reads 100 Watts full scale in the forward position and 10 Watts full scale when measuring reflected power.

I doubt if any ham manufacturer would produce a transceiver that did not have some kind of speech processor. Swan's Astro 102BX is no exception. When processing is selected by the front-panel switch, the microphone amplifier becomes a simple logarithmic compressor. The processor level control, along with the VOX adjustments, lies on the rig's left side, recessed behind holes in the cabinet. Since a screwdriver is needed for adjustment, these controls are less than conveniently located for operators who like to tinker with different settings.

Swan definitely kept the CW user in mind when they designed this radio. It is the only rig I have seen that has a front-panel switch allowing you to select "hard" or "soft" CW rise and decay times. Swan suggests that by using a soft waveform for slow speed code a more pleasing sound is produced. Similarly, selecting the hard position results in better clarity at speeds greater than 25 wpm.

The hard/soft switch might be considered a frill, but the Astro 102BX's full break-in capability can be a real asset. The unique T-R switch causes the transmitter output to be continuously connected to the antenna. In the receive mode, the transmitter appears as an open circuit. The receiver is coupled to the antenna through a transformer and reed relay. When you transmit, there are no loud relay contacts banging into place—just a soft click. This circuit allows full

Swan's Astro 102BX transceiver.

break-in on CW or, if you want, conventional semi-break-in is available.

Brickbats and Kudos

One unpleasant aspect of operating the 102BX is the appearance of the frequency readout. Red LED displays are used, but no filter is placed in front of them to screen out the stray light which reflects from the unlit segments. This annoyance can be partially eliminated by looking at the display from an angle and controlling the room lighting.

The 102BX owner who uses his rig at home with an external supply and speaker is not likely to notice that the internal speaker is very small and anemic. Serious mobile operators would be well advised to use an external speaker.

An idea of the care that goes into the design and construction of a rig can be obtained by disconnecting the antenna, turning up the volume, and tuning across the bands, listening for "birdies." These mixing products are very difficult to eliminate, so every attempt should be made for them to fall away from the frequencies of interest and be at extremely low levels. When testing the Astro 102BX, we found six noticeable birdies within the amateur bands. Correspondence from Swan acknowledges the presence of these mixer products and suggests that they are below the .5-uV level. Our own on-the-air tests indicate that when noise levels are low, several of these heterodynes are detectable—but at a low enough amplitude to cause interference to only the weakest of signals.

Evaluating a piece of equipment as complex and expensive as the Astro 102BX can be a tough job. The evaluator has to be careful that insignificant shortcomings don't dominate the review. Every rig has its faults, but they must be weighed against the larger pool of good points.

Each Astro 102BX is shipped with a Performance Check Sheet. It gives the receiver sensitivity and power out on each band for that particular radio. Every 102BX also receives a 72-hour elevated temperature burn-in during which the rig is cycled between transmit and receive. It is comforting to know that quality control is a reality that occurs before shipping rather than in the new owner's shack.

This may be the age of appliance operating, but there are a few hams who still like to repair or modify their store-bought gear themselves. Swan has made the 102BX in such as way that this can be done with a minimum of gymnastics. Fifteen circuit boards are used, with most of the interconnections made at a distribution board. Dip-style jumpers are used rather than plug-in cards. The documentation is excellent; there are individual one-page schematics and parts placement diagrams for each board. For once you don't have to buy an extra service manual to find out what is where.

The styling of the American-made Astro 102BX runs counter to the military-like appearance popularized by such firms as Kenwood, Icom, and Yaesu. Features such as dual PTOs and a single conversion receiver are among Swan's symbols of an independence from the everyday world of amateur radio products. Priced at $1195, the 102BX joins a growing list of transceivers costing a kilobuck or more. The accessory power supply lists at $179.95. As Swan's premier transceiver, the Astro 102BX is intended for the discerning amateur, one who can appreciate its styling and versatility.

Swan, a division of Cubic Communications, Inc., 305 Airport Rd., Oceanside CA 92054; (714)-757-7525. Reader Service number 476.

Tim Daniel N8RK
73 Staff

THE CON-PUTER 1

Con-puter 1 is a new type of memory keyer for amateur radio CW contest or casual operation. It permits the operator to store contest exchange messages which contain serial numbers. Such exchanges are required in the Sweepstakes, WAE, VK/ZL, and many other CW contests.

After initial storing of desired contest messages by the operator, Con-puter 1 automatically inserts the correct serial number. This number is also displayed. Each time the message is initiated, the serial number automatically increases by one, and the complete message, with number, is sent without further attention from the operator. Numbers up to 9999 can be accommodated.

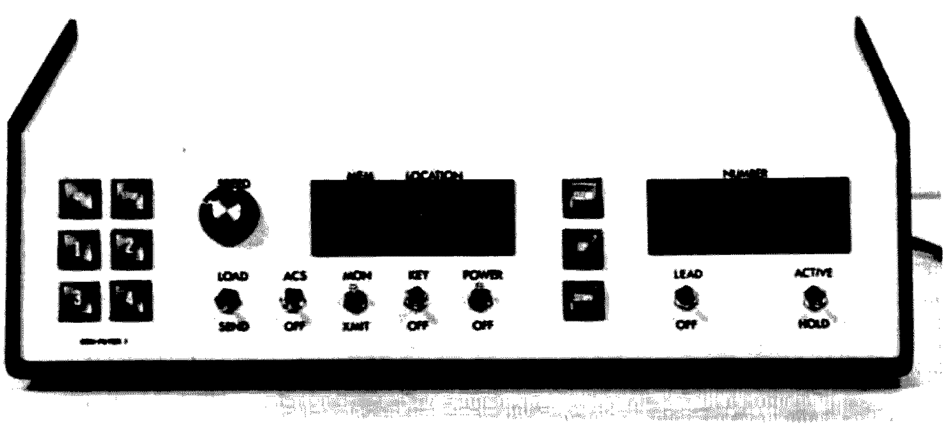
Con-puter 1 also contains a leading zero option which, when activated, automatically places lead zeros in front of numbers less than 100. The memory and address locations are digitally displayed for loading convenience.

Con-puter 1's front panel is purposely kept simple for operating ease. Con-puter 1 operates like a regular memory keyer when the serial number feature is not needed. Approximately 200 characters may be stored in the 4 primary and 4 secondary message locations.

Con-puter 1 has built-in sidetone and speaker. A regular or iambic key paddle may be used. Continuously adjustable keying speed is 5-60 wpm. Power requirements are 120 volts ac, 60 Hz or 12 volts dc. Memory contents may be protected against power loss by connecting an external battery to terminals provided for that purpose on the rear panel.

The heavy-duty aluminum cabinet measures 12" wide × 3½" high × 10" deep. The unit weighs 8 lbs.

For further information, contact *Con-puter 1, 3006 Lockheed, Midland TX 79701.* Reader Service number 481.



The Con-puter 1.

THE ICOM IC-2AT SYNTHESIZED TALKIE

Miniaturization techniques and frequency synthesizers are creating some radical and exciting innovations in the world of 2-meter hand-held transceivers. Large, crystallized handies capable of operation on 5 or 6 discrete channels are giving way to pocket-sized equivalents capable of 800-channel operation, two-tone encoding and much more. The mass clamor for these palm-sized gems and their accessories is extensive, with almost every active amateur wanting to get in on the action. The capability of carrying a full communications system comfortably in one hand has a distinct advantage which is, indeed, hard to beat.

In addition to their everyday use through one's local repeaters, frequency-synthesized handies are particularly useful when traveling via airlines and rental cars. (I don't advocate us-

ing the HT aboard a commercial airline, but its emergency capability is reassuring.) Once clear of airport hassles, the HT can be set on an area repeater and placed on the rental car's seat. This pleasure is proving its worth to HT owners every day.

Hand-held talkies also make ideal mobile rigs when used with a 25- or 50-Watt amplifier and a gain antenna mounted on the auto's roof. When leaving the auto, the handie can be carried right along and used portable.

During recent years, I've used almost every hand-held transceiver on the market. Every unit was an exceptional performer, each exhibiting some special feature or features unique to that manufacturer. Recently, however, I secured what seems the most enjoyable and logical talkie I've owned—a new Icom IC-2AT.

The Rig

Two models of the Icom handie are available in the US: the IC-2A and the IC-2AT. The difference between these units is that the IC-2AT includes a touchtone encoder which is molded into its front case. The encoder adds only 1/16" to the case thickness, its inner area is rubberized, and the buttons have a positive snap action. The rubberized area is slightly recessed to provide some protection from pocket edges, etc. There are two unique features in the Icom's encoder. When punching numbers, the tones can be heard on the handie's speaker. The loudness of these tones follows the handie's volume control setting. After punching a single digit and hearing those two tones in return, the handie's push-to-talk can be released. A VOX circuit in the unit holds the rig on transmit until approximately 1 second after the tones are completed. This delay will follow almost any dialing speed one cares to use. Next, the transmit LED atop the unit will extinguish and the handie will automatically return to receive mode.

The Icom handie is smaller and lighter than other handhelds, and it can actually be slipped into pockets where other units won't fit. In fact, the Icom can be comfortably carried in the vest pocket of a suit coat all day without evidencing itself by a bulge or pull from weight.

Frequency selection with the

✓ Reader Service—see page 195

Conditions	Total Current
Receiver on, squelched	12 mA
Receiver on, signal present, low volume	25 mA
Receiver on, signal present, high volume	35 mA
Transmitter on, low power	200 mA
Transmitter on, high power	400 mA

Table 1. Current drains measured on the IC-2AT. Battery voltage was 8.7 volts.

Icom handie is done with small thumbwheel switches mounted atop the unit. Two main advantages of this arrangement are the ability to change frequencies by merely feeling and counting steps rather than looking at the rig (very beneficial when mobiling in rush-hour traffic) and the fact that this mechanical memory doesn't require battery current or reprogramming during periods of minimal use. An LED mounted beside the thumbwheel switch/frequency display indicates transmit mode and battery condition. Three small switches are submounted on the Icom's back for selecting high/low power, simplex or duplex operation, and +600- or −600-kHz transmitter offset. Odd splits and 1-MHz splits are not provided in the Icom. A belt clip is also furnished with the Icom; it can be used or removed, as desired.

Internally, the Icom handle consists of layered PC boards which open book-style for servicing. The receiver is double conversion with a first i-f on 10.695 MHz and a second on 455 kHz. Through actual on-the-air use, I've found sensitivity and selectivity comparable to other quality handies on the market. The transmitter uses a conventional and popular varicap/frequency multiplier arrangement to achieve a crisp, clean transmitted signal. A voltage regulator circuit applies +5 and +6 volts to all stages except the transmitter's driver and final amplifier. Those stages receive full battery voltage for producing maximum transmitted rf energy. The handie's LED monitors voltage to the regulator during transmit mode.

The Power Source

Power for the Icom handie is supplied by a slide-on battery pack on the unit's bottom section. Mating is accurate and positive, without "play" or loose edges. The standard battery pack supplied with the Icom is a 250-mAH unit of relatively small size. This pack is no slouch, however; it powers my unit to 2.4 Watts output when normally charged. The output power drops to 1.3 Watts when the batteries are almost depleted. (These measurements were conducted using a dummy load and a Bird wattmeter.) Battery life when using this 250-mAH pack depends on the amount of transmitting, receiving and squelched time employed. Obviously, this situation varies with individual applications. You can calculate HT use time for your particular type of activity with the aid of Table 1. If, for example, you listen for 1 hour (approximately 30 mA) and transmit for a total of 3½ minutes (approximately 60 mA), a fully charged 250-mAH pack will be dropped to approximately 160 mAH. Speaking from a more non-technical standpoint, the Icom (with its 250-mAH pack) exhibits the same battery life as the Yaesu FT-207R. Several optional battery packs should soon be marketed for the Icom handie, although the manufacturer is back-ordering them as this report is being written. The BP5 pack will contain nine 450-mAH nicads and power the HT to an advertised 2.3 Watts output. The BP2 pack will contain six 450-mAH nicads and power the unit to a solid 1-plus Watt output. Finally, the BP4 case looks particularly appealing and useful. This is a blank case which can be loaded with 6 alkalines or 6 nicads of the 450- or 500-mAH variety. When this case is used in conjunction with the standard 250-mAH pack (BP3), continuous operation is possible by alternately swapping and charging packs. The slide on/off feature permits this option without missing a single QSO.

Personal Evaluation

I've personally found the Icom handie perfectly adaptable to my particular needs and pleasures. Its small size and light weight are, in my opinion, definitely a worthwhile trade-off for the scanning feature of my previous frequency-synthesized HT, and the slide on/off battery packs are an ideal means of keeping the unit operating continuously. The microphone is placed midway along the unit and opposite the antenna. This allows the unit to be canted back during use to prevent rf from radiating broadside into the eyes. Both transmit and receive audio are exceptionally crisp and clean. I think it's a great little transceiver and recommend it heartily. The U.S. distributor is *Icom, Inc., 3331 Towerwood Drive, Suite 307, Dallas, TX 75234.*

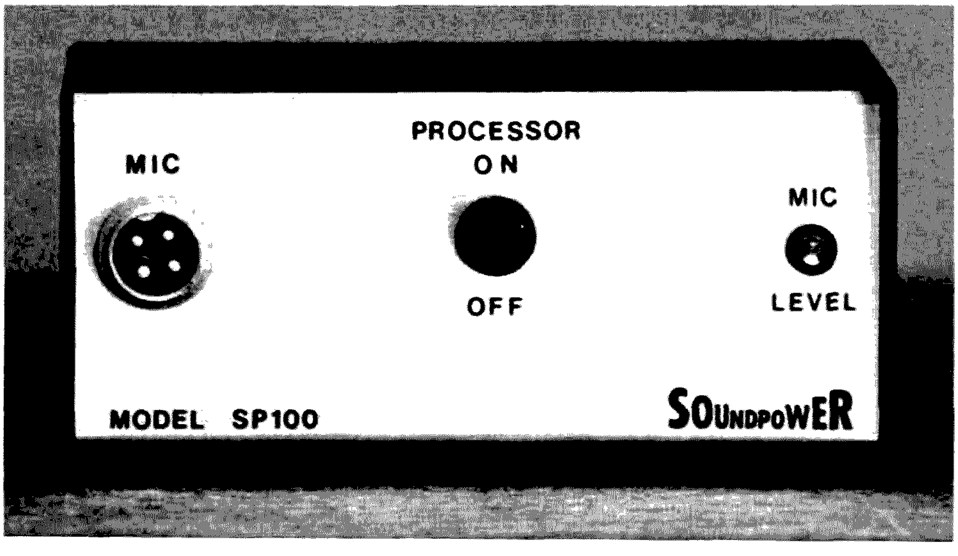
Dave Ingram K4TWJ
Birmingham AL

SOUNDPOWER SP100 SPEECH PROCESSOR

Every ham dreams of having the loudest signal on the band. Some amateurs make an obsession out of this. They build or buy gain antennas, amplifiers, and now speech processors. Of course, these signal boosters do have some drawbacks. Antennas require a lot of real estate and amplifiers have final tubes that are expensive to replace. Speech processors, on the other hand, are usually inexpensive and don't require more then a few inches of desk space. Is it any wonder that many of the signals heard today are clipped, compressed, amplified, expanded, and so forth?

Enter the SP100 speech processor made by Soundpower. The SP100 is advertised as increasing the "effective voice power output well over ten times." Packaged in a 5¼" W × 2½" H × 2½" D cabinet, the SP100 uses only two eight-pin integrated circuits and a handful of common resistors and capacitors to give you a 10-dB increase in talk power. The user must supply 6 to 13 volts dc. A small plug-in supply, the PS9, is available as an accessory.

The Soundpower processor eliminates unneeded frequency components so that the system voice power can be concentrated in the high articulation frequencies. The result is an adjustable constant amplitude signal containing only the frequency components needed to make the human voice intelligible.



Soundpower's SP100 speech processor.

Our bench and on-the-air tests confirmed that the SP100 does selectively amplify parts of the complex audio signal coming from your microphone. We used a D104 microphone which plugged into the standard 4-pin connector on the processor. A short cable runs from the SP100 to the rig. In our case, it was a Kenwood TS-820 and we were able to use the spare 4-pin connector supplied with the SP100.

Two trimpots were adjusted according to the instructions and on-the-air feedback. If you succumb to the temptation to crank up the processor's gain, the result may be a loud signal but also an unintelligible one. The S-meter on a nearby station's receiver showed a 9- to 12-dB improvement over unprocessed speech. This agrees with the claim of a voice power output increase of about 10 times.

There is no free lunch when it comes to using the Soundpower unit. The gain in talk power is accompanied by a loss of fidelity. The low frequency parts of speech are dropped, so the natural resonance that accompanies the human voice is lost. The result is signal that is far less pleasing to listen to. One station expressed his amazement at the substantial increase in signal strength provided by the SP100, then he asked me to turn it off. Unprocessed speech is likely to be preferred by just about everyone you meet. Of course there are situations when your normal signal won't break through the noise and interference. In such cases, the SP100 can help you out, but don't expect the operator on the other end to praise your audio.

When properly operated, the SP100 should not cause your rig to splatter. The duty cycle imposed on the transmitter section is likely to increase, so the rig is going to run a bit hotter. Costing $79.95, the SP100 is an inexpensive way to boost your SSB signal. Don't forget that you sacrifice some audio quality, too.

Soundpower, PO Box 426, Bergenfield NJ 07621. Reader Service number 477.

Tim Daniel N8RK
73 Staff

RTTY READER

A new radioteletype code

Microcraft's RTTY Reader.

reader has been introduced by Microcraft Corporation for SWLs, Novices and veteran radio operators. It is completely self-contained and features an eight-character moving LED display, separate active mark and space filters, and tuning LEDs. All text characters—letters, numbers and punctuation—are shown sequentially on the display. It features an extremely versatile decoding system capable of handling 170, 425 and 850 Hz FSK with RTTY speeds of 60, 67, 75 and 100 Baudot and 100 ASCII.

All that is required is to connect it to the loudspeader of a communications receiver—no CRT is needed. It is compact, measuring 7.375" W × 5.75" D × 3.375" H, and weighs 4 lbs.

Microcraft Corporation, PO Box 513, Thiensville WI 53092. Reader Service number 479.

INSTANT SOFTWARE'S "QSL MANAGER"

While tuning across the ham bands have you ever said to yourself, "I've worked that guy before; it was on 15 meters about a month ago, or was it 40 meters?" You could make a mad dash for the logbook and furiously flip pages in hopes of finding the QSO. If your memory is like mine, though, chances are that you won't find the entry in time.

The "QSL Manager," a disk-based program from Instant Software, Inc., turns your 32K TRS-80 Level II computer into a video logbook, one that can find a record of any past QSO with that "familiar" callsign in just a few seconds. No more log sheets are needed; just load the program and choose one of the five functions: view log, add entry, print summary, search entries, and end.

The program can be used with a single disk drive system, but this will limit the number of entries to about 400 since the disk must hold both that program and data. With a dual drive system, one disk can store the program and the other has room for about 1400 entries if the TRS-80 has 48K of memory. Computers with 32K are limited to approximately 1000 entries.

In order to make the most of the disk storage, each QSO entry is limited to the date, time, call, band, mode, name, remarks/QTH, and a record of QSL exchange. When the data is loaded at the beginning of each session, the callsigns are stored in the computer's random access memory. If a search is initiated, the computer scans the memory, which points to the appropriate location on the disk. This results in fast search times, even when your log contains hundreds of QSOs.

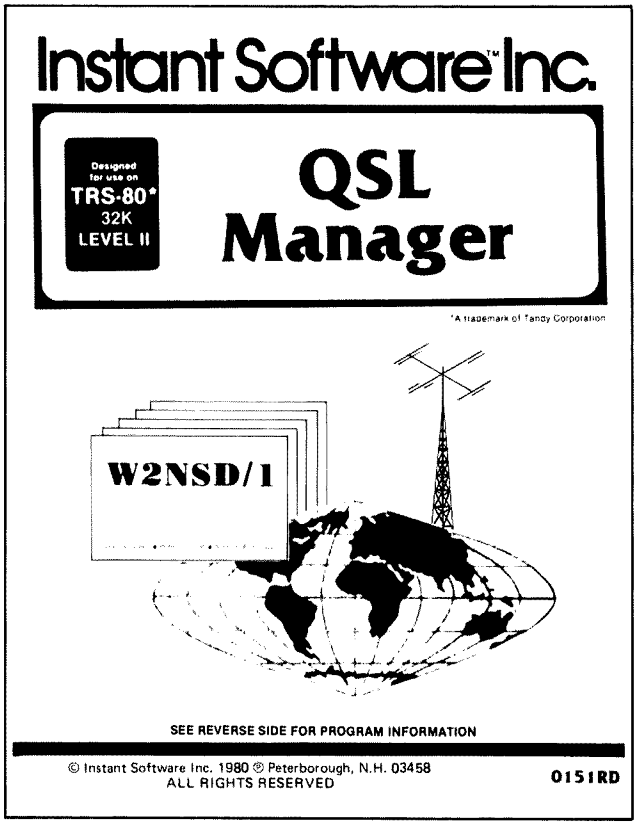
The "QSL Manager" package is more than 6000 bytes long. It contains a title program, the manager program, and an auxiliary program that allows convenient start-up. You can customize the program to include your callsign in the heading and, if you want, other changes can be made to tailor the program to your specific needs.

This type of video log is intended for rag chewing rather than contest use. It allows you to keep track of stations that have forgotten to send a QSL, something that is handy if you are trying for a multiband Worked All States or DX award. A hard copy of your entire log (or selected entries) can be made if your system includes a printer.

A computer costing hundreds of dollars may seem to be an expensive way to keep a log. The "QSL Manager," however, represents the tip of an iceberg of potential ham radio applications for the TRS-80. The "QSL Manager" costs $19.95 and is available from many computer stores or direct from the publisher.

Instant Software, Inc., Peterborough NH 03458. Reader Service number 482.

Tim Daniel N8RK
73 Staff



Instant Software's "QSL Manager."

REPEATER "TAIL CHOPPER"

Circuit Specialists has introduced a repeater squelch tail eliminator called the "Tail Chopper." Both models of the "Tail Chopper" maintain normal squelch hysteresis to 0.1 mV and feature adjustable sensitivity.

Model TC-2100 is a universal module for use with most repeaters. It has a built-in enable/disable function which can be connected to the tone control system of the repeater. The TC-2000 is designed to plug into the Regency U10R UHF repeater to improve its squelch operation and eliminate the squelch tail.

Completely assembled units as well as PC boards and parts are available from *Circuit Specialists, Inc., 621 Bishop, Salina KS 67401.* Reader Service number 484.

SOUNDS OF SHORTWAVE

How do you describe the notorious Russian woodpecker to a friend who has never heard it? Words just do not do the job when you want to tell someone about the unusual squawks and buzzes you hear on your ham or shortwave receiver.

Now you don't have to settle for words—you can produce those strange sounds any time you want with Grove Enterprises' cassette tape, *Sounds of Shortwave.*

One half of this 60-minute tape is devoted to explaining and listening to dozens of on-the-air sounds. You'll hear everything from common RTTY signals to the rare and unexplainable English "number" transmissions.

Side two helps the listener select the best shortwave receiver and design an effective antenna. To an experienced

SWL or ham, much of this will be old news. The tape is intended for the listener who is new to the hobby.

The tape's interesting and useful content could be enhanced by better quality production and a less sing-song narration. However, don't skip over this tape if you are looking for a novel way to introduce a friend or relative to shortwave listening. *Sounds of Shortwave* costs $5.95 postpaid and is available from *Grove Enterprises, Route 1, Box 156K, Brasstown NC 28902.* Reader Service number 480.

Tim Daniel N8RK
73 Staff

HY-GAIN ADDS THREE NEW PRODUCTS TO TOWER LINE

Hy-Gain, a division of Telex Communications, Inc., has announced the addition of three new products to its tower line. The HG-70HD, a new 70-foot self-supporting crank-up tower, is the tallest of seven towers now offered by Telex/Hy-Gain. The tower is all steel, has four sections, and features an improved guide system providing rigid, close-tolerance structural support while leaving the tube ends open for complete surface galvanizing and unrestricted moisture drainage. This heavy-duty tower was designed for antenna loads of up to 16 square feet in winds of up to 60 mph. The top section is predrilled for thrust bearing bolts; a rotor mounting plate is included.

Hy-Gain has also developed a new electric winch system, Model HG-EW, that fits the new HG-70HD as well as the existing 54-foot HG-54HD and the 52-foot HG-52SS. The winch control box can be locked, which allows the tower to be secure in either the extended or retracted position. It has a limit switch which prevents a possible overload at the upper stop position. A manual crank is also supplied in the event of an electrical power failure. The HG-EW is equipped with an automatic brake which is always in positive engagement when the winch is not operating.

This winch system can be converted at any time to remote control operation by adding the new Hy-Gain tower control (HG-EWRC) which has been specifically designed as a

Continued on page 160

Chris Brown N1AUI
73 Magazine Staff

In Profile: Dick Bash KL7IHP

—the father of The Final Exam speaks out

Dick Bash KL7IHP has created a furor by publishing FCC test questions, verbatim, in a series of controversial license manuals called The Final Exam. *Individual manuals exist for the Advanced, General, and Extra class tests and will be released soon for the Novice class test. Controversy has arisen because many hams feel that these manuals are nothing more than elaborate cheat sheets and, as such, should be suppressed. The following profile is drawn from an interview I conducted with Dick Bash at the 1980 Dayton Hamvention.*

"Morality? Man, who am I to judge morality? Who can address moral issues in these changing times? Legality? Now that's something else, altogether."

As he speaks, the intensity in Dick Bash's steel-blue eyes is meant to telegraph the high seriousness of his positions on various issues. But whether discoursing on the controversial nature of his license manuals or on his vision of the future of the ham radio hobby, he exudes the smooth confidence that's so often present in the laid-back, sunny California personality.

"The FCC won't mess with me. I've got some high-priced legal talent in San Francisco ready and waiting to take them on. They haven't got a case, and they know it. A thing called the Freedom of Information Act is involved."

The format for the controversial manuals is straightforward. Actual test questions and multiple-choice answers are reproduced exactly as they appear on the official government tests. Bash suggests in the General class guide that some outside reading be done to supplement his information. In the Advanced class guide, however, he indicates that simple memorization of his material will be sufficient preparation to allow one to pass the test.

Bash solicits the test questions appearing on the FCC exams from cooperative hams who have recently taken the tests.

"Every day, I go down to the examining station, stand outside the door, and wait for them to come out: all the young kids and oldtimers who have failed the Advanced class test three and four times. I say, 'Hi buddy. Did you pass?' Most say no." (I have it from Commission insiders that the failure rate on the Advanced test is a whopping 69%.)

"When they tell me they have failed, I say, 'Well, maybe you should have used my book.' Then I ask them if they remember any of the questions. Usually they can come up with one or two.

"I also get lots of questions in the mail from guys who have heard of me and are fed up with the BS way the FCC writes its exams. It's as simple as that."

Bash maintains that test aids similar to his are available for many other federally-administered tests where licensing is involved. His examples include FCC commercial radio exams and the certification tests the FAA periodically requires of pilots. He is upset that the ham radio establishment has not been more receptive of his efforts at making its own tests easier to pass.

More than altruism is involved. What began as a ten-meter, self-help net for San Francisco-area General class hams trying to upgrade to Advanced has become a full-time business for Dick Bash. He estimates that approximately 8,000 copies of his books have been sold during the past four months. Most of the substantial inventory in his booth at the Dayton Hamvention was depleted by the close of business on Sunday afternoon. He seems to have an enthusiastic market for his product.

"I'll tell you something else. Today's ham is not an engineer, he's an appliance operator. And there is not a damn thing wrong with that. How many Kenwood, Yaesu, and Ten-Tec rigs do you think are on the air? Lots, that's how many. These guys just want to get on and shoot the bull. So

why not let them? Why make such a damn game of it?"

Bash, a TS-820S owner/operator, feels that current FCC amateur tests favor technically-oriented hams—many of whom are professionally involved with the electronics industry—at the expense of socially-motivated hams. This perception provides the rationale for the publishing of his test guides. Bash suggests that anyone who questions this premise read Part 97.1, Subpart A—General, Basis and Purpose. He feels that this section indicates that, officially, the social aspects of the hobby are at least on an equal footing with technological aspects.

In Bash's opinion, the situation is compounded by the fact that the ARRL has abandoned the Novice. He also feels that much of the ham media (*QST, 73,* and *Ham Radio Magazine*) has nothing at all to offer the beginner. Further, he will tell you that the East Coast Establishment soon will sound the death knell of ham radio if allowed to continue its domination of the hobby.

"But you know what? Ham radio is alive and well on the West Coast. You guys from back east ought to come out to the real world sometime and see what has been happening."

Like most California true believers, his faith in the "west is best" ethic is strong. And, believing the sweep of trends in America to be a west-to-east phenomenon, he places himself in the vanguard of a new ham movement.

"I'm gonna have five thousand new Novices on the air next year alone. They are all going to use my Novice guide to get their tickets and they're all going to pass the test on the first try."

Whether or not one feels that the declining ranks of US amateurs would benefit from 5,000 new recruits next year, the prospect of the instant existence of 5,000 new, Bash-prepared amateurs is an interesting one to speculate upon. Would today's already crowded bands plunge into chaos? Would the declining domestic ham industry receive the shot-in-the-arm it sorely needs? Would there be any impact at all? The debate is raging among those familiar with Dick Bash.

Bash does allow that an operator must know enough theory to run his station in a legal manner, within qualitatively acceptable limits: no out-of-band operation, no splatter, etc. To him, expecting more than this is unnecessary and unfair.

Bash perceives the ranks of amateur operators with a simple dualism. Old/young, east/west, have/have not. The lack of cooperation and communication which he feels exists within the amateur fraternity has resulted from the unwillingness of the privileged class of operators to share their bands and privileges with others: an "I've got mine, you get yours" situation, where maintaining the status quo is the rule. For Bash, the end result is the loss of new talent and stagnation of the hobby. He feels that eventually his manuals may rectify this inequity and, for that reason, are threatening to a great many old guard operators.

A Jerry Brown liberal, he often seems to be subject to the same confusion of goals and vagueness of purpose that appeared to plague his governor's presidential election campaign. Though his social theory may be simplistic and his solutions short-term, he has begun to have an impact on amateur licensing procedures as well as on the hobby itself. And, like the governor he admires, he has accrued his share of detectors.

His relationship with the ARRL is, predictably, stormy. To him, it represents everything that is wrong with ham radio today. By refusing to run an ad for his manuals in its monthly journal, *QST*, the League has given Bash a slap in the face that he finds particularly infuriating.

The federal government does not get very high marks from Dick Bash either. He feels that it has failed in its responsibility to oversee the ham licensing procedure and has buried its sense of purpose in the bureaucratic quagmire known as Washington DC. Rather than encourage the development of the hobby, he feels that the government has inhibited development by placing obstructions in the path of people trying to upgrade. These obstructions take the form of licensing tests which feature needlessly vague questions on esoteric subjects, all cleverly phrased to trick the reader into answering incorrectly.

Recently, Bash has asserted that the Personal Radio Division of the FCC has been exerting pressure on those magazines which do advertise and sell his manuals. The pressure, he claims, comes in the form of threats of lack of Commission cooperation with the ham media. His assertion, while startling, is true. One national magazine, regularly advertising and selling his books, has ceased doing so for the reason he cites. This probably indicates that the FCC has either recognized the legality of what Bash has been doing or has given up hope of prosecuting him in the anti-regulatory atmosphere existing in Washington today. In either case, the FCC's use of coercion is a questionable (but not unheard of) tactic for a federal agency to employ.

The issue of Dick Bash's

Dick Bash KL7IHP. (Photo by Frank Novac.)

manuals goes beyond what is merely legal or illegal, moral or immoral. Dick Bash's manuals are a response to a malaise existing within ham radio today. While it is unrealistic to assume that the hobby will greatly benefit from an influx of non-technical operators, it would seem that an examination may be called for of just what qualities an amateur operator should embody.

If there is a place within ham radio for rag chewers, bull throwers, and social butterflies, then maybe current licensing tests with their emphasis on things technical are not valid indicators of the ability to use the ham bands effectively. If there is no place within our hobby for these people, then possibly Part 97.1, as it applies to the basis and purpose of the hobby, should be revised. As Bash points out, the ability to run the dB calculation does not mean one is able to enhance international goodwill.

Dick Bash and his manuals will not go away. In fact, he intends to step up his publishing activities with more frequent updates of his entire line of manuals to coincide with changing FCC exams. In addition, he is planning a series of licensing seminars around the country using his manuals. He guarantees a 95% passing rate for seminar attendees, the first time around.

It is obvious that a head-in-the-sand approach to dealing with him is not realistic. While national magazines may choose to ignore him and the federal government may try to subvert him, his manuals continue to sell briskly. There is a reason for this, and concerned hams, old and young, east and west, should start wondering why. ■

John F. Sehring WB2EQC
PO Box 306
Oradell NJ 07649

That Mysterious Mode: 10 FM

—an examination of propagation phenomena

As a 10-meter aficionado I've spent most of my operating time during the last few years on the FM portion of that band, which lies between 29.5 and 29.7 MHz. Use of the FM mode (narrowband, ±5 kHz deviation) is allowed above 29 MHz, just as on the VHF and UHF bands. The mix of long-distance propagation together with FM-receiving characteristics is most interesting, and one hears effects not noticed during either HF-SSB or VHF-FM operation.

The propagation anomalies which I've noticed can be divided roughly into three types.

Type I. Discovering that two different 10-meter FM QSOs can be heard on the same frequency at the same time by switching the receiver from a vertical to a horizontal antenna. The band is "open" when this occurs.

Type II. A strong FM signal is received which, when unmodulated, is typically at full-quieting. During modulation it becomes almost unintelligible, sounding like an SSB signal received on an AM receiver (no bfo). On the air, this effect is referred to commonly as "phase distortion." It often happens just before the band is about to shift or close, and is accompanied by deep QSB. The lower audio frequencies seem to be the most distorted.

Type III. A weak FM signal is received which shows a fair degree of quieting when unmodulated. In this case, modulation also distorts the signal but not at all like Type II. Instead, the audio quality becomes completely "fuzzed-up" during modulation to the point of being unreadable. At the same time, the degree of quieting goes to zero and the receiver's squelch may chop up the signal. This type of signal distortion seems to be associated with "backscatter" propagation conditions.

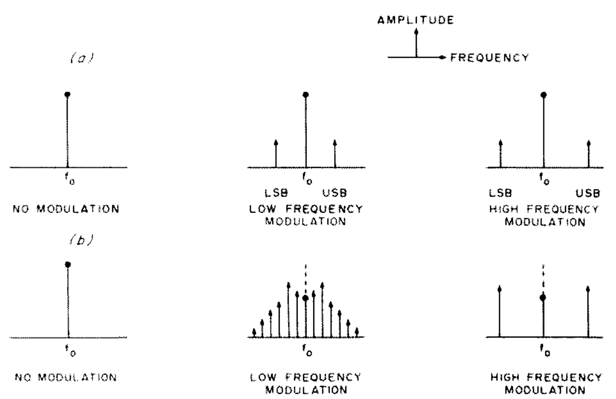


Fig. 1. (a) AM and (b) FM modulation spectra. Carrier is shown at f_0 in all cases.

Some Detective Work

As an aid to observing what was happening during these conditions, two different meters were installed in the receiver's FM i-f strip. The first one acts as a signal strength indicator, showing how much signal energy is present in the receiver's bandpass by reading first-limiter current. It is analogous to an S-meter and then some. The second meter shows the degree of quieting on a signal by sampling the amount of "supersonic" noise on it. This supersonic noise energy is found above the usual communications audio range (about 6 kHz and up) where audio energy does not normally lie. This noise spectrum also is used to activate the noise-operated squelch circuits found in most FM receivers.

Now, from VHF-FM experience you might reasonably expect that the signal strength and quieting indications would correlate at all times, i.e., a strong signal should display a large degree of quieting, but this is not always so on 10 meters, as we'll see. In fact, let's see just what the meters tell us under Type I, II, and III conditions.

With Type I conditions, we see relatively equal signal strengths from the two different signals but only a fair amount of quieting on them. Under Type II conditions, signal strength and quieting are good on the un-

modulated signal, but with modulation signal strength drops sharply in step with the modulation; quieting remains adequate. Type III signals produce the opposite effect: Signal strength holds steady with modulation (as it normally should) but the quieting falls to zero on modulation peaks, letting noise bursts through. In other words, a great deal of supersonic energy is being generated during modulation and is responsible for causing the noise-operated squelch to drop.

Amplitude vs. Frequency Modulation

At this point, it would be useful to review briefly the difference between amplitude- and frequency-modulated signals. Fig. 1(a) shows the frequency spectra for three cases of an AM signal: with no modulation, with low-frequency modulation, and with high-frequency modulation. Note that with AM there is always only one set of sidebands, that the sidebands move further away from the carrier for higher audio-modulating frequencies (bandwidth increases), and that the carrier level stays constant during modulation.

By contrast, the narrowband (±5-kHz deviation) FM case is shown in Fig. 1(b), using the same audio modulation frequencies as before. Notice that the lower audio-modulation frequency produces numerous, closely-spaced sidebands, whereas only one set is found for the higher audio frequency. Also, the bandwidth of the FM signal does not vary with modulating frequency and the carrier amplitude drops during modulation.

This carrier energy is not lost, however, as it reappears in the FM sidebands, i.e., the average power level of an FM signal remains constant during modulation. This is not so with AM, where the modulator must supply additional power during modulation—up to 50% of the carrier power level. Typical bandwidths using speech modulation (3 kHz maximum audio frequency) are 6 kHz for AM and about 13.6 kHz for FM.

You may wonder why the bandwidth of a ±5-kHz FM signal is not just 10 kHz. It is because there are additional, lower amplitude sidebands accompanying an FM signal. For narrowband FM, the second set of sidebands might have only about 13% of the total signal energy. While these sidebands must be passed by the receiver for correct demodulation, in the interests of clarity we will ignore the extra sidebands for our discussions.

One of the most attractive properties of FM is, of course, its noise-reducing capabilities. As usual, however, there is a price to be paid for this advantage: FM's performance at very low signal levels is inferior to AM and SSB. As can be seen in Fig. 2, at low carrier-to-noise ratios (CNR), under 9 dB, the AM signal-to-noise ratio (SNR) is better than with FM. At these low levels, the FM signal suppression effect occurs, i.e., the FM signal's modulation becomes increasingly swamped by noise and finally abruptly disappears. On the other hand, at greater CNRs (above 9 dB), FM begins to show its superior SNR qualities, and at 12 dB of CNR, the threshold of full improvement is reached, beyond which the FM signal will have an SNR of about 10 dB better than an equal-strength AM signal. Greater FM deviation ratios will yield more startling improvements, e.g., broadcast FM uses ±75 kHz of deviation which can provide an ultimate SNR of around 75 dB!

Receivers

Next, take a quick look at the typical AM and FM i-f strips shown in Fig. 3. Aside from using a different detector, the FM receiver also has a limiter whose function is to remove any amplitude variations (including amplitude modulation) from the incoming signal, leaving only the frequency variations for the FM detector to demodulate. Since most QRN is amplitude in nature, static can be reduced markedly when using FM.

What about the situation where two different FM signals occupy the same frequency simultaneously (co-channel QRM)? Well, just as when two AM signals sit on top of one another and interfere, the FM carriers and sidebands also will

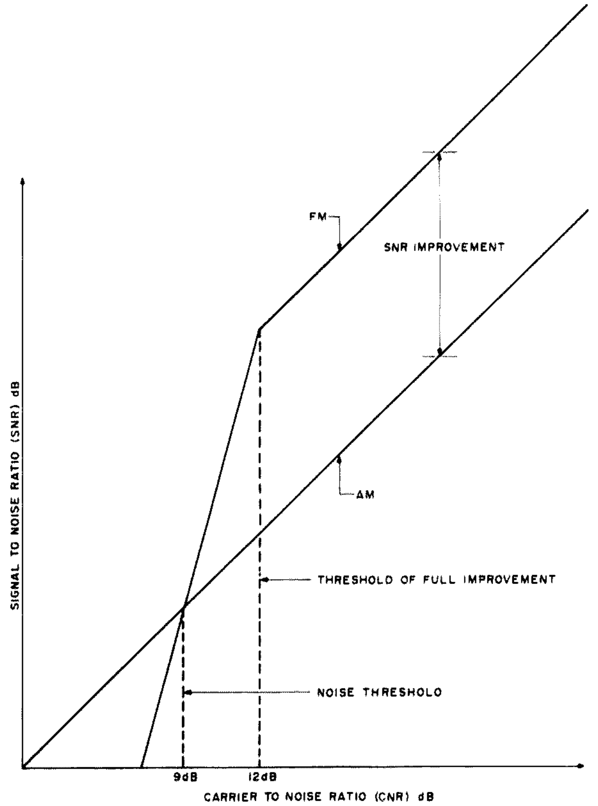


Fig. 2. Signal-to-noise ratio improvement in FM systems.

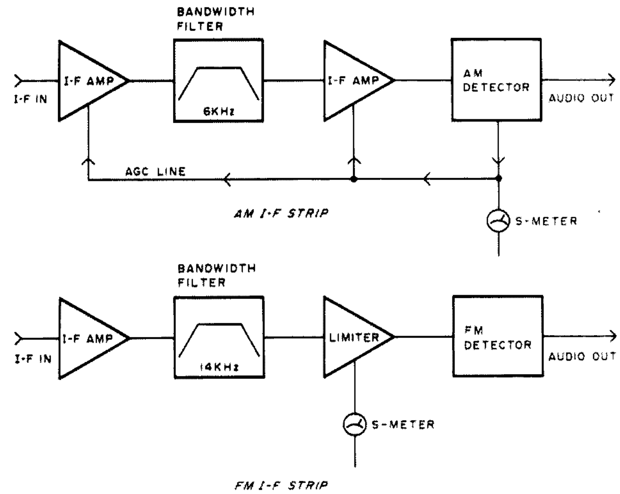


Fig. 3. Comparison of AM and FM receiver i-f strip design.

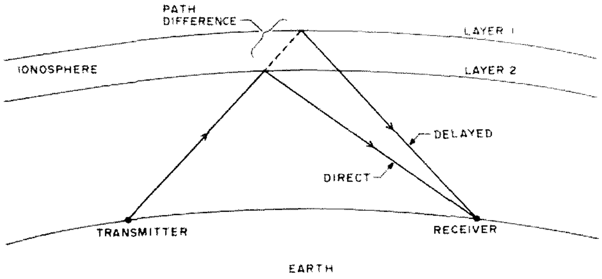


Fig. 4. Two-path ionosphere propagation.

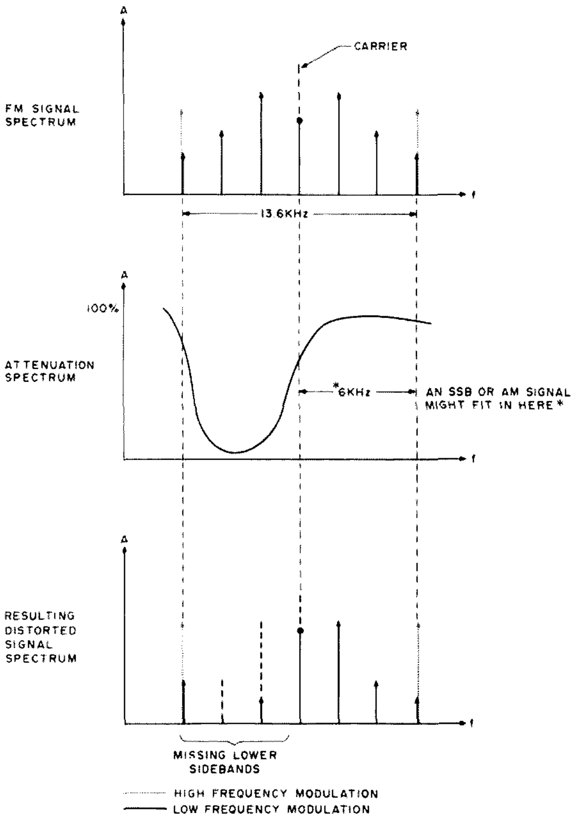


Fig. 5. Multi-path distortion effects.

beat together, producing heterodynes. But the FM receiver's limiter stage(s) will tend to remove these interference beats, as they are amplitude modulated, thus leaving only the stronger FM signal to be detected. This is known as the FM "capture effect"—one signal need be only a few dB stronger than the other to capture the FM receiver and produce an interference-free output. The minimum difference (in dB) in signal strength between two co-channel signals which completely suppresses the weaker one is called the capture ratio.

We now can begin to explain the Type I effect: Obviously, one signal needed to be only a few dB stronger than the other in its respective antenna to capture the appropriate receiver. Some interference from higher-order beats still will remain in the supersonic region, causing the quieting meter to act up a bit, as noted. Why the two antennas heard different signals still must be explained.

Propagation Primer

We now can leave the receivers behind us and begin to look at some typical HF propagation mechanisms. Of course, we're all familiar with the usual skip propagation modes on HF, i.e., signal reflection from various ionospheric layers such as the F_1 and F_2 (longer skip distance, multihops) and the E layer (shorter skip distance, sporadic-E).

Most of us are willing to accept the reason for fading on skip signals as being a temporary loss of reflective properties in the ionosphere, but this is not quite accurate. Actually, the ionospheric layers are not just single, mirror-like reflectors but are each composed of many closely-spaced sub-layers whose relative and absolute heights are constantly shifting in a random manner. Any one signal, therefore, often will be reflected from two or more sub-layers at the same time. Since reflection from slightly higher sub-layers results in a slightly longer path from transmitter to receiver, both direct and delayed signals will arrive at the receiving antenna—see Fig. 4. This is known as multi-path propagation.

Now, if the delayed signal's path is just one-half wavelength (or odd multiple thereof) longer than the direct signal's path, the two signals will arrive at the receiving antenna 180° out of phase (this corresponds to a half-wavelength) and will cancel each other out, thus producing a down-fade. Moments later, as the reflecting sub-layers shift to different relative heights, the path length difference might become one whole wavelength or a multiple thereof; the two signals then would arrive in phase (0° phase shift) producing a fade-up. It is this constantly changing behavior of the ionosphere which produces most short-term HF fading. On 10 meters for example, one half wavelength amounts to only 15 feet—peanuts, when compared to a 3000-mile trip through the ionosphere—so QSB is not a surprising phenomenon. Experiments have shown that in most cases of selective fading only two propagation paths are involved, the direct and the delayed, both having similar strengths.

In addition to reflecting signals, the ionosphere also plays tricks with a signal's polarization, rotating it in a random fashion. It matters not what polarization sense the transmitted wave has during skip propagation, as it may arrive at a distant location with any polarization—vertical, horizontal, or any angle in between, and will change from moment to moment. Some HF fading is due to the arriving signal's polarization not matching that of the receiving antenna. Further, I would suspect that there are differences in polarization between the direct and delayed signals, producing circular and even elliptical polarization. Polarization shifts do not ordinarily take place during ground-wave propagation; in this case, therefore, transmitting and receiving antenna polarization should be matched or up to 20-dB cross-polarization loss may result. No such consistent penalty results from sky-wave contacts.

Returning to our Type I observation, the two different signals that we heard must have arrived with predominantly different polarizations: one mostly vertical, producing the strongest output from the vertical antenna, and the other mostly horizontal, producing the strongest output from the horizontal antenna. Because cross-polarization losses come to about 20 dB, the signal whose polarization was "wrong" in a particular antenna would be attenuated more than enough to exceed the FM capture ratio and thus

be suppressed.

Current communications satellites use the same technique, running two separate channels on the same frequency by using horizontal polarization for one and vertical for the other. The video channels are frequency-modulated to take full advantage of the FM capture effect and superior SNR, and achieve very high co-channel isolation. I think that Major Armstrong would have been pleased![1]

A logical question at this point might be: Wouldn't the direct and delayed signals interfere with one another just as two different co-channel signals would? Yes, because the delayed signal's modulation is no longer identical to the direct signal's—its modulation lags behind due to the extra time delay. It's just like one word of a sentence which, when shouted into an echo canyon, comes back just in time to interfere with the next word of the (direct) sentence. This is an important multi-path propagation effect which can produce great amounts of signal distortion in addition to signal fading.

Up to now, our explanation of propagation and fading has assumed a signal of only one discrete frequency, i.e., a carrier of zero bandwidth. However, modulated signals also have sidebands whose frequencies (and wavelengths) are different from the carrier. Because these sidebands are of slightly larger and smaller wavelengths, they will not all fade simultaneously due to half-wavelength (180° phase shift) cancellation effects. For example, the path difference might be such that only the carrier fades, leaving the upper and lower sidebands relatively intact. This would, of course, distort a signal severely. An AM signal, for example, would be unintelligible if its carrier faded, sounding like an SSB signal received on an AM receiver. Since the sidebands lie very close to the carrier frequency, percentage-wise, only very small shifts in the ionosphere (on the order of inches) are necessary for cancellation to take place. This so-called "selective fading" literally punches holes in the propagated rf spectrum of a signal, selectively eliminating certain portions of it.

SSB's superiority over AM is due in part to the fact that it has no carrier or other sideband to fade out; the SSB receiver provides a steady, fade-proof carrier (the bfo) for demodulation.

Fig. 5 depicts another possible case of selective fading. Here, the spectrum is attenuated in the vicinity of the lower sideband. An AM signal would be quite receivable with its lower sideband missing; indeed, some AM stations transmit the carrier with only one sideband to save spectrum space. By way of contrast, an FM signal is shown under the same conditions of selective fading, using both low- and high-frequency audio modulation.

It is clear that the lower audio frequencies, which produce many more FM sidebands, are much more susceptible to selective fading since almost all of the FM signal's low-frequency, lower sidebands have been lost. Unlike AM, both sidebands must be present for distortion-free FM demodulation. The FM signal with higher frequency audio modulation would come through relatively unscathed since it has only one set of sidebands. This, then, explains why the lower audio frequencies were more distorted during Type II conditions.

Selective fading also shows us why our S-meter indications dropped during modulation. When a carrier is frequency modulated, energy disappears from the carrier but shows up in the sidebands, keeping the average signal power constant. In the case of selective fading, some of the carrier energy is being distributed to sidebands which are being attenuated; the received signal power drops with modulation, and the S-meter kicks downward, i.e., some energy "disappears" during modulation.

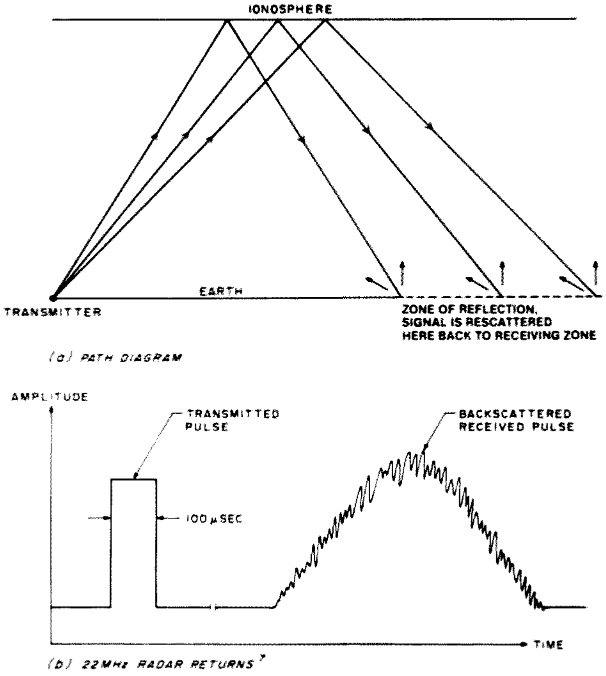


Fig. 6. Backscatter propagation.

A partial analogy can be noted when an over-deviated FM signal is received on a selective FM receiver—the first limiter current drops during modulation because such over-deviation produces extra energy-laden sidebands lying outside of the receiver's bandpass, i.e., total energy within the passband is reduced during this time.

Quieting is maintained because the signal is still strong enough for limiter saturation. Better limiting in the receiver will have no effect on selective distortion because no amount of limiting can possibly restore the missing sidebands or carrier.

Well, two down and one to go; now for Type III. The key to this one is the observation of backscatter-type propagation conditions. We've all heard backscattered SSB signals on 10 meters. Typically, a station beyond ground-wave range but inside the minimum skip distance is heard weak and fluttery with odd sounding (hollow or echo-like) audio quality.

Fig. 6 shows how backscatter propagation takes place along with a pulse sent out and returned to a 22-MHz radar set. Notice how that clean, rectangular pulse came back ragged and about five times wider than it was originally. This occurred because a large area of ground rescattered the original, point-source signal, thereby generating a very large number of differently delayed signals. In other words, we see here a terrible case of multi-path distortion! Any additional ionosphere multi-path propagation will only compound the effect.

If a two-path situation can produce the attenuation spectrum of Fig. 5, just imagine what 10 or 20 paths (as with backscatter)

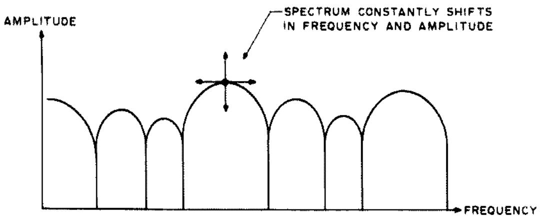


Fig. 7. Backscatter propagation attenuation spectrum.

would do. Fig. 7 shows what the spectrum might look like under such conditions. While an SSB signal might get through due to its narrow bandwidth, an FM signal, being much wider, would be distorted to the point of uselessnes. This is exactly what we hear under Type III conditions.

Once again, no amount of limiting can restore the missing parts of the signal spectrum although certain other improvements can be effected. We still don't know why the quieting went to zero on modulation, though, so we'll have to look a little deeper into the theory of FM multi-path distortion.[2,3,4]

Spurious Amplitude Modulation

First, a large amount of spurious amplitude modulation—up to 100%—may be impressed on the FM signal under adverse multi-path conditions. This type of distortion becomes progressively worse for larger amounts of deviation, more numerous propagation paths, and/or greater time delays. Here is where overall receiver performance can help—limiter characteristics in particular. Adequate receiver sensitivity and i-f strip gain will ensure that the limiter(s) will always have enough signal to saturate, even though spurious amplitude modulation may drop the instantaneous signal amplitude toward zero. If the limiter is allowed to drop out of saturation at these points, noise bursts will accompany the FM signal's modulation. In addition to high gain, the limiter's bandwidth must be wide enough to respond to (limit) very short-duration amplitude fluctuations. In commercial broadcast FM radios, it is not common to see a 1-MHz-wide limiter following an i-f strip having only 200-kHz bandwidth.

Spurious Frequency Modulation

Second, there is the more difficult-to-cure case of spurious frequency-modulated distortion. Multi-path effects cause the instantaneous frequency of the received signal to vary spuriously during modulation, i.e., the distortion is itself frequency-modulated in nature. Here, the limiter can have no effect on reducing the distortion because it can eliminate only amplitude fluctuations. The FM detector cannot, of course, distinguish between the desired frequency modulation and the spurious, distortion-producing frequency modulation, and will respond to both.

As a result, the detector's audio output may contain, along with the desired signal, large amounts of odd-order harmonic distortion, to the extent of completely obliterating the desired signal—i.e., 100% distortion. The spectrum of this harmonic distortion extends through and beyond the audio range, into the supersonic region. Fig. 8 illustrates this result.

It's now evident that our quieting meter was responding to these higher-order harmonics in the supersonic region during Type III conditions, indicating the relative amount of multi-path distortion on the signal. Theory tells us that this type of distortion becomes much worse when many delayed paths are present, which is just what backscatter consists of. Once again, greater deviation aggravates the problem and higher audio frequencies contribute more to distortion than the low ones, to the point where the spurious frequency modulation's deviation can be *twice* that of the original, undistorted signal.

For Skeptics

Lest you doubt the existence of multi-path propagation, you can see its effects in other ways, too. The traditional ghosting on television screens is due to multi-path propagation of ground waves. Small path delays produce only "fringing" effects on the trailing edges of images. Longer delays will shift an entire scene or place a vertical bar in the middle of the picture. Sometimes the video may be obliterated completely by multiple ghosting to the point where picture stability may be lost as the arrival of multiple sync pulses fools the receiver's synchronization circuits. And, of course, the sound channel also may suffer distortion, as it uses ±25-kHz deviation FM.

While it is not so easy to determine exactly how long the time delays are in HF propagation (experiments show a range from 1 to 100 microseconds), you can do it easily for TV ghosting. Given the scanning frequencies used for TV (the horizontal frequency is 15,750 Hz), we know that it takes about 60 microseconds for the cathode ray tube to "paint" just one line from left to right on the screen. Since the radio waves travel at about 186,000 miles per second, you can figure out that the duration of one scanning line would allow a radio wave to travel about 11 miles. If you see a vertical ghost bar about halfway across your screen, therefore, the ghost signal was delayed 30 microseconds (60 microseconds ÷ 2) because it traveled an extra 5½ miles.

If you have an FM broadcast radio in your car, you've probably noticed periods of "fuzzed-up" reception even in cities where signal strengths are high but multi-path effects abound. Commercial FM broadcast uses ±75-kHz deviation, making it highly vulnerable to such distortion. On nearby 2 meters, where deviation is only ±5 kHz, you'll hear lots of things on signals but not much multi-path distortion at all unless signals are very weak. Such weak signals are often subject to squelch chopping, which can be alleviated somewhat by backing off from the mike. In this case, the multi-path distortion is generating harmonic distortion components in the supersonic range, which the noise-operated squelch is mistaking for noise. Reducing the deviation by speaking more softly cuts down on these distortion components, as our theory predicts, and squelch chopping is reduced.

Interesting side-note: Simultaneous observation of amateur FM skip signals on 10 and 6 meters over the same paths reveals that the 6-meter signals are consistently "cleaner" with fewer multi-path effects. I would suspect that the ionosphere looks less "rough" (more specular) for the reflection of 6-meter signals since their wavelengths are only 60% of the size of 10-meter signals.

Some Suggested Cures

Based on observations and theoretical considerations, certain simple tech-

niques can be used to minimize the extent of multi-path distortion on FM signals.

1) Reduce the FM transmitter's low-frequency audio response since the lows are much more prone to distortion. Recall that the lower frequencies produced many more sidebands, rendering such a signal more susceptible to spectral distortion caused by multi-path propagation.

2) Use sufficient pre-emphasis in the speech amplifier—about 6 dB per octave—to suppress the lows and boost the highs. This ensures that the harmonic distortion arising from the lower frequencies will be masked and covered by the boosted higher frequency speech energy. For example, the odd-order harmonics of 500-Hz energy would lie at 1.5 and 2.5 kHz, which would be masked by the boosted part of the speech range (see Fig. 8).

A graphic example of not following this advice is provided by a certain commercial 10-meter FM transceiver whose transmit audio response is notoriously muffled (high frequencies too sharply rolled off). When received under multi-path conditions, the harmonics from the predominant lower audio frequencies fall right into the upper half of the audio passband. Since there is little high frequency speech energy to mask this distortion, intelligibility is severely degraded.

3) Roll off the speech amplifier frequency response above about 3 kHz. This should be done to reduce the generation of the spurious frequency modulation mentioned before. It turns out that this unwanted FM component can itself have a deviation of up to twice that of the original signal when sufficient high frequency audio is present in the signal. Ironically, this effect may cause more problems on a high-selectivity FM receiver as the excessive spurious deviation would place extra, energy-robbing FM sidebands outside of the normal receiver passband.

4) Reduce deviation levels to decrease the number of sidebands and reduce signal bandwidth. By concentrating the FM signal into a smaller bandwidth, the effects of spectrum "hole-punching" are reduced, resulting in less spurious amplitude- and frequency-modulated distortion. However, reducing deviation will make the signal sound less loud at the receiving end and thus degrade SNR.

Audio clipping could be used profitably to raise the average deviation level, therefore, even though the peak (most distortion-producing) deviation has been cut. If done correctly, the reduced-deviation, audio-clipped FM signal might sound subjectively as loud as before. During multi-path conditions, the benefits of a reduction in distortion would far outweigh the small loss of SNR. After all, what is the purpose of a good SNR when the signal is 100% distorted? A deviation ratio of 1.0 (±2.4-kHz deviation) would provide a signal bandwidth of 6 kHz (equal to an AM signal) and sacrifice only about 6 dB of SNR.

On a casual basis, when operating under difficult multi-path conditions using FM, try backing off from the mike to reduce deviation and, consequently, distortion. I know this certainly goes against the grain of the typical phone op—the tougher it gets, the more you shout!

5) On the receiver side, high gain and hard limiting to produce adequate sensitivity and capture characteristics are fundamentally important, of course. But beyond that, I've found that tailoring the receiver's audio response carefully by using de-emphasis can be beneficial. One of my 10-meter FM radios originally had a rather extended audio response (high fidelity?) that let all sorts of crud and distortion come through. By selecting the right amount of de-emphasis, one can strike a good balance among (a) having sufficient high frequency response for good intelligibility, (b) suppressing the higher-order harmonic distortion components of the lower frequency speech sounds, and (c) restoring at least some of the lows lost in the transmitter due to pre-emphasis. In my particular receiver, I've found 100 microseconds of de-emphasis to be about right. See Fig. 9 for details of pre- and de-emphasis circuit design.

6) Some studies have shown that even the seemingly insoluble problem of frequency-modulated distortion (the FM detector can't discriminate between such distortion and the desired signal) may be improved by use of certain receiver configurations. In particular, an FM i-f strip consisting of several cascaded stages of wide-band, hard limiters each followed by a sharp bandpass filter, has been shown to reduce multi-path distortion effects. Its principle of operation has to do with the output spectrum of a limiter in FM service: The distortion-producing components tend to lie further away from the signal, and repeated limiter/filter-stage action eventually cleans things up.[5]

This technique should not be confused with the usual FM i-f strip design which does not have any post-limiter filtering. Similar work using this idea has been done on RTTY demodulators to process FSK (Frequency Shift Keying) signals under multi-path conditions. FSK is, of course, a special form of frequency modulation.

The two 10-meter FM receivers used in my shack are quite different in i-f strip design: One is a tube-type with two stages of limiting and a quadrature detector; the other is solid state—all limiting and detection is accomplished on one IC chip. Yet both behave very similarly when copying multi-path-distorted signals.

Oddly enough, the time-honored tradition of increasing transmitter power is of only limited benefit on FM under adverse multi-path conditions. As long as

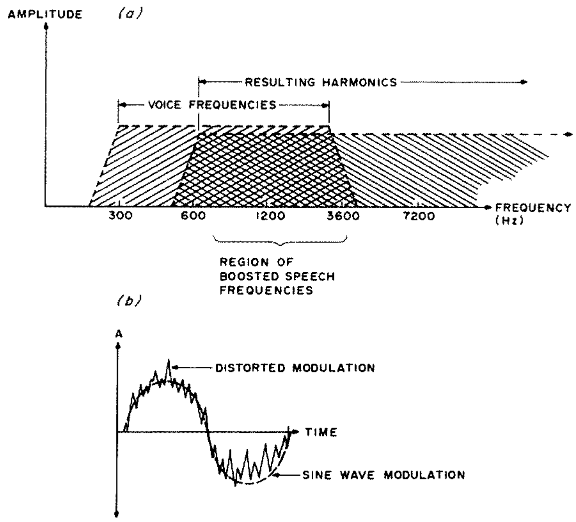


Fig. 8. Resultant waveform distortion.

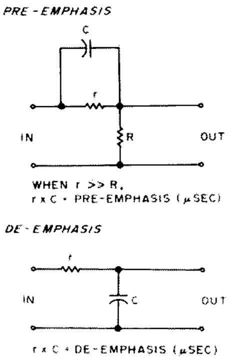


Fig. 9. Pre- and de-emphasis circuits.

there is sufficient signal strength to quiet the receiver, further increases in signal strength will have little effect on reducing distortion—the amplitude ratio of the direct and delayed signals will not change at all with power levels and the distortion will remain.

Diversity Reception for 10-Meter FM

Originally, the Type I effect was discovered quite by accident. Two 10-meter FM receivers were present in the shack but only one 10-meter antenna was available, a roof-mounted, half-wavelength vertical. The only other antenna was an 80-meter inverted vee with its apex about 45 feet high, located 60 feet south of the vertical antenna; it was pressed into service to drive the second receiver. Surprisingly good reception resulted from operating in the inverted vee's 7th harmonic mode.

In addition to the occasional Type I effect, also noted was the reception advantage of having two receivers during periods of QSB. Oftentimes, when a signal faded from one antenna it was still copyable on the other. Using two physically separated antennas driving separate receivers is known as diversity reception. The excellent article of Reference 6 gives a review of the subject.

Briefly, sky-wave fading does not usually occur simultaneously at all points in the zone of reception. Therefore, when two or more physically separate antennas are used, the chances of simultaneous signal-fade at both antennas is small unless, of course, the band or path goes out completely. Numerous studies have shown that antenna spacings of as little as one wavelength can result in significant diversity gain. This improvement is not gain in the usual sense but represents the increase in average signal strength levels obtained from two antennas over that from a single antenna, in the face of QSB. It has been shown that not much extra diversity gain occurs beyond spacings of 2½ wavelengths, when using two antennas. On 10 meters, one wavelength works out to be only 30 feet for appreciable gain, which may approach 6 dB at two-wavelength spacing.

Since FM suffers an inherent disadvantage over AM at low signal levels (the threshold effect), diversity reception offers a workable way of making up for it to some extent as well as reducing the effects of QSB in general. As 10-meter FM activity is all channelized, tuning two receivers to the same frequency is not as critical a factor as it would be on SSB. At present, I use two converted CB/FM scanner combination transceivers for 10-meter operation; they are set up to scan the two simplex frequencies (29.5 and 29.6 MHz) as well as the four repeater-output channels (29.62, .64, .66, and .68 MHz). The scanner logic is set up to drive the PLL frequency synthesizer in the converted CB for frequency selection; a second, identical transceiver is slaved to the first by paralleling the PLL divide-by-n lines of both rigs. In this way, both receivers scan together while listening to two different antennas. Due to the FM capture effect and tight squelch action, signals pop back and forth between receivers in a rather pronounced fashion but rarely fade in both receivers simultaneously.

The antenna arrangement described above combines both space and polarization diversity. Sixty feet of separation provides two wavelengths of spacing, and the inverted vee responds primarily to horizontally polarized radiation. I suspect that vertical angle-of-signal-arrival discrimination effects also occur. Whereas the half-wave vertical is a strongly low-angle radiator, the inverted vee, operated on its 7th harmonic as a longwire antenna, no doubt displays numerous lobes in both azimuth and elevation. Signals arriving at higher vertical angles, such as short-skip or sporadic-E, will favor this antenna rather than the vertical one. Longer skip tends to favor the vertical antenna, as expected.

For example, when Type I conditions occur, the more distant of the two stations usually is heard on the vertical, whereas the closer-in signal favors the horizontal antenna. Before the band fades over a particular F-layer path to the west in the evening, signal strengths usually rise greatly just prior to drop out and are accompanied by deep QSB with lots of Type II distortion. At this point, the horizontal antenna often provides the best signal. My guess is that as the sun sets, the Earth's shadow shields increasingly higher-altitude layers of the ionosphere. Thus, just prior to complete propagation circuit failure, only the uppermost layer still would be capable of supporting communications and any signal reflected off it necessarily would arrive at higher-than-usual vertical angles.

Interestingly, some casual diversity observations using a pair of 2-meter FM receivers and ground-plane antennas spaced about 10 feet apart have shown reductions in both mobile signal chopping and distant-signal slow QSB.

Repeaters

The existence of a local 10-meter FM repeater has allowed me to make some extended-spacing diversity reception tests. This repeater's 10-meter receiver is remote-sited, about 15 miles from my QTH. Listening to both the repeater's output signal and my own local receiver shows little improvement for short-term (half-second to a minute) QSB conditions. Rather, long-term (several minutes) effects are noticed, mostly on DX stations, i.e., the signal is not swapped back and forth between receivers as quickly as when using two-wavelength spacing.

There are presently about a half-dozen 10-meter FM repeaters (and one AM repeater) on the air in the continental United States. No matter how sensitive their receivers are, though, they all suffer mightily from the same problem of fading. Skip stations don't always know whether (a) the path between themselves and repeater has faded, (b) the path between the repeater and the other station has faded, or (c) they've timed the machine out. This leads to some confusion.

Space and/or polarization diversity would seem a good way to gain 3 to 6 dB of effective repeater-system sensitivity. High-speed solid-state or reed-relay switching could be used to select the quietest receiver's audio output for repeating. Such "voter logic" techniques already

are used for VHF and UHF repeaters having satellite receivers.

Stampede to FM DX? Nah!

Believe it or not, under certain conditions FM can do a better job than even SSB on 10 meters! To wit, during a recent FM QSO with a Japanese station, it was decided to switch over to SSB for comparison purposes. On this occasion, there was the usual amount of heavy, erratic QSB but fair peak signal strengths and not too much multipath. The FM audio levels were very steady, with no trace of the QSB due to the limiter's action. On SSB though, the rapid signal flutter made copy very tough as the agc was not able to follow the QSB; contact, therefore, was re-established on FM and the QSO continued. How about them apples?■

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The World Above 430

—part II: next stop, 1296

This article deals with getting more activity going on the UHF and higher bands. Part 1 (*73 Magazine*, August, 1980) dealt with a very special modulation scheme to allow simple rf equipment running class C to be used and multiplying the frequency to get to 432 MHz and 1296 MHz. As promised, this part of the article will deal with the rf part of the scheme, starting with the rig I used to get to 432 MHz, a section of a commercial FM transmitter, the Motorola T-44. If your only wish is to get to 432 MHz, as I initially did for OSCAR, that's it—no modification is required beyond getting the T-44 tripler and final aligned on 432 MHz. Some may require a bit of padding, but mine went on as is.

I removed the final section from the T-44 main strip and remounted them on a good, sturdy Premier chassis base with a self-contained power supply. The supply really isn't much, and any article covering the conversion of the T-44 to amateur FM use probably provides power-supply information. The *FM Digest* series also covers it well. Remember, you will be running class C just like FM, so no fancy bias or screen supplies are needed to keep things linear. If you run the audio deck into a 2-meter transceiver and run FM, you should be done—fire it up and run. You will have to come up with appropriate connectors and plugs to match your rig and the chassis with the T-44 parts, but there is no major circuit hacking.

For 1296-MHz operation, things get somewhat tougher, and this is where our only remaining buy remains in the rf sections. You need a good, efficient, and easily-tuned circuit to replace the plate circuit of the last 2C39 that was your 432-MHz final. It must tune to 1296 MHz and somehow couple energy at that frequency over to the APX-6 transmitter tube cathode. The 432-MHz final now runs as a tripler, so the 2C42 or 2C43 APX-6 transmitter tube can run straight through for maximum power gain and efficiency. Due to the cavity layout and other considerations, this tube will run class C grounded grid in our setup. As in any grounded-grid amplifier, any power to the cathode is added on to the power gain in the tube. Using the grounded-grid configuration avoids having to use pads, and mechanically change the existing grounded-grid circuit in the APX-6. Fig. 1 shows the mechanical layout I am now using. It works, but not extremely well. Somewhere along the line I think that the system can be made cleaner, have more power output, and certainly be more efficient. I am open for suggestions in the area of the 1296-MHz circuits, since I am sort of new here once again. If you come up with a classy circuit, *please* write it up or let me know about it. It seems to be our biggest bug at this time.

The system as described did work, but the same distortion-type products still seem to prevail. It was not until recently that I discovered a major error on my part. I had been trying to add back in all of the AM component at audio before the 2-meter transceiver. Since I was trying to evaluate SSB at the time, the class C amplifiers were still attacking (distorting) even the AM component—just as Karl had stated it would. The AM part was obviously going to have to be added, at least in part, at the end. I have considered partial screen modulation, or a scheme used quite successfully by Globe for years called Heising or choke modulation. These trials are still in progress, but look very promising in clearing up the last of our modulation problems. On the T-44 and APX-6 units, if you go that way in the rf section, you can just modulate the B+ to the final with the AM component, as well as the audio final. It seems to work out to be somewhat of the same answer to AM modulating a solid-state transmitter by modulating more than just the final stage. The modulation required at the final rf stage appears to be far from

100%, but a fair amount sure seems to clean things up!

On some APX-6 models, you will still need to carefully remove a bit from the transmitter cavity plunger. On one of mine, I did not have to do anything but tune. On the other, it required trimming, but someone else did it for me (on a lathe), so I suggest you obtain copies of the articles in the bibliography and digest them well before chopping away. The modification of the cavity plunger would make an article in itself (as it did several times in the past) and mine was done strictly using their technique and only after trying to run it stock, first.

All of this brings us down to having our transmit signal on 432 or 1296 MHz, but I have not mentioned the receiver. On 432 MHz you are somewhat on your own, but many converters are available to convert to 2-meters, or to a low-band receiver for receive. On 1296 MHz, where I was headed, it is simpler, since you already have the converter—the APX-6. Instead of hacking up the rest of the cavities and plungers to raise the APX-6 to the 1296-MHz range, I plan to cheat and ignore their noisy and ineffective 60-MHz i-f in the APX-6. The local oscillator cavity and oscillator will cover a wide range of frequencies, one of which is 1152 MHz. Mine did it with the stock cavity and plunger. Taking 1296 MHz minus 1152 MHz equals 144 MHz, or just right for the input to the receiver of the 2-meter transceiver you started with for transmit. You can rig the 1152-MHz oscillator to be tunable from 1152 to 1148 MHz for outputs from 144 to 148 MHz on receive. That is touchy at best, and I wanted to tower-mount the APX-6 part of the system near the antennas. Therefore, for the time being anyway, I am settling for using a Hamtronics 2-meter converter into the 14-MHz i-f of my TR-6 and using 0.5-MHz coverage per converter crystal.

There are some places the system happens to work out just right using the transceive idea and APX-6 alone. At 144.0 MHz, you have 144 × 3 × 3 = 1296 MHz and 1296 MHz − 1152 MHz = 144 MHz. That's fine, but now try 144.1 MHz! 144.1 × 3 × 3 = 1296.9 MHz and 1296.9 MHz − 1152 MHz = 144.9 MHz. Oops! That's an 800-kHz offset, and thus requires a separate converter and receiver for simplex operation. If you try FM on one of the multi-mode rigs like my KLM 2700, you can also cheat and use the repeater offset at one frequency. At 144.07 + 5, or 144.075 MHz, you have 144.075 × 3 × 3 = 1296.675 MHz and 1296.675 − 1152 = 144.675, a natural 600-kHz offset normally used for repeaters. I'd like to suggest that frequency as a simplex FM location, so we can all have some coordination.

The APX-6 cavity is broad, but not the 4 MHz necessary to cover the entire 1296 to 1300 MHz, so why not use the 144 MHz start point for CW-SSB and a 1296-MHz output, and the 144.075-MHz start point for FM and a 1296.675-MHz output? It's not so crowded up there that we couldn't all live together and a lot more contacts might be the result of it. Later, we could worry about separate receiver-converter combinations and then spreading out a bit. In some ways, I hate to see channelization of any band, but even when it comes, I hope it is in .010-MHz increments at the 2-meter frequency or .090-MHz at the 1296-MHz frequency. It would make looking for each other a lot easier until the population up there increases. Please, let's hear your ideas and suggestions concerning this band and my ways of reaching it. GE and RCA gear like the Progress line and CMU-15s should work just as well as the tripler/amplifiers and there is a large quantity now available cheap, along with articles on getting them on the 432-MHz band. I just had the Motorola, so I used it! Ideas from the stripline, cavity, and plumbing group of hams would sure be appreciated to eliminate our biggest bug in getting from 432 MHz to 1296 MHz. It would also help to see more receiver, preamplifier, and antenna ideas specifically for 1296 MHz, instead of everyone trying to extend 432-MHz article ideas to work up there.

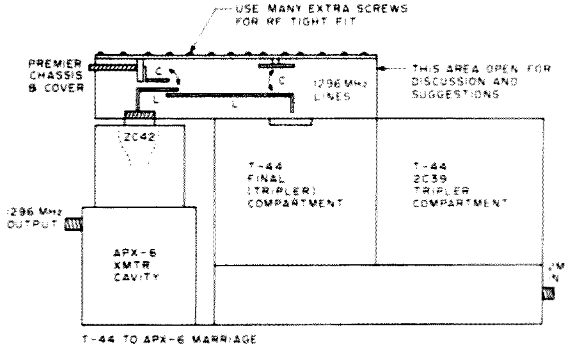

Fig. 1.

If you can help with an article or two, please do, but be realistic about it. Give up a precious dB or two and stay away from the gold-plated antennas and $50 solid-state devices few can find or afford. Some of the UHF TV tuner solid-state devices surely must work up there or how about a modified UHF tuner?

1296 MHz does not have to be a short-range band! Remember when 2 meters would get you across town—maybe? I have 11 states confirmed on 2 meters now using SSB and the barefoot KLM 2700 in the 1-Watt position. I'm not saying this for ego, but to show you what a little population will do for a band. When the 1 Watt runs out, I'll go to the 10-Watt position and wring it out, and only then will I go back to building the 100-Watt 5894 amplifier I started to build when I bought the KLM. QRP has turned out to be too much fun. I do run decent antennas in the form of an 8 over 8 J-slot with a screen relector, but even it is homebrew, and was an article in *73 Magazine*, June, 1978, p. 140. The same sort of homebrewing can happen for 1296 MHz if only a bit of help starts appearing in the way of articles.

I hope, most of all, that this article has stirred up a renewed interest in 1296 MHz. I could not find a single article on this band and its use over the last 5 years in my files (*73*, *CQ*, *QST*, and *Ham Radio*) with the exception of the solid-state peanut whistles suitable as lab bench items or beacons, or if your DX interest lies with the guy next door! I'm not knocking any of these articles, believe me, because it at least reminded me that 1296 MHz was still around.

Remember Wayne's "220—use it or lose it"? Don't laugh—it could happen to 1296 MHz more easily, and we almost lost the 220-MHz portion as it is. The sting of that one should still be sharp in everyone's mind, and it wasn't the hams that

stopped the loss from happening! I am only saying that if we give the band the honest chance it deserves, it should reward us just as the others have. Let's go for 10- to 20-Watt rf equipment, reasonable receivers, and see just how much reward the band can provide. ■

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5. Gianni Lovisolo I1LOV, "Conversion of the APX-6 to 1290 MHz operation," *73 Magazine*, October, 1964.
6. Jim Fisk W1DTY, "A 1296 Grid Dipper (a GDO for 1050 to 1320 MHz)," *73 Magazine*, June, 1967.
7. Other sources for this article (non-articles) taken from USAF, T.O. 12 P 4-2, APX 25-2 by W9CGI. The APX-25 and APX-6 are identical for your purposes, so bear that in mind when shopping for a unit. The APX-25 has an additional keyer modification to the pulse circuits that you discard anyway.

Notes

1. The normal APX-6 frequencies are: Receiver—990 to 1050 MHz and local oscillator—1050 to 1110 MHz.
2. The plunger cutting specification on the transmitter cavity per *73 Magazine*, reference 5, above, was, "remove 9/16" from the cavity plunger," for those unable to obtain the article.
3. Further, I will copy (for a small fee to cover my expenses) any of the above or other articles I might have for those who are *seriously* interested. *Please* try to obtain them from the magazines wherever possible, but I realize some of the above and others are no longer in business so I will try to help. As for any other help I can provide, just send an SASE and I'll try.

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Bridge Over Troubled Audio

—another method for driving speakers

Most low- to medium-power audio amplifiers operate with an unbalanced output stage in which the load, i.e., the loudspeaker, is grounded. Fig. 1 shows a typical audio power amplifier output stage. This type of circuit is sometimes called the *totem-pole* amplifier because the transistors appear "stacked" (i.e., series connected) on top of each other in the schematic. Transistors Q1 and Q2 are a matched pair fed out of phase with each other.

Output is taken from the junction (A) between transistors, so that Q1 contributes power on one half-cycle and Q2 contributes on the other half-cycle.

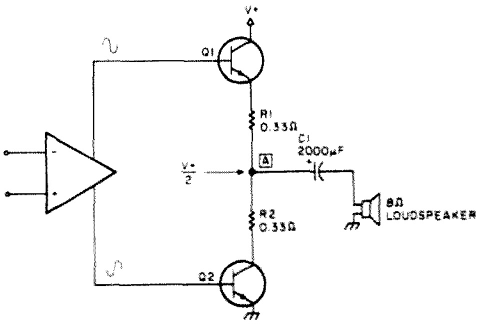

Fig. 1. Totem-pole audio power amplifier circuit.

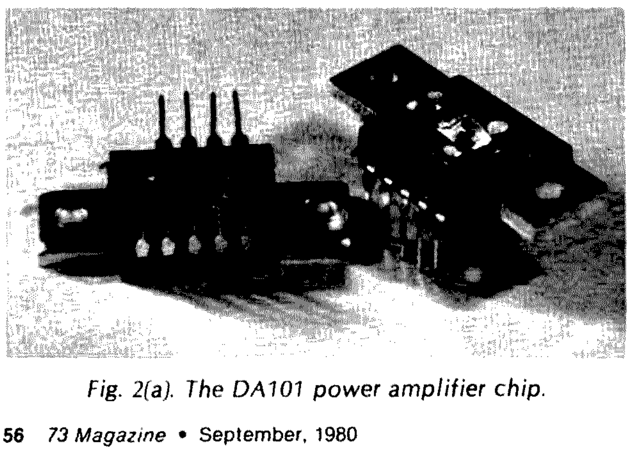

Fig. 2(a). The DA101 power amplifier chip.

But a problem exists: Point A has a dc potential approximately equal to half of the supply voltage. This potential necessitates the use of capacitor C1 to block dc and prevent it from being applied to the voice coil of the loudspeaker. If C1 were not used, or if it becomes shorted, then a potential of ½ V+ is applied to the loudspeaker, causing its destruction.

Capacitor C1 must have a very large value so that its reactance at the lowest frequency passed by the amplifier is negligible. If there were a significant reactance, then there would be significant output power reduction and phase shift at low frequencies. Audio amplifier designers have solved that problem in the past by making C1 a very large value capacitor, with values as low as 500 uF in some car radios and up to 10,000 uF in some hi-fi amplifiers. Capacitors in these values tend to be physically very large and bulky, which in car radios and other mobile audio applications becomes a distinct disadvantage.

Delco Electronics, the General Motors division responsible for making car radios and other auto audio products as well as being a manufacturer of transistors and ICs, solved the problem of the large capacitor with a unique integrated circuit audio power amplifier—see Fig. 2—using a circuit technique called *bridge audio*. The IC is shown in Fig. 2(a), while its pinouts are shown in Fig. 2(b). This device is designed to be operated from a single power supply up to +16 volts dc. (The usual automotive battery has a potential of about 14 volts dc when the engine is running, not 12 volts dc as is commonly believed.) The heat sink is the power supply negative terminal, so it is compatible with the standard negative-ground electrical system used in US-made automobiles.

Delco uses the bridge audio IC (under the type number DM84) in their car radio products, but offers it under the type number DA101 through their distributors. The current price of the DA101 in 1-10 quan-

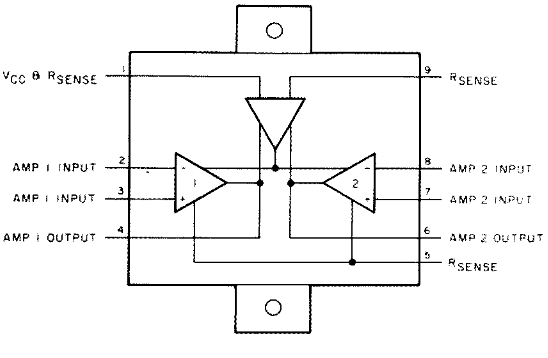

Fig. 2(b). Pinouts for the DA101.

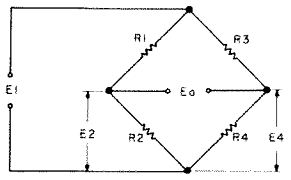

Fig. 3(a). Wheatstone bridge.

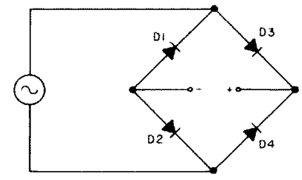

Fig. 3(b). Bridge rectifier.

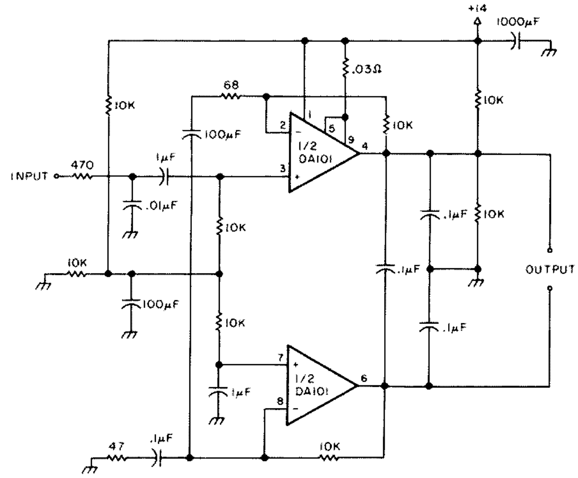

Fig. 5(a). Delco bridge audio circuit features balanced output. Actual circuit.

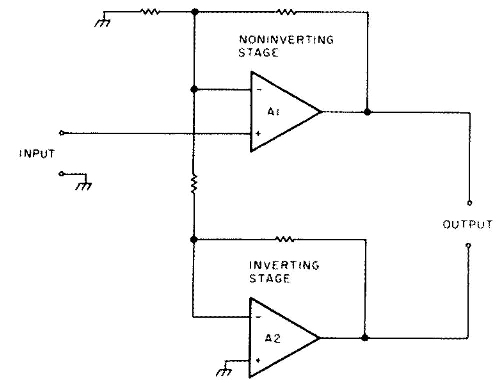

Fig. 5(b). Simplified circuit.

tities is about $7.

What Is Bridge Audio?

Bridge circuits are used extensively in electronics; two common examples are shown in Fig. 3. The operation of the audio bridge can be more easily understood if the simple dc Wheatstone bridge of Fig. 3(a) also is understood.

We may view the bridge in Fig. 3(a) as a pair of resistor voltage dividers connected in parallel across the same power supply (E1). The output voltage, E_O, is the difference between E2 and E4: E2 = E1 × [R2/(R1 + R2)], and E4 = E1 × [R4/(R3 + R4)].

When E2 = E4, the bridge is balanced and E_O is zero; therein lies the beauty of the audio bridge (Fig. 4). In the audio bridge, circuit transistors Q1 through Q4 replace the resistors. Under zero-signal conditions, the collector-emitter resistances of Q1-Q4 are approximately equal, so E_O is zero, or has, at worst, a very small value. This means that a loudspeaker can be connected across the bridge output terminals without capacitor coupling! No harm will come to the loudspeaker.

The circuitry provided in

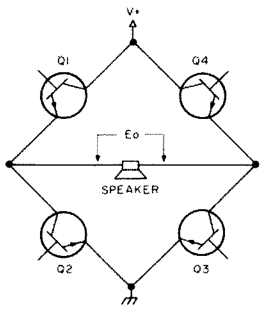

Fig. 4. Audio bridge is similar to circuits in Fig. 3, except that power transistors form the bridge elements.

the DA101 IC consists of a pair of power operational amplifiers, each similar to the circuit in Fig. 1, less the output capacitor, of course.

Fig. 5 shows how the two totem-pole sections inside the DA101 can be connected together to form a bridge audio power amplifier. Pins 4 and 6 are the output junctions, each corresponding to point A in Fig. 1. These pins are both at a potential of ½ V+ under zero-signal conditions, so in the car radio (where V+ is 14 V dc), the potential between each of these pins and ground is +7 volts dc. But the loudspeaker is connected *between* pins 4 and 6, so it is not grounded. The dc potential across the loudspeaker is 7−7, or 0 volts.

Driving the audio bridge requires one of the amplifiers to be used in the inverting mode and the other to be in the non-inverting mode, to ensure the proper 180° phase-angle difference required of any push-pull amplifier. One is tempted to solve this problem by tying together the − and + inputs of the two amplifiers, but this tactic will not work because the low input impedance of the inverting amplifier will pull the overall input impedance too low.

Delco engineers solved this problem—see simplified schematic in Fig. 5(b)—by taking advantage of one of the elementary properties of an operational amplifier: Both inputs tend to stay together. This means that a voltage, either a signal or a dc bias, that is applied to one input will also be found on the other input terminal! In the standard inverting follower circuit, the input is grounded, so the − input is at a potential of 0 volts; this is the fact that leads to the confusing misnomer, "virtual ground."

Similarly, if you apply a dc potential, E, to the + input, then a voltmeter at the − input will read E. The non-inverting follower, A1, has a very high input impedance, and input potential E_{in} is applied to this input terminal. This situation means that E_{in} also appears on the − input terminal of A1, and that signal can be used to drive the inverting follower circuit, A2. The result is that we retain the

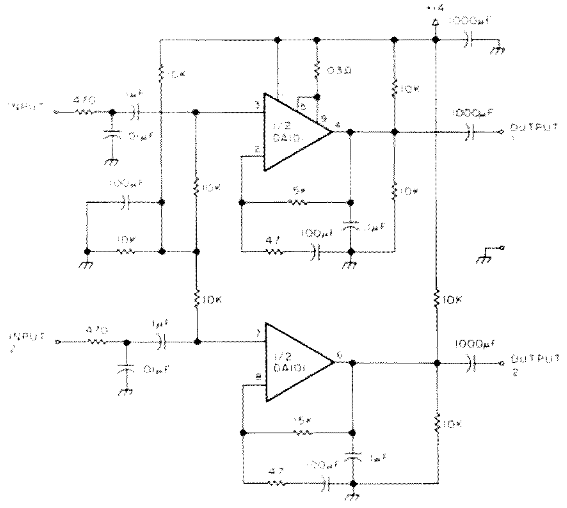

Fig. 6. Using the DA101 as a single-ended totem-pole stereo amplifier.

high input impedance of the non-inverting follower circuit (always a desirable feature in a voltage amplifier) while also meeting the requirement for driving the two amplifiers out of phase with each other. Ingenious, those Kokomo Kids.

The bridge audio power amplifier will deliver as much as 12 Watts when E_{in} is 100 mV and will deliver 5 to 6 Watts at 5 percent THD (total harmonic distortion). At 1 Watt of output power, the THD figure is 0.7 percent minimum and 1.5 percent maximum. It requires only 9 mV of input signal to produce 1 Watt of output power. These figures are based on a V+ of 14 volts dc and an 8-Ohm load. The maximum output power exists when the load is 4-5 Ohms.

Stereo operation can be obtained either by using two bridge circuits such as in Fig. 5(a) or by connecting a single DA101 in the classic totem-pole (i.e., non-bridge) circuit as shown in Fig. 6. Note well, however, that dc-blocking capacitors are needed to prevent the +7-volt dc potential at output terminals 4 and 6 from damaging the loudspeakers. This circuit results in lower maximum output power ratings in each channel, but the THD rating at 1 Watt output power remains the same.

The DA101 contains several protection features, including thermal protection and output current limiting. The 0.03-Ohm (that's 30 *milliohms*) resistors in Figs. 5(a) and 6 are the sense resistors for the current limiting stage. These resistors can be made from fine wire, using data given in any wire table (such as in most elementary electricity textbooks), or by parallel-connecting low-value "fusistors" used in the emitter circuits of power transistors.

The bridge audio circuit requires a *floating*, i.e., non-grounded, loudspeaker system. Grounding one side of the speakers is standard practice in auto electronics, so be wary of connecting an audio bridge into an existing speaker system. All Delco models that are equipped with bridge audio have a label on the chassis warning the service technician not to ground the loudspeakers either in the vehicle or on the test bench. ■

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Load a Lawn Chair

—even if you can't carry a tune, you can build this matchbox

This here's a project for all you folks who have a yen for one of those thirty-, forty-, or even fifty-buck matchboxes that will let you load your transmitter into a lawnchair, but who know that those hard-earned shekels have to be spent elsewhere.

Now, I realize that there's been plenty written about tuners already, but there seems to be a shortage of articles on versions that are simple enough and cheap enough so that one does not have to go out and buy it ready-built.

Well, this one has no hard-to-find parts, is simple to build, and will give an excellent match into almost anything that even vaguely resembles a longwire. The icing on the cake is that the sum cost of all the parts in it will probably be less than the cost of the box that you choose to put it in. That could get pretty cheap!

The Parts

The capacitor is straight out of a junked AM or AM/FM tube-type radio. The only care in choosing one lies in making sure the plates aren't bent to the point of scraping one another. The plates we want to connect are always the larger set (in multi-ganged versions); just ignore any others. Plate spacing in these older radios was pretty much standardized, and all that I've seen will work at the 150-200-Watt level for SSB and at slightly less for CW. The frame of the capacitor is already connected to the rotating set of plates, so all you have to do is make one connection to the stationary set.

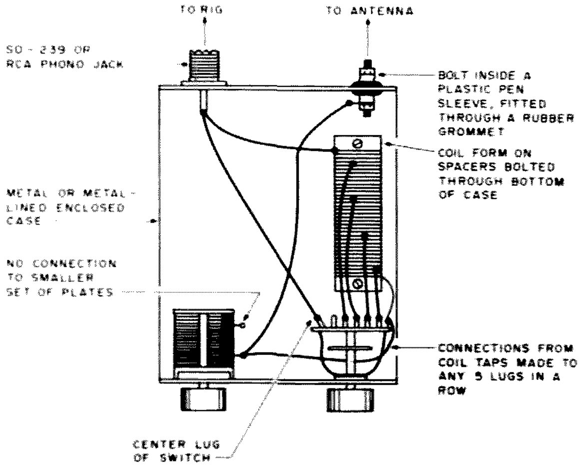

Fig. 1. Suggested layout.

The inductor is home-wound, which solves that procurement problem. It consists of 48 turns of about 18 gauge (not critical) insulated or bare hookup wire wound on a one-inch diameter form, 16 turns to the inch, for a total of three inches of coil. Some hookup wire that Radio Shack sells in three-packs has insulation over it that makes it wind at 16 turns to the inch when close-spaced, so you might use some of that if you have any. If not, just wind the wire you have, close-spaced, and then stretch it out until it is three inches long.

What you wind the inductor on is up to you. A piece of plastic pipe (ABS is preferable to PVC, but again, this is not critical), a tube that solder comes in, a couple of pill bottles glued end-to-end, or a Plexiglas™ X-shaped frame—which would be ideal. Lacking any of these, just about any non-metallic, one-inch diameter by at least three-inch long form would be satisfactory since we don't intend to run kilowatts of power through it. Any minor difference in inductance due to the form material would be compensated for by the infinitely variable capacitor.

After you have completed winding the inductor, solder short pieces of wire to the third, tenth, nineteenth, and twenty-ninth turns on the coil, taking care to avoid making electrical contact with any adjacent turns. These wires will be connected to the inductance-selector switch later.

The inductance-selector

rotary switch is stock Radio Shack; either the 6-position or the 12-position type will work just fine. I know that using these runs afoul of the tradition of using rf ceramic switches in this application, and if you have a ceramic version, by all means use it. I didn't use one in any of the tuners I built and thus far have had no problems. The 12-position switch has the advantage of allowing you to add extra taps to the inductor if you want to experiment, while the 6-position is less cumbersome in the original version.

Construction Hints

Something along the lines of a metal enclosure should be used to house the tuner; otherwise, hand capacitance could cause the settings to not stay put when anything near the tuner is moved. That means that if you were planning to build a plywood, fiberboard, or even cardboard box to house the thing, make sure the inside of the box is completely lined with tin foil or the equivalent. That also prevents TVI and gives a ground return path for the rotary plates on the capacitor.

When transmitting, the antenna end of the tuner can have some pretty high rf voltages present on it, so be sure to use a connector that has some insulation to it. A bolt through a plastic pen sleeve on a vinyl grommet would be one suitable example. Try to keep the individual wires separated and away from the case to avoid flashovers, and keep wire lengths down to the minimum needed to make the connections. That last precaution will help avoid stray inductance.

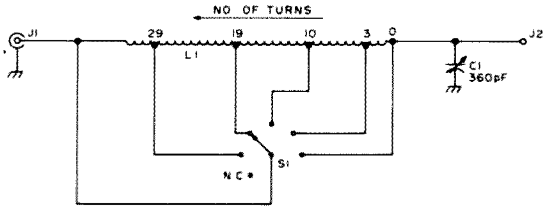

Fig. 2. Schematic. See Parts List.

Summary

Before I built my first longwire turner, my activities were confined to one or two bands due to the lack of a good all-band antenna. Now I operate wherever I want, with capability for really quick band change, thanks to the tuner and a handy knob-setting log. It's also kind of nice not to have to worry about bad weather knocking out my antenna, since the tuner would be loaded quickly into a makeshift wire thrown up for the occasion. All in all, having one is a heck of an asset to my station. I hope you enjoy yours as much as I do mine.■

Parts List

J1—SO-239 connector or RCA-type phono plug
J2—Feedthrough antenna insulator, commercial or homemade
L1—Home-brew inductor—see text
S1—6- or 12-position rotary switch, Radio Shack or equivalent
C1—Approx. 360-pF variable capacitor, salvaged out of tube-type radio, AM or AM/FM type
Miscellaneous: cabinet, 2 knobs

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The Penultimate CPO

—a nondiscrete LSI device

It has been my observation that most code-practice oscillators in use these days—both commercial and home-built—leave a lot to be desired. Many of these are actually buzzers—or sound like one!

I enjoy teaching the code to prospective Novices, and it is my contention that a good code-practice oscillator ought to sound like the real thing. That is, it should sound just the way a CW signal received off the air sounds! A perfect CW signal should—and does—sound like a perfect-keyed sine wave, with no clicks or thumps as the key makes or breaks contact, and with no frequency shift when the oscillator starts up.

Building a perfect sine-wave oscillator is easy. The trick is to build one that won't produce clicks or shift frequency as it is turned on and off. This is next to impossible with less than a very complicated and elaborate circuit. However, there is another and simpler way to do the job (see Fig. 1). It is much easier to build a square-wave oscillator, which *is* easily keyed, and filter its output with a narrow bandpass filter so that only the fundamental frequency is passed to the output. The result is a perfect-keyed sine-wave oscillator, with no clicks, thumps, or chirps.

Fig. 2, the schematic diagram, shows the results of my attempts to design the ultimate code-practice oscillator. The circuit is truly state of the art, using no discrete transistors. All active components are commonly-available ICs. This circuit will produce a sine-wave tone with no clicks or chirps and with sufficient audio-power output to drive a speaker to room-filling volume at very low distortion.

Circuit Description

Referring to Fig. 2, the power-supply circuitry is straightforward, employing a bridge rectifier, capacitor-input filter, and a 3-terminal voltage regulator (IC1). An LED is included as a pilot lamp to indicate when power is on.

The oscillator circuit, IC2a, is a classic op-amp square-wave oscillator, modified to provide for a frequency (tone) adjust and on-off keying. It is followed by a narrow bandpass filter, IC2b, with a center-frequency adjust to provide for matching the filter-pass frequency to the oscillator-output frequency.

The output from the bandpass filter, a keyed sine wave, is passed on to the audio-power amplifier, IC3. I chose an LM380 IC amplifier for the audio-output stage because it is a high-quality, low-distortion audio amplifier capable of

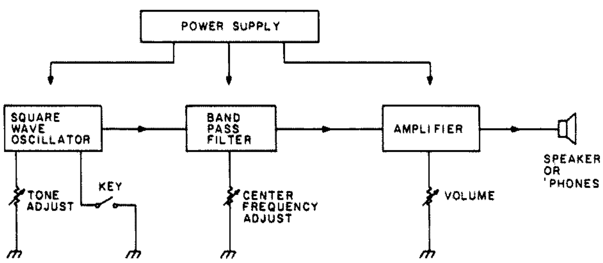

Fig. 1. Block diagram.

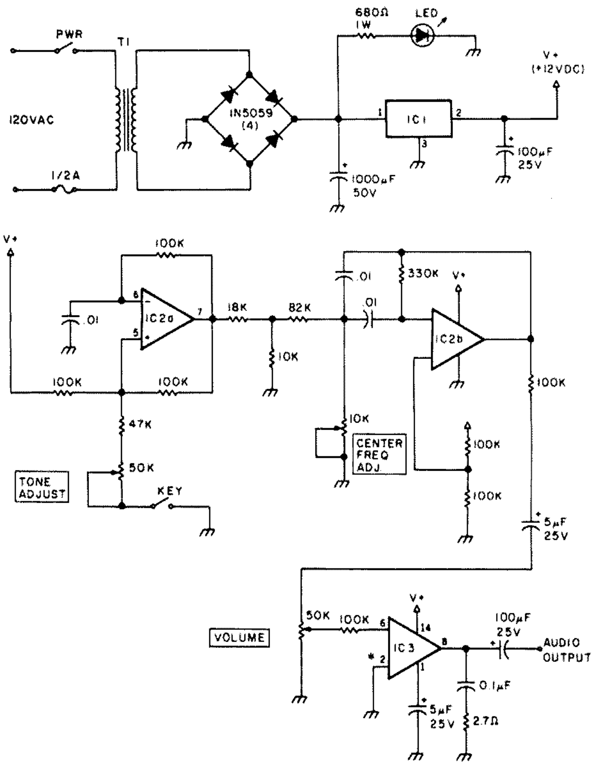

*Fig. 2. Schematic diagram. T1 = 120-V primary, 18-V (300-mA) secondary; IC1 = uA7812UC 12-V regulator; IC2 = LM358N dual op amp; IC3 = LM380N power amp; *IC3 ground pins: 2, 3, 4, 5, 7, 10, 11, 12.*

driving anything from a 4-Ohm speaker to high-impedance headphones.

Construction

This circuit is so simple that the time required to produce a PC board for it did not seem justified. I built my unit on a small piece of perfboard. Although I used trimmer pots for the tone-adjust and filter center-frequency-adjust controls, these could be front-panel-mounted-type controls if you feel that frequent tone adjustments are desirable. I built my unit into a small Ten-Tec enclosure and mounted the power switch, pilot light LED, and volume control on the front panel, with the key jack, headphone/speaker jack, and ac fuse holder on the rear panel. You may wish to eliminate the power-supply circuitry if you have a source of 12 V dc available to power the unit and do not desire a built-in power supply.

Initial Adjustment

To adjust the controls, proceed as follows: Plug the unit in, turn on the power switch, and advance the volume about a third of the full rotation. Center the tone and center-frequency controls. Plug a key into the key jack and key the unit. Holding the key down, adjust the tone control for the desired pitch. Next, adjust the bandpass control for the loudest volume and clearest tone. The unit is now ready to operate.

You will find that this oscillator will produce a tone that remarkably resembles the quality of a CW signal received off the air. It is easy to build and a pleasure to use. If you are learning or teaching the code, this project is for you! ■

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Get Out and Vote

—a grass roots project for this election year

This system was designed to allow two or more remote receivers to be fed into one repeater transmitter. The system is very inexpensive and is simple to build (Fig. 1).

I originally designed this circuit to be used with four remote receivers and a four-frequency scanner at the transmitter. The scanner I had would not scan fast enough to satisfy me. We are using Midland 13-509 220-MHz rigs split apart for our links. I had a receiver for each transmitter, so I put a separate receiver in for each link. These four receivers are tied together and fed into the transmitter with a circuit to be explained later.

What It Does

This circuit causes a delay on link key-up. The length of the delay is determined by the signal strength at the receiver.

When a mobile station keys his mike to access the system and brings up more than one remote receiver, the receiver with the strongest signal will come on first. The COR on the link receiver at the repeater transmitter also will come on first. The positive voltage from the COR will cause the audio latching board to lock the audio from that receiver to the transmitter.

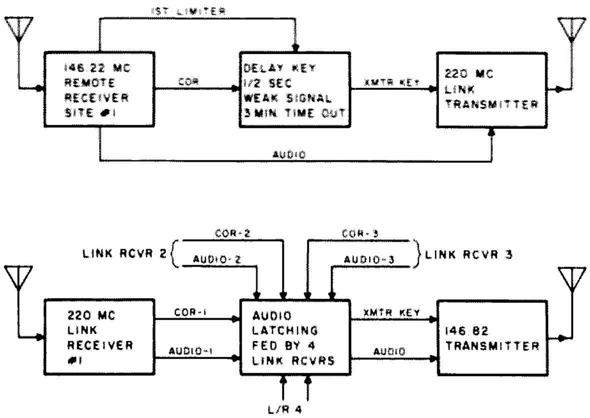

Fig. 1. Voting system block diagram.

How It Works

This system uses a 555 timer (IC1) to give a delay on the remote link transmitter key-up (Fig. 2). This delay time varies from no delay with a strong signal to up to a one-second delay on a weak signal. This is done by varying the voltage on pin 5 of the 555 delay timer. Varying the voltage on pin 5 will change delay time independently of the RC network. As the voltage on pin 5 is decreased, the delay time will decrease. This is done with Q1 and Q2. Q1 simply amplifies the voltage from the first limiter of a Motorola Motran receiver. The first limiter voltage varies from 0 with no, or a weak, signal, to about a minus 1.5 volts with a strong signal. D1 is used to raise the base voltage on Q1 enough for it to function. The average (silicon) diode has a 0.7-volt drop across it. This 1N270 (germanium) has only a 0.3-volt drop. I have not tried a silicon diode, but if a 1N270 is not available, I believe the only difference would be in sensitivity adjustment.

As the signal gets stronger, the collector voltage of Q1 rises, causing the collector voltage of Q2 to lower. This pulls the voltage of pin 5 of IC1 down. This, in turn, decreases the delay time. The amount of delay with a weak signal may be varied with R3 of IC1. I have our system set at about half a second.

The basic voting system is Q1, Q2, and IC1. I have incorporated a 3-minute timeout timer (IC2) on the same board. The COR (Fig. 4) is not mounted on the board —but look at the connections. When the COR is relaxed, it pulls pins 2 and 4 of both timers through a diode to ground. This resets both timers. The COR then applies 12 V dc when keyed to the circuit.

Q8 is a U56 and gives you a high output (+12) with delay and time-out. Q9 is a U06 and will pull in just about any push-to-talk circuit. It also has delay on

and time-out.

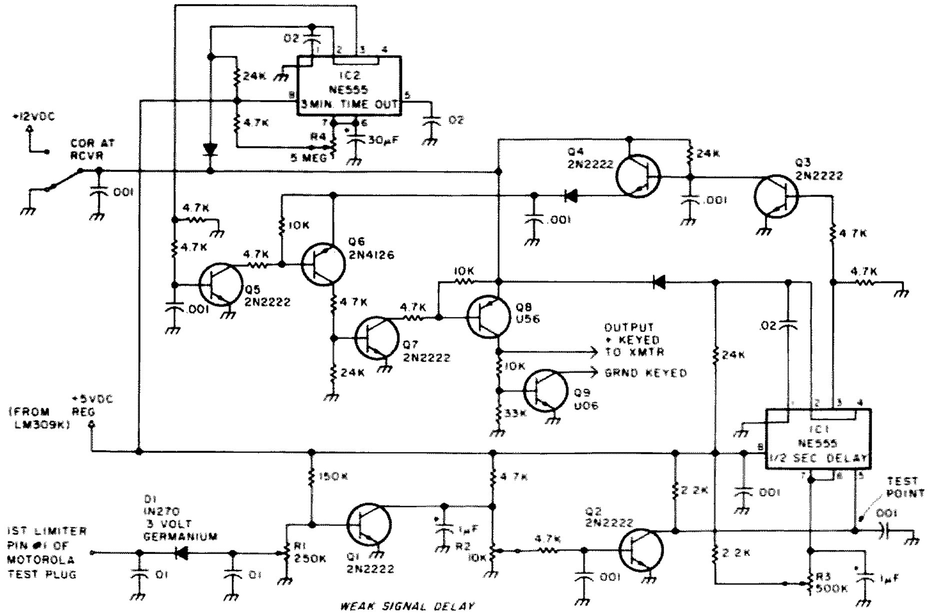

Fig. 2. Link-signal delay and 3-minute time-out board.

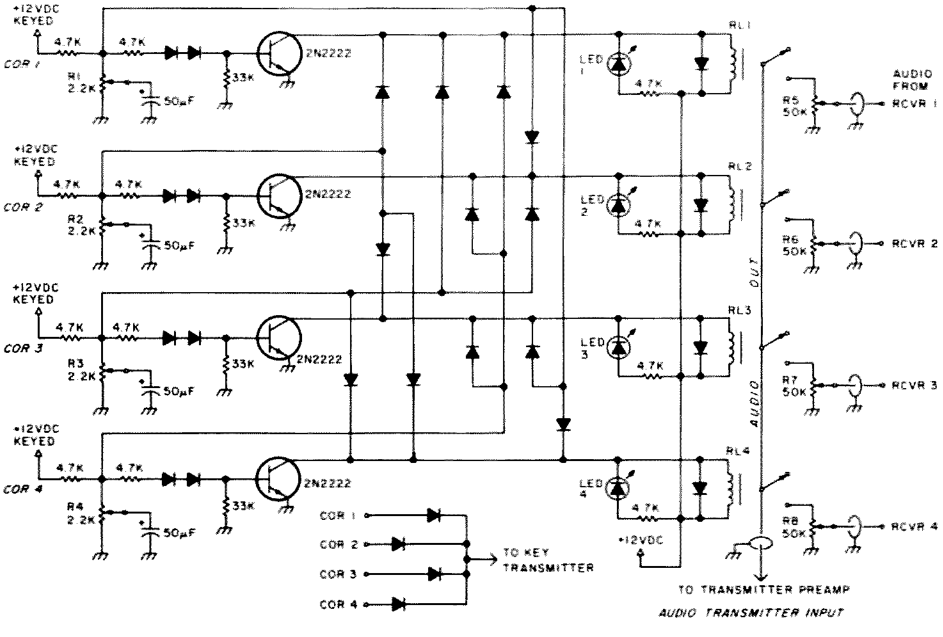

Fig. 3. Audio latching board.

You should notice that a large number of bypass capacitors are used. These are needed to prevent oscillation and rf problems. I have never shielded any of these boards, but it may not be a bad idea if it will be near a strong rf field.

With the exception of D1 (1N270), the diodes are not critical.

Alignment

Alignment is simple. All voltage readings are taken from pin 5 of IC1. To start the alignment procedure, set R1 to maximum sensitivity and R2 to ground. Adjust R4 of IC2 for maximum time. Make all connections and apply voltage. Adjust R3 for about a one-second delay on key-up. This can be set to whatever delay you want later. At this point, pin 5 of IC1 should be about 0.7 to 1 volt below Vcc. The voltage should not vary when a full saturating signal is applied to the receiver. Apply a fully-saturating signal to the receiver and adjust R2 until pin 5 of IC1 reads 0.25 volts.

While the signal is still applied, adjust R1 to decrease sensitivity. Decrease R1 just enough to raise pin 5 voltage by 0.1 to 0.2 volts, giving you a total voltage on pin 5 of 0.35 to 0.45, with a strong signal. Do not exceed 0.5 volts. With no signal, pin 5 will read about 3.7. This reading will depend on Vcc. I had 4.8 volts on this circuit. Exactly 5 volts is not necessary, but the readings may vary a little. It is very important to have well-regulated voltage on pin 8 of IC1 and Q1 and Q2. I use LM309 regulators. Adjust R3 to the desired delay, R4 to time-out time, and that is it!

I have built four of these delay boards and was very surprised to find that they all tuned exactly the same and all worked well. The voltage readings did vary a small amount due to the fact that all four had just a little different input voltage. The difference really was not enough to mention.

Bob Heil K9EID, of Marissa, Illinois, is working with this system also, on his club's .81/.21 machine. He seems to be very happy with it. As far as I know, he has had no problems with it.

I have been working on this circuit for about three years. I knew it had to be possible, but did not know just how when I began. I have had this circuit in use for about a year on the Gillespie, Illinois, .22/.82 machine. We have two remote receivers on now, with a third one just about ready to go. The receiver sites are about 25 miles apart. Everyone seems to be well satisfied with its operation. It does a good job for mobiles and hand-helds.

I have found that running the repeater receiver squelch and COR adjustments just a little tighter than normal helps the fading base stations. This way, the signal does not have to get so noisy before the system switches to another receiver site. This switching

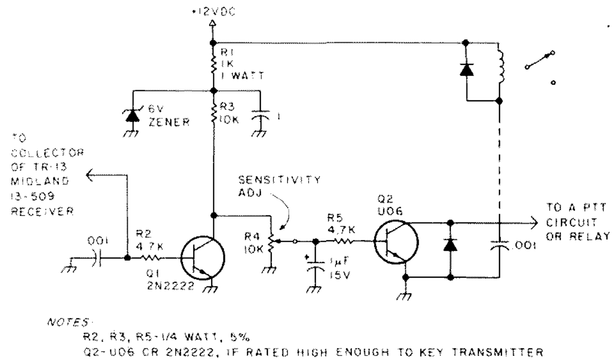

Fig. 4. COR for the Midland 13-509.

has been no problem with mobiles or hand-held units. I am sure that most repeaters were meant for them, so there is no real problem.

Fig. 3 shows what I am doing at the transmitter site to pick out the receiver site that comes on first or the strongest signal. This circuit is fed by the output of all four link-receiver CORs. The audio from the four receivers is fed to the four relays, then to an audio preamp, and from there to the repeater transmitter audio input. The relay that passes receiver audio to the repeater transmitter is closed when COR voltage is applied to the base of the relay-keying transistor. The collector of that transistor then pulls the base of the remaining three transistors to ground through the diodes. This prevents any of the remaining relays from closing. Should a mobile drop out of the first receiver keyed up, he will then jump to the next receiver activated, and so on.

R5 through R8 are 50k pots installed for audio level matching. R1 through R4 are balancing pots. These may not be necessary, but I found that without them, one of the four circuits would always key up before the rest.

To align R1 through R4, set them all to ground, or no capacity added. Tie all four COR inputs together and pulse 12 V dc to all of them at the same time. Each time you put voltage to all four, one will always key. Adjust in a small amount of capacity until the next one does the same. By adjusting R1-R4 in this manner, you soon will get the unit to key up at random, i.e., each time voltage is applied, a different circuit will lock on. This procedure should balance it as well as ever needed.

The diodes are not critical. As long as all values are close to the same for each of the four relay circuits, I am sure the resistors are not critical. I used the values marked on the diagram. The resistors are ¼-Watt, 5%. The four transistors are 2N2222s.

This COR circuit was originally designed for the Midland 13-509 receiver. We are using the Midland and this COR for our link setup on the Gillespie, Illinois, .22/.82 repeater. The input of the COR is connected to the collector of TR-13. The collector voltage goes low with a signal.

This COR is very stable and sensitive. There are no critical parts, but I did use 5% resistors and a good grade of wire-wound 10k pot.

This COR also has been installed on other FM receivers with good results. ■

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A Wider Windom

—broadbanded sans transmatch

It has been nearly fifty years since Loren Windom W8GZ started experimenting with an off-center-fed dipole which would catch the fancy of generations of hams.

The principle was simple: While a centerfed dipole exhibits a 75-Ohm resonant response on its half-wave frequency and near that on the third harmonic, it is far from an allband antenna. Would it be possible to locate a feedpoint other than the center which would show a common impedance on several harmonically-related ham bands? Loren Windom decided to find out.

After considerable experimentation, he determined that a point 14% away from the center of the antenna (that is, 36% from the end) exhibited a nearly identical feedpoint impedance on even multiples of the half-wave frequency. Rf signals at 3.5, 7, 14, 21, and 28 MHz would see an impedance of approximately 400 Ohms under ideal free-space conditions. Early amateurs used single-wire feed, approximating the correct feedpoint impedance. Later, 300-Ohm open-wire line was used, as was TV twinlead.

But, as many amateurs have found out, longwire antennas cut for the CW portion of the bands begin to balk at signals in the higher portions of the phone bands.

With these limitations in mind, I decided to see if the off-centerfed antenna could be reconfigured to accommodate phone operation without the use of an external tuner.

Dozens of individual experiments were devised, each involving a gradual change in feedpoint, feedline length, total dipole length, and individual lengths of each dipole leg. Results were frustrating. When one band would represent a 1:1 swr, another would show a zillion to one! The problem was not so severe on 75 and 40 meters because subtle dimensional changes were not so critical, but at 20 meters and above the roof came in!

Initial trials were done with a 4:1 balun transformer connected directly at the antenna feedpoint. I then remembered a comment published somewhere that it is often better to isolate the balun with a length of balanced line first. The literature reported that a length of 44 feet, or multiples thereof, seemed to be ideal.

I could not get that length to work. Nor did I find a harmonically-related 67-foot length to be of advantage. But at 47-48 feet of 300-Ohm feedline, the antenna tamed down considerably. Swr readings were reasonable on all bands, and with some judicious pruning of antenna length, the swr was reduced even further.

The magical combination, at least at my location, with the antenna elevated about 25 feet above ground, seems to be a 134-foot dipole divided into 90- and 44-foot sections. This combination results in a feedpoint 17% off center (33% from one end).

Early versions of 300-Ohm-fed antennas were generally matched by running the feedline directly to an antenna tuner in the shack or by matching the feedpoint impedance with a 4:1 balun transformer. The transformer was almost always made from two bifilar-wound B & W self-supporting coils mounted on ceramic standoff insulators and secured inside an aluminum Bud box. It was a large contrivance, but it worked!

Nowadays, with the ready availability of ferrite core materials, the physical size and the balun may be reduced considerably. Kits may be ordered from advertisers found in the pages of *73 Magazine*, and commercial units are available already assembled.

The balun transformer which we used was the world-famous W2AU, marketed by Unadilla (Microwave Filter Company, 6743 Kinne Street, East Syracuse NY 13057) for $14.95 and carried by many amateur radio supply houses.

Ferrite-core balun transformers typically perform uniformly from 3-40 MHz, but ours seemed to work well down to 160 meters.

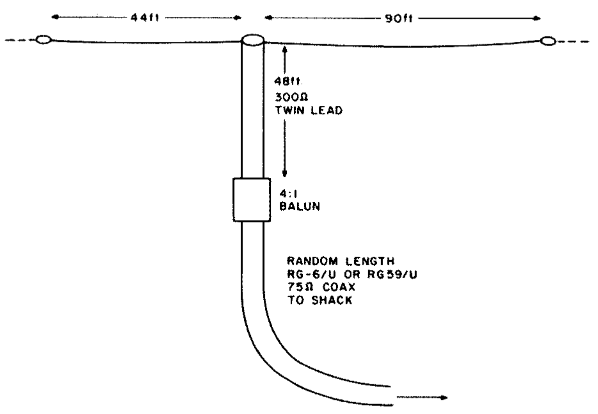

Fig. 1. Construction details of the phone man's Windom.

We did not try transmitting on 6 meters, but reception from 100 kHz to 50 MHz was phenomenal!

It is recommended that the experimenter who intends to put up one of these modified Windoms should start with measurements slightly long and prune the antenna down to proper performance. Begin with a 48-foot feedline, 93 feet of wire for the long end of the antenna, and 46 feet for the short end.

Three strain insulators will be needed, one for the middle and one on each end. Galvanized stranded-steel guy wire is probably the best all-around antenna wire for this purpose. It is strong, corrosion resistant, inexpensive, and easily soldered. It is readily available at most hardware stores.

After passing the antenna wire through the end insulators, wrap it lightly around itself so that it can easily be changed in length for tests.

For feedline, use a 48-foot length of outdoor 300-Ohm TV twinlead to start with. It may be trimmed to 47 feet if juggling the antenna length does not bring the swr down to a satisfactory level.

For the run to the shack, 75-Ohm coaxial cable is recommended. Unless transmit power is to exceed 300 Watts, RG-59/U will work just fine. If you have a length of RG-6/U cable-TV coax, it will work just as well. Its slightly larger diameter may require some vinyl jacket shaving at the ends to accommodate a conventional adapter sleeve for the PL-259 connectors.

I found the easiest way to erect the antenna was to tie a rock to the end of a roll of nylon twine, unwind thirty feet or so, and heave it over an upper limb of a tree. The twine is cut from the roll and tied to an end insulator. It is easily hoisted over the branches. The process is repeated at another tree at the far end of the antenna. Such an arrangement makes it easy to lower and raise the antenna during tuning procedures, as well as provides access to the antenna for repair or severe weather protection. The lower end of the twine may be tied to an inconspicuous nail driven into the tree trunk.

A typical chart of swr versus frequency for one off-centerfed antenna, which I personally use, is shown below. The antenna is 134 feet in total length, fed at a point which divides it into 90- and 44-foot lengths by a 48-foot length of heavy-duty outdoor 300-Ohm TV twinlead. A Unadilla 4:1 balun transformer connects the twinlead to a random length of RG-6/U, 75-Ohm TV coax to the shack.

FMHz	SWR
1.8	2.0
3.5	1.3
3.6	1.4
3.7	1.3
3.8	1.3
3.9	1.4
4.0	1.3
7.0	1.5
7.1	1.3
7.2	1.1
7.3	1.1
14.0	2.7
14.25	2.4
14.35	2.0
21.0	3.5
21.25	1.8
21.45	1.2
28.0	3.0
28.5	1.8
29.0	2.5
29.5	1.9

Signal reports have been outstanding. Even with less than 100 Watts input to the rig, it was hard to call CQ without receiving a reply, often from several stations, commenting on the strength of the signal.

Carefully pruned, the phone man's Windom antenna is an inexpensive way for any ham to get top performance on all HF bands without having to resort to a transmatch. ■

✓ Reader Service—see page 195

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RYRYRYRY

—an electronic torture test for RTTY systems

Here is an electronic "RY" tape for those who don't have a mechanical transmitter-distributor (TD) for their Teletype® system or who have become tired of making paper tapes. It is useful for on-the-air transmissions, as well as for adjusting and troubleshooting your own teletype system. The solid-state RY tape has to be superior to a paper tape if only because it can send an unlimited number of RYs.

The solid-state unit uses eight integrated circuits and can be built to operate on any of the teletype circuit speeds. It always starts by sending an R as the first letter and will shut off only after sending a Y. One of the prototype units was tested with an expensive teletype distortion tester and was found to have had zero distortion without requiring any adjustment to the unit. It was built for 100-wpm operation, used a reed relay to control the teletype loop, and had been set to speed with a homemade frequency counter.

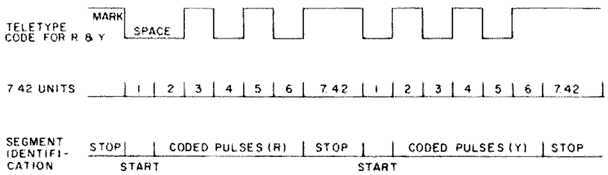

Fig. 1. R and Y Teletype® coding.

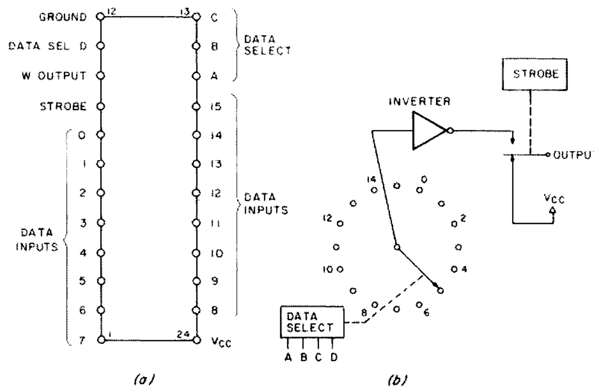

Fig. 2. The 74150 pinout and function.

The solid-state RY tape in this article is designed for 60-wpm operation, although the builder can change it to any speed by changing the RC values in the clock circuit. The unit can be made using TTL ICs or CMOS ICs. A unit made with TTL ICs requires that a well-regulated 5-volt power supply be used. The TTL output IC is capable of sinking 48 mA, so it is able to drive most 5-volt reed relays.

A unit using CMOS ICs can be powered by nearly any dc supply in the 5-to-15-volt range. Stiff regulation of the voltage is not required. The CMOS output IC cannot drive a relay, so a transistor is required.

Since performance will be the same for units made with either TTL or CMOS ICs, overall cost should be the deciding factor in determining which to use.

Teletype circuits use a seven-pulse code to transmit data. See Fig. 1, which illustrates the coding for an R and a Y. One pulse is used as a start signal, another is used as a stop signal, and the remaining five contain the coded information for each letter. The teletype pulses are called mark and space pulses. A space indicates the circuit is open and a mark means a closed circuit. The start pulse and the five code pulses are the same length, but the stop pulse is 1.42 times as long as one of the other pulses. For this reason, the teletype code is often referred to as a 7.42-unit code.

The stop pulse is longer in order to synchronize the machines on a teletype circuit. The stop pulse gives machines that are running slightly slow an opportunity to catch up after each letter or function and thereby start in synchronization at the beginning of each new letter. If the stop pulse is longer or shorter than 1.42 units, most teletype machines are not affected, but the rate at which information is handled on the circuit is slowed or speeded up. The actual rate of information transmittal on the so-called 60-wpm circuit is 61.33 wpm. If the stop

pulse were made 1.50 units long with the other pulses remaining 1 unit in length, the transmission rate would decrease about 0.65 wpm and the circuit would transmit information at the rate of 60.68 wpm. Such a small difference would not affect the machines nor be noticeable to the operators.

Increasing the stop pulse to 2.0-unit lengths would decrease the rate by 4.44 wpm and slow the circuit speed to 56.89 wpm. While not harming the machines, the loss of speed is noticeable to the users. The solid-state RY tape uses a 7.50-unit code as a compromise between the cost of building a unit with exactly the correct stop pulse length and one that may do the job but obviously runs slow. Several more ICs would be necessary if the stop pulse were to be made 1.42 units long.

Accepting that a 7.50-unit code is satisfactory, the design of the solid-state RY tape can be based on an 74150 IC, which can be used to form the teletype code for the R and Y letters. The 74150 is a 16-line-to-1-line data selector/multiplexer, which means, in simple language, that it has 16 inputs and only one output. Fig. 2(a) shows a bottom view of the 74150 pins and their designations. The output pin of the 74150 can be switched to any of the input data pins, just as if the IC were a single pole, 16-position rotary switch. See Fig. 2(b). The position of the switch is controlled by the binary code present at the data-select pins of the 74150.

For example, if the binary code for 5 were present at the data-select pins, the output pin would be connected to data input pin number 5. There are two important differences between the 74150 and a mechanical switch. The IC inverts the information between the data inputs and the output pin. That is, if the data at input pin 5 was a high, it will appear at the output pin as a low. The other difference is that the output of the 74150 has to be "strobed," which means that the output has to be turned on by a signal at its strobe pin. In the absence of the strobe signal, the output pin is at the high level. True output data is available only when the strobe signal is applied.

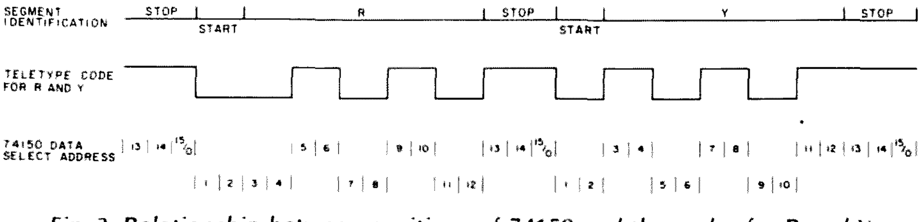

Fig. 3. Relationship between positions of 74150 and the codes for R and Y.

To cause the 74150 to form the teletype codes for the letters R and Y, the data-input pins are connected to high and low sources so that the 7.50-unit code for each letter appears at the output pin as it is connected in turn to each of the input data pins. To simplify the formation of the 7.50-unit code, the 74150 data inputs are connected to the external sources in such a manner that all 16 positions are used to form one letter. After a letter has been scanned, the external data-input sources are changed so that the other letter is generated the next time the data inputs are scanned. Using all 16 positions to form one letter allows the use of two data inputs or switch positions for each unit pulse, and three data inputs for the stop pulse, thereby making the stop pulse 1.50 times the length of the other pulses. Actually, only 15 of the 16 positions of the 74150 are used to generate a letter; the remaining position is discarded by forcing the data-select counter to rapidly advance over the unused position.

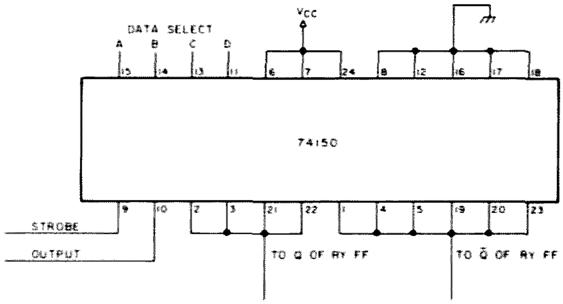

Fig. 4. External connections to 74150.

Fig. 3 illustrates the relationship between the positions of the 74150 and the codes for R and Y. Data-select positions 13, 14, 15, and 0 are used for the stop pulse. Positions 1 and 2 are used for the start pulse. Positions 3 and 4 are for the first coded pulse, 5 and 6 are for the second coded pulse, 7 and 8 are for the third coded pulse, 9 and 10 are for the fourth coded pulse, and 11 and 12 form the fifth coded pulse. Position 15 is the position that is skipped over by forcing the data-select counter to go to a count of 0 whenever it attempts to stop on 15. More on this later.

The high and low source connections for each data input pin of the 74150 can be determined from Fig. 3. Since 13, 14, 15, and 0 are always used to form the stop pulses, they are connected to a low source. (The 74150 inverts the input signal so that the output from these pins becomes a high at the output pin.) Data inputs 1 and 2 always form the start pulse, so these pins connect to a high source. Data inputs 3, 4, 7, 8, 11, and 12 should be high to produce an R and low to form a Y. Data inputs 5, 6, 9, and 10 have to be low for an R and high to form a Y. Fig. 4 shows the external connections to the data-input pins of the 74150 to form the teletype code for R and Y.

The alternating high-low sources for the coded pulses are obtained from the outputs of a flip-flop which is caused to change states each time the data-select inputs skip position 15. This flip-flop is a 7473, IC2a, as shown in Fig. 5.

The data-select information for the 74150 is furnished by a 7493 binary counter, IC3. The 7493 counts to 16 and its outputs are connected to the data-select inputs of the 74150 to drive the IC through its 16 positions. (The positions are numbered 0 through 15.) IC4b, a 7420, is used to detect the number 15 when the binary counter, IC3, arrives at that count. When the 7493 reaches 15, its four outputs are all high. Since the four inputs of IC4b are wired to the counter outputs, the output of the 7420 goes low. The output is inverted by IC4a and is used to reset the 7493 binary counter to zero, thereby

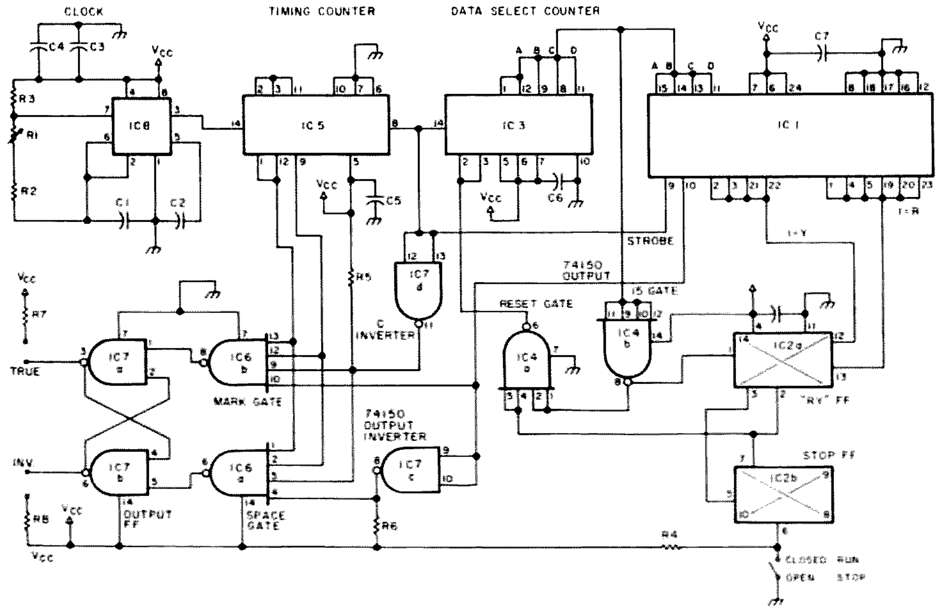

Fig. 5. Solid-state RY tape generator schematic.

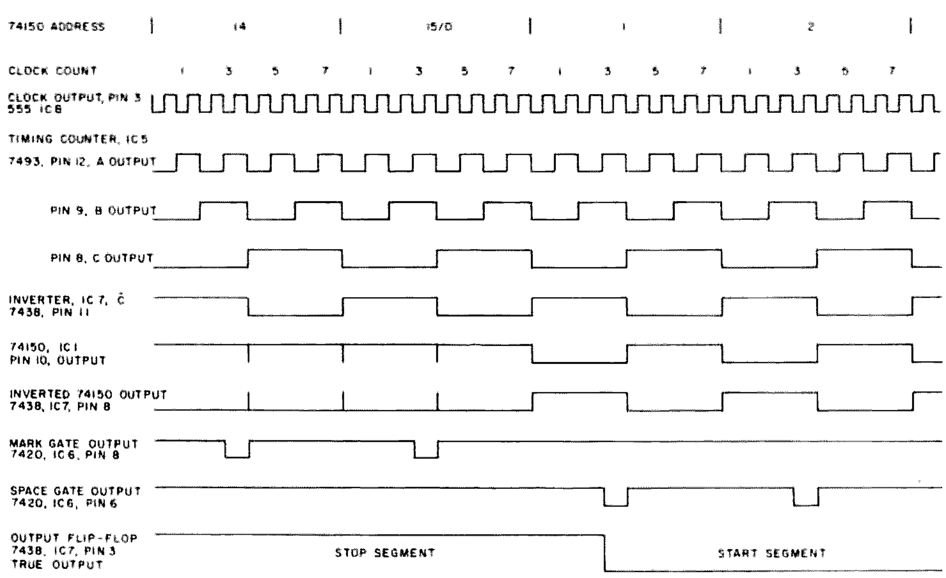

Fig. 6. Solid-state timing chart.

skipping position 15 of the 74150. The output of IC4b is also connected to the clock input of IC2a, causing the RY flip-flop to change states each time the output of IC4b goes low. Since this action takes place during the stop pulse, the new letter code is present at the data input pins long before it is needed.

The binary counter, IC3, is driven by another counter, IC5. This counter can be either a 7490 or a 7493, as the wiring in the schematic of Fig. 5 is arranged so that either IC can be used. This counter is used to generate the timing signals for the RY tape unit in addition to driving the data-select counter, IC3. The timing signals are formed from the ABC outputs of IC5. The C output of IC5 (pin 8) is connected to the clock input of the data-select counter IC3, so the data-select counter advances one number for each eight counts for the timing counter.

Count three of the timing counter is used to examine the output of the 74150 and determine whether the code is a mark or a space. This is done by using a pair of 4-input NAND gates, IC6a and 6b, to detect the level of the 74150 output. The A and B outputs of the timing counter, IC5, are connected directly to two inputs of 6a and 6b. The C output is inverted by IC7d, one section of a 7438, and connected to a third input of IC6a and 6b. When the timing counter is on the count of three, the A and B outputs of the counter are high and the C output is low. The inputs of IC6a and 6b are all high because the C output was inverted by IC7d. If the fourth input of either gate becomes high, its output will become low.

The output of the 74150 is connected directly to the fourth input of IC6b. The output of the 74150 is inverted by IC7c and then is connected to the fourth input of IC6a. The C output of IC5 is used as the strobe. It turns on the output of the 74150 when the timing counter, IC5, is on counts 0, 1, 2, and 3. With a true output from the 74150 on timing count three, one of the IC6 gates will have all highs on its four inputs and a low on its output. If the output of the 74150 is high, gate 6b will have a low at its output. IC6b is the mark gate. If the output of the 74150 is low, the output of IC6a will be low. Gate 6a is the space gate.

The output stage of the solid-state RY tape is a flip-flop made up of the two remaining gates of IC7, 7a and 7b. The flip-flop is connected as an S-R type of flip-flop, with the outputs of the mark and space gates setting and resetting the flip-flop. The 7438 is an open-collector type of NAND gate and requires an external load for each gate output. The external load can be a resistor or a relay. Each of the collectors of the 7438 is capable of sinking 48 mA at 5 volts, which is more than adequate to operate 5-volt reed relays. Both collectors in the flip-flop have to have a load, so the collector not used to drive a relay has to be connected to a load resistor. If the solid-state RY tape is to be used to drive other ICs or transistors instead of a reed relay, the 7438 can be replaced with a 7400 IC, and the load resistors for all four gates can be eliminated since the 7400 is

not an open-collector IC.

One output of the flip-flop is a true output whose waveform is shown in Fig. 3, while the other output of the flip-flop is inverted. If the RY tape unit is used to drive a relay whose contacts are in series with the teletype loop current, the relay has to be connected to the inverted output of the flip-flop in order to key the line current correctly. The other (true) output of the flip-flop has to be connected to a load resistor.

A 555 IC timer is used for the clock generator. The 555, IC8, is a very stable oscillator and the circuit requires few components. The clock frequency for the solid-state RY tape used on a 60-wpm teletype circuit is 727.2 pulses per second. The usual rate for a mechanical TD is 45.45 pulses per second, but the circuit of the RY tape unit requires a much higher clock speed to arrive at the 60-wpm teletype circuit speed.

Two of the data-select positions are used for each teletype code segment. This doubles the internal clock speed from 45.45 to 90.90 pps. The timing counter divides the clock by eight, so 8 times 90.90 equals 727.2 pulses per second.

The clock can be set without a counter if necessary, if an operating teletype printer is available. With the solid-state RY tape unit connected in your local teletype loop, adjust the frequency control until the machine prints RYs. Refine the adjustment until the rangefinder on the printer can be set to the normal reading for your loop, using the solid-state RY tape as the source for checking the rangefinder. The 100k adjustable resistor in the clock circuit is adequate to compensate for the tolerance of the components in the timing circuit so that the clock easily can be adjusted to the right frequency.

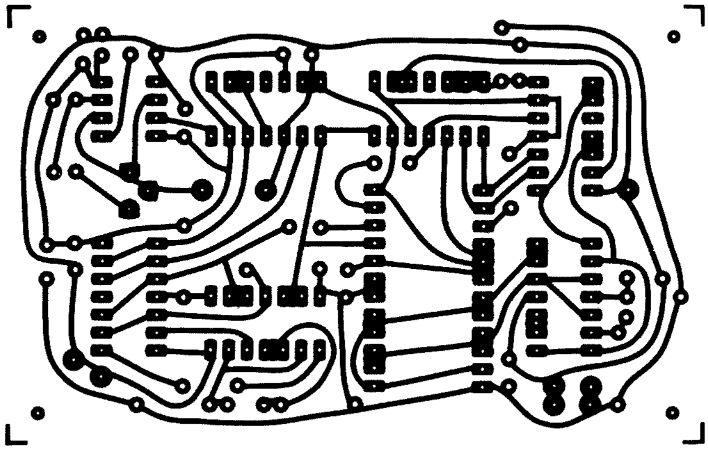

Fig. 7. PC board layout.

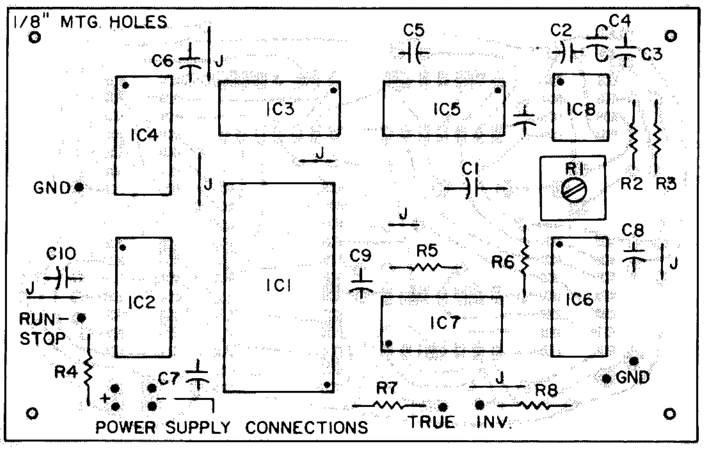

Fig. 8. Component location.

The slightly longer stop pulse used in the solid-state RY tape does not change the required clock speed nor influence the setting of the rangefinder. The only pulse lengths bearing on clock frequency or rangefinder setting are the start and coded pulses. They have to be 22 milliseconds long for a 60-wpm teletype circuit. The stop pulse affects just the rate of information transmittal.

The circuit which causes the solid-state RY tape to start with an R and end the transmission after sending a Y includes a 7473 flip-flop, IC2b, and the reset gate, IC4a. The clear or reset, pin 6, of IC2b is connected to 5 volts through a 1k resistor. Pin 6 is also connected to a switch indentified as the Stop-Run switch. This switch connects the reset to ground when the switch is closed. The switch is closed in the Run position and the low on the reset pin holds the flip-flop in the reset condition. The $\overline{Q}$ output of IC2b is held high and fed to the reset of IC2a, allowing IC2a, the RY flip-flop, to respond to signals on its clock input. The high from the $\overline{Q}$ output is applied also to input pins 4 and 5 of the reset gate, IC4a, enabling the 15 gate, IC4b, to control the reset signal to the data-select counter, IC3. Under these conditions, the solid-state tape runs, coding teletype RYs, until the Stop-Run switch is opened.

When the Stop-Run switch is opened, the unit stops running after a complete Y is sent. With the switch open, there is a high from the 5-volt supply through the 1k resistor on the reset pin of IC2b. This enables the Stop flip-flop to respond to negative-going signals on its clock input, pin 5. Following the completion of a coded Y, the 15 gate clocks the RY flip-flop to a reset condition where the Q output becomes low. The low from the Q output of the RY flip-flop clocks the input of IC2b, causing the flip-flop to assume the set state. The $\overline{Q}$ output of the Stop flip-flop is now low. This low is fed to the reset, pin 2, of the RY flip-flop, holding IC2a in the reset condition. The RY flip-flop is held in the state which will cause an R to be sent as the first letter of the next sequence. The low is

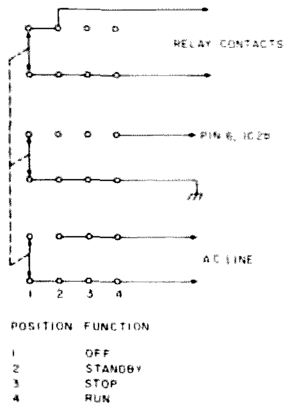

Fig. 9. Alternate Stop-Run switch arrangement.

also fed to input pins 4 and 5 of the reset gate, IC4a. The output of IC4a becomes high and holds the data-select counter, IC3, in the reset condition with its output on number zero.

The solid-state RY tape is stopped until the Stop-Run switch is placed in the Run position. Closing the switch resets the Stop flip-flop. This removes the reset from the data-select counter and the solid-state RY tape runs beginning with R as the first letter transmitted.

Fig. 6 is a timing chart of the solid-state RY tape unit. It illustrates the waveforms of the important circuits during part of the stop segment and part of the start pulse. This action takes place during the time the 74150 IC is advancing through positions 14, 15/0, 1, and 2. As shown, the 74150 data-select count is advanced one position for each eight clock pulses. The A, B, and $\bar{C}$ outputs combine with the output of the 74150 in the mark and space gates each time the count in timing counter IC5 is three. During the time the 74150 is on positions 14 and 15/0, the output of the IC is a high. This causes the mark gate output to become low during the time the timing counter count is three. The low triggers the output flip-flop and causes the true output of the flip-flop to remain high. The stop pulse is always a mark.

When the 74150 is on positions 1 and 2, the output of the IC is low. Notice that the true output of the 74150 occurs only during the time the strobe is low (output C of IC5). Now the inverted output of the 74150 combines with the A, B, and $\bar{C}$ outputs of IC5 in the space gate to generate a low at the output of the gate. This low triggers the output flip-flop to the opposite state, and the true output now is a low or space.

Notice that the teletype pulses or segments do not coincide with the start of the 74150 positions. The beginning or end of each teletype segment coincides with the count of three in the timing counter. At that time, three of the four waveforms that have to be in coincidence have stabilized and the fourth waveform is the high at output A of the timing counter. The mark or space begins with the positive edge of the A output waveform.

While there are two triggers or lows developed during each teletype segment (three in the case of the stop pulse), only the first will cause a change in the state of the output flip-flop.

Fig. 7 is the foil pattern of the printed circuit board for the solid-state RY tape. It is a single-sided board with seven jumpers completing the pattern. The spacing between ICs is sufficient so that sockets can be used, although they are not recommended. It's preferable to solder the ICs to the PC board.

Fig. 8 is the layout of components on the board. All the components shown in Fig. 5, except the Stop-Run switch, mount on the PC board. Four external connections to the board are required to make use of the RY tape unit. The four connections are: Vcc, Stop-Run switch, output, and ground. Several extra ground pads are located on the edge of the board pattern for convenience in wiring the unit into the teletype system.

	TTL	CMOS
IC1	74150	74C150
IC2	7473	74C73
IC3	7493	74C93
IC4	7420	74C20
IC5	7490 or 7493	74C90 or 74C93
IC6	7420	74C20
IC7	7438 or 7400	74C00

Table 1.

There also are solder pads in the pattern so that the load resistor can be connected in the unused output of the output flip-flop.

While the discussion of the RY tape unit referred to TTL IC numbers only, the unit can be constructed with CMOS ICs if the lower cost of the power supply is important or if it is desired to share an existing power supply of suitable voltage. In either case, a 555 IC will be used at IC8.

The TTL ICs and their CMOS equivalents are listed in Table 1.

IC5 can be a 7490 or 7493 TTL IC or a 74C90 or 74C93 CMOS IC, as the PC board foil pattern is made so that either type of IC can be placed in this position. The counter is used only to count to eight, so either a decade or binary counter will work.

The table of TTL ICs shows a 7438 or a 7400 TTL IC at IC7. If the unit is to be used to drive a power-consuming load such as a relay, the 7438 IC should be used as it can sink 48 mA. If the RY tape unit is used as a signal source, a 7400 IC can be used at IC7. The 1k load resistors are not required if the 7400 is used.

If the unit is built using CMOS ICs, the load resistors are not needed and the IC used at IC7 will not drive a load. If it is necessary for the unit to operate a relay, a transistor can be added as the relay driver.

If the tape unit is to be installed permanently in the teletype loop, the simple Stop-Run switch can be replaced with a 3P4T rotary switch, as in Fig. 9. One pole of the switch is used to place a short across the relay contacts of the RY tape unit in the Off and Standby positions. This keeps the teletype loop closed so that the other equipment attached to the loop can function when the relay contacts are open during the time the power is off to the RY tape unit. When the power is applied by switching to the Standby position, it is possible, depending on the ICs in the unit, that a letter or part of a letter will be generated. The short on the contacts in the Standby position will prevent the unwanted transmission from appearing in the loop.

Another pole is used to turn the ac power on and off and the third pole is the Stop-Run switch. It operates just as in the previous description of the SPST Stop-Run switch action. ■

Parts List

C1	2000-pF, 5% mica
C4	6.8-uF, 25-volt, tantalum
C2, C3, C5-C10	0.02-uF, 50-volt
R1	100k trimmer, cermet, 63P104
R2	390k
R3	120k
R4-8	1k

Goin' Mobile

—equipment for air-conditioned gypsies

SSG James T. Ashcraft
KL7IPE/DA1SM
261st Signal Company
DCS Station Breitsol
APO NY 09162

Dieter W. Potzel DF7NM
Gartenstrasse #2
8751 Dammbach O.T. Kr
West Germany

"KP4I, this is DA1SM/mobile."

"DA1SM/mobile, this is KP4I; you are 5 and 3 here, old man . . ."

Not too bad for a converted CB from central Germany on a homebrew helical whip. If you like excitement, this little rig can deliver!

"Hey, Dieter, I just got a 1979 Cobra 140 GTL SSB CB rig. Will you help me convert it to 10 meters?"

So, in the true ham spirit, we jumped into something about which we knew very little. Since *73 Magazine* is just about the only link we have with current technical information and trends in amateur radio, I read every article printed during 1978 pertaining to CB-to-10 conversion with PLL frequency synthesis. From this information, it was apparent that we would be looking at two crystal-controlled oscillators in the Cobra. They are controlled by crystals X1 and X4. Crystal X1 runs the programmable divider, IC2, operating at 10.240 MHz. The other, X4, operates at 11.1125 MHz, and that is the one we are going to change.

So, the first thing to do was figure out what's the first thing to do! Since the bulk of 10-meter DX in Europe is between 28.450 MHz and 28.700 MHz, we decided to put channel 1 at 28.450 MHz, with channel 40 ending up at 28.890 MHz.

Fig. 1.

FREQUENCY SYNTHESIZER ALIGNMENT

Test Equipment	Test Point	Transceiver Controls	Adjust	Remarks
Frequency counter	TP12	Ch. 19, AM	—	Check for 10.240 MHz (we got 10.2385 MHz).
Oscilloscope or rf mV meter	TP16 (L18 secondary)	Ch. 19, AM voice lock mid-range	L18	Adjust for maximum rf.
dc voltmeter	TP9	Ch. 40, AM	L13	Adjust for 5.00 volts.
Oscilloscope or rf mV meter	TP1	Ch. 19, USB	L14	Adjust for maximum rf.
Frequency counter	TP1	Ch. 19, USB voice lock mid-range	CT3	Adjust for 36.4725 MHz +/−20 Hz. Check all channels. See Fig. 2. If no reading, readjust L18 and L14 until they have more than one peak. Use maximum peak.
Frequency counter	TP1	Ch. 19, LSB voice lock mid-range	L19	Adjust for 36.4675 MHz +/−20 Hz. Check all channels. See Fig. 2.
Frequency counter	TP1	Ch. 19, AM voice lock mid-range	L20	Adjust for 36.4700 MHz +/−20 Hz.
Frequency counter	TP1	Ch. 19, LSB Transmit	VR3	Adjust for 36.4675 MHz +/−20 Hz.
Frequency counter	TP10	Ch. 1, USB	—	Check for 1.430 MHz. Check all channels. See Fig. 2.
Frequency counter	TP3	Ch. 19, USB	CT1	Adjust for 7.8025 MHz.
Frequency counter	TP3	Ch. 19, LSB	CT2	Adjust for 7.7975 MHz.
Frequency counter (disconnect TP7 and TP8)	TP3	Ch. 19, AM Transmit	L17	Adjust for 7.800 MHz +/−5 Hz.

RECEIVER ALIGNMENT

Connect an ac VTVM or high-Z FET VOM (ac) across the speaker coil and adjust the volume control for a suitable indication. Keep the rf signal generator output level as low as possible to prevent agc limiting. If you do not have a generator, you can use another transmitter operating AM or CW into a dummy load on low power at the operating frequency for Ch. 19, and then adjust the "rf cans," in sequence as listed below, for maximum noise. Mode AM, rf-gain maximum, squelch minimum, voice lock mid-range, NB off.

Test Equipment	Transceiver Controls	Adjust	Remarks
Output of signal generator through	Ch. 19, AM	L3, L4	Adjust for maximum output on

The formula for determining the frequency of crystal X4 is not the manufacturer's, but it still works accurately for some strange reason. The formula: Add the desired channel 1 frequency in MHz to 6.3725 MHz and then divide the sum by 3. That will do the job very nicely. We changed X4 to 11.6075 MHz. The crystal, with .001% tolerance, was purchased from JAN Crystals for $4.25. To get channel 1 at 28.965 MHz, change X4 to 11.7792 MHz.

I gathered up my brand-new customized X4, my Cobra, and a signal generator and went to Dieter's house. Dieter had the power supply, ac VTVM (or high-Z FET VOM) with an rf probe, VOM, frequency counter, and a dummy load. Some people have everything.

The alignment procedures presented in Fig. 1 should be followed carefully and repeated at least once to ensure maximum performance. The frequencies indicated at TP10 in Fig. 3 will remain the same regardless of the frequency of X4. The indications at the operating frequency and at TP1 were the ones for us. To figure the frequency for TP1 on USB, add 2.5 kHz (for LSB) and subtract 2.5 kHz with the voice lock centered.

The test equipment I've listed is necessary. The tools needed are: a #2 Phillips screwdriver, needlenose pliers, a 15 to 25 Watt soldering iron, rosin-core solder, and an alignment tool for the rf transformer.

Remove the cover that has the speaker holes and unplug the wires from the speaker. Remove the other half of the housing and find a small dish or cup in which to place the screws so you won't lose them under the radio. Instant smoke!

Turn the chassis so the knobs are toward you, component side up. Compare the radio with Fig. 2 and locate all the test points and adjustments to help avoid confusion when the going gets good. Locate and replace crystal X4.

The power supply should be adjusted for 13.8 V dc. However, a good auto battery will work. The transceiver is stable down to about 10 volts. Connect the power supply to the radio, observing the polarity (red to positive, black to negative). Connect the dummy load or antenna, the speaker wires to the speaker, and the microphone to its receptacle. If you trace the wires from the microphone on the schematic, you will see that the speaker is disabled during the transmit condition. This is to prevent feedback and oscillations during transmissions. If you ever add a speech processor, be sure to use the same type of plugs and jacks, as well as the same type of microphone cable. So, if you're working on the Cobra and you don't get any audio, check to see if the microphone is plugged in properly. Voice of experience!

Final Comments

The alignment sequence, as presented here, was originally obtained from *Sam's Photofacts*, volume CB-19. I have modified the procedures to reflect the new frequencies involved, because I realize that not all hams have all the right test equipment. Since we don't have any power restrictions for the unit itself, the transmitter adjustments should give you about 20 Watts PEP output SSB and 7 Watts out on AM. On our units, we have obtained 22 Watts PEP output on SSB. There has been no change in operating stability or any noticeable heating of the rf power transistor.

The first unit took about 6 hours to convert and align completely. Most of

.01 uF capacitor to TP13 (collector TR10). Set generator for 7.8 MHz, 1000 Hz at 30% modulation.			speaker.
Output of signal generator through .01 uF capacitor to antenna input. Set generator at 28.670 MHz, 1000 Hz at 30% modulation (your Ch. 19 op.freq.).	Ch. 19, AM	L5, L6, L7, L8, L9, L10	Adjust for maximum output. If necessary, readjust L3 and L4 for maximum.
Output of signal generator through .01 uF capacitor to TP13 (collector TR10). 7.8025 MHz, no modulation.	Ch. 19, USB	L3, L4	Adjust for maximum output.
Output of signal generator through .01 uF capacitor to antenna input. 28.670 or your Ch. 19 operating freq., no modulation.	Ch. 19, USB	L5, L6, L7 L8, L9, L10	Adjust for maximum output at speaker. If necessary, readjust L3 and L4 for maximum.

Disconnect the test equipment. Take a break and relax for a few minutes. You can't do it all at once.

TRANSMITTER ALIGNMENT

Connect an rf wattmeter or an swr meter to indicate rf power peaks, and a 50-Ohm, 50-Watt dummy load to the antenna connector.

In the steps below that call for the injection of a two-tone signal, you may not have the test equipment to do it and you can substitute by humming into the microphone to generate a sufficiently complex waveform to do the transmitter adjustments. Although with this method it is harder to observe the peaks, you'll get it adjusted just fine with a little practice at humming and going throught the adjustments two or three times. Hummmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm

Test equipment	Transceiver Controls	Adjust	Remarks
Inject a two-tone, 50-mV signal at mic input. Or hum if you prefer.	Ch. 19, USB Transmitter keyed	L26, L27, L28 L29, L36	Set VR7 to minimum. Adjust for maximum rf output.
Same as above.	Same as above	VR7	rf ALC. Adjust for maximum rf output.
Disconnect signal source from mic input. No modulation.	Ch. 19, AM Transmitter keyed	VR6	AM power. Adjust for maximum rf output.
No modulation.	Ch. 19, AM Transmitter keyed	VR10	Tx power meter. Adjust so that front panel power meter does not hit the stop at the end of the scale. This is now a relative indication.

That's all. You are ready to go.

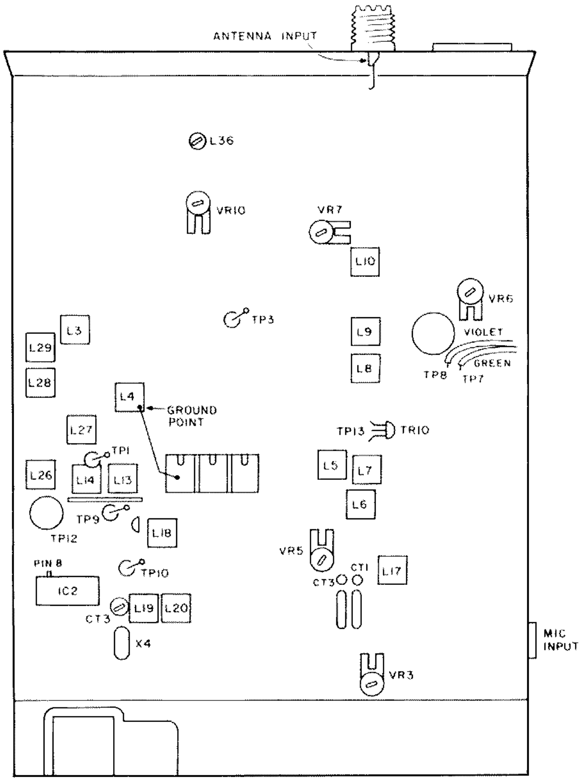

Fig. 2. Control knobs.

the time was spent finding out that L14 and L18 have more than one peak indication, and that only the correct peaks would produce the correct indication on the frequency counter at TP10. The second unit took only 40 minutes. So, take your time and follow the directions carefully. Watch out for the front panel settings. We also spent a lot of time backtracking by not having the correct transceiver control settings.

What do you think about 10 kHz transceiver incremental tuning—and still have RIT operate normally? I just couldn't take it when some station was just far enough off frequency that I could hear him/her, but I wasn't able to transmit on the same frequency. Now we have almost continuous tuning from channel 1 to 40. But that's another story, and I love it!

Dieter and I usually monitor channel 9 (that's 28.550 MHz) or USB when we're mobile 5 days a week (any five days) between 0500 and 0600 GMT and 1700 and 1800 GMT. If the band is good, see you there. 73 and good DX.■

Channel	Operating Frequency(MHz)	Divider Input TP10 (MHz)	AM Rec, vco out TP1 (MHz)
1	28.450	1.4300	36.2500
2	28.460	1.4400	36.2600
3	28.470	1.4500	36.2700
4	28.490	1.4700	36.2900
5	28.500	1.4800	36.3000
6	28.510	1.4900	36.3100
7	28.520	1.5000	36.3200
8	28.540	1.5200	36.3400
9	28.550	1.5300	36.3500
10	28.560	1.5400	36.3600
11	28.570	1.5500	36.3700
12	28.590	1.5700	36.3900
13	28.600	1.5800	36.4000
14	28.610	1.5900	36.4100
15	28.620	1.6000	36.4200
16	28.640	1.6200	36.4400
17	28.650	1.6300	36.4500
18	28.660	1.6400	36.4600
19	28.670	1.6500	36.4700
20	28.690	1.6700	36.4900
21	28.700	1.6800	36.5000
22	28.710	1.6900	36.5100
23	28.740	1.7200	36.5400
24	28.720	1.7000	36.5200
25	28.730	1.7100	36.5300
26	28.750	1.7300	36.5500
27	28.760	1.7400	36.5600
28	28.770	1.7500	36.5700
29	28.780	1.7600	36.5800
30	28.790	1.7700	36.5900
31	28.800	1.7800	36.6000
32	28.810	1.7900	36.6100
33	28.820	1.8000	36.6200
34	28.830	1.8100	36.6300
35	28.840	1.8200	36.6400
36	28.850	1.8300	36.6500
37	28.860	1.8400	36.6600
38	28.870	1.8500	36.6700
39	28.880	1.8600	36.6800
40	28.890	1.8700	36.6900

To make a chart for the *73* channelization plan when X4 is 11.7792 MHz, just start channel 1 at 28.965. TP10 will not change, TP1 will be 36.7650, and go from there. Channel 23 frequencies are not a mistake.

Fig. 3. Frequency chart when X4 is 11.6075 MHz.

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Inside Radio Shack's Digital Receiver

—SWLing with the DX-300

If you have been around communications equipment for at least the past ten years or so, you will recall literally drooling over a receiver whose digital display of frequency was so accurate that you could dial up a frequency and listen. If nothing was heard, you were assured that the transmitter was not on the air. This selfsame receiver had controls for audio bandwidth and rf/af gain and cost a pretty penny unless you were o.d. in color and eligible to have government property.

Well, as I unpacked Radio Shack's new model DX-300 receiver, that old feeling crept up on me. The receiver is everything you have always wanted to ask for in a receiver, and more. The more is the LED digital frequency display and the price, which is less than $400.00. Considering the fact that frequency coverage extends from 10 kHz to 30 MHz, the DX-300 would appear to be that single multi-purpose receiver suitable for both the Novice ham and the Advanced ham, with the shortwave listener thrown in for good measure.

Naturally, I was a doubting Thomas—several of us were: The price, the way the receiver looked, and the specifications contained in the manufacturer's literature seemed like a dream come true. But true skeptics that we were, we subjected the DX-300 to a series of tests, using a likewise diverse series of testers. The receiver was used portable (on its internal eight C-cell batteries), plugged into a car's cigar lighter, and fixed, operating off conventional 120 V ac. During the long periods of portable operation, the battery-saving dial light switch was used to conserve the battery, but, considering the efficient design and extensive use of solid-state devices, we didn't notice any appreciable loss in battery life during the test.

The DX-300 covers from 10 kHz through 30 MHz in thirty bands and shares a very efficient preselector which is switchable and tuneable in six stages: 0.01-0.15, 0.15-0.5, 0.5-1.6, 1.6-4.5, 4.5-12, and 12-30 MHz. Literally any frequency you might be interested in from the submarines to the CBers will be covered in these ranges.

The basic frequency determination is via the main tuning control with the LED display. Each frequency is displayed and carried

through in MHz and kHz (e.g., 12.000-12.999 MHz with a 1-kHz fine tune for better reception of SSB and CW signals). Examining the more-than-complete block diagram, we note that we have triple conversion—quartz controlled with the first i-f, 54.5-55.5 MHz, second i-f, 3-2 MHz, and the third i-f, at 455 kHz.

Following an incoming rf signal from the antenna, it travels to the rf section with attenuation capabilities (20-0-40 dB) switch selectable and into the preselector. The signal is amplified by Q201 and mixed down in the 1st mixer, Q202-203, by means of the 55.5-81.5-MHz local oscillator, Q401 (MHz tuning). The MHz tuning converts the antenna input signals up to 30 MHz into 55.5-54.5 MHz at 1-MHz separation into amplifiers Q205-214 and 206 (first i-f). Also at this time, the first local oscillator of MHz tuning is mixed down with ¼ × N integer harmonics of 4 MHz (3-32 MHz) produced by the second oscillator, Q507, in the third mixer, IC201, and amplified by a 52.5-MHz amplifier, Q207, 208, 209, and the second mixer, Q206 (3-32 MHz), signals are produced by harmonic generator D501-502.

The resulting signal from the first i-f (55.5-54.5 MHz) is mixed down with the 52.5 MHz of the second mixer and converted to 3-2 MHz for the second i-f. From this point we have a conventional and rather ordinary single superheterodyne circuit which converts the signal to the third i-f of 455 kHz and then to a detector and audio output.

Description	Condition	Nominal Spec.		Limit Spec.	
Frequency coverage	Band A	10-150 kHz		10-150 kHz	
	Band B	150-500 kHz		150-500 kHz	
	Band C	500-1600 kHz		500-1600 kHz	
	Band D	1.6-4.5 MHz		1.6-4.5 MHz	
	Band E	4.5-12 MHz		4.5-12 MHz	
	Band F	12-30 MHz		12-30 MHz	
Sensitivity	10-50 kHz	Not specified		Not specified	
(S + N)/N = 10 dB		AM	SSB	AM	SSB
Output = 50 mW	100 kHz	10 uV	10 uV	50 uV	50 uV
	300 kHz	2 uV	1 uV	10 uV	5 uV
	900 kHz	2 uV	1 uV	10 uV	5 uV
	3.1 MHz	0.5 uV	0.3 uV	2 uV	1 uV
	7.1 MHz	0.5 uV	0.3 uV	2 uV	1 uV
	15.1 MHz	0.5 uV	0.3 uV	2 uV	1 uV
	28.1 MHz	0.5 uV	0.3 uV	2 uV	1 uV
Selectivity	± 10 kHz	70 dB		60 dB	
Image ratio	10-50 kHz	Not specified			
	100 kHz	60 dB		50 dB	
	300 kHz	60 dB		50 dB	
	900 kHz	60 dB		50 dB	
	3.1 MHz	60 dB		50 dB	
	7.1 MHz	60 dB		50 dB	
	15.1 MHz	60 dB		50 dB	
	28.1 MHz	60 dB		50 dB	
Signal to noise ratio	At 7.1 MHz 1 mV 30% Mod.	40 dB		35 dB	
Intermediate frequency	1st	54.5-55.5 MHz			
	2nd	2-3 MHz			
	3rd	455 kHz			
Spurious rejection	At 7.1 MHz	40 dB		30 dB	
1 MHz harmonics	At 7 MHz	0.5 uV		3 uV	
Audio output power	Less than 10% T.H.D.	1.8 W		1.2 W	
Phone jack output power	At 0.5 W speaker output	100 mV		50-200 mV	
Tape output voltage	At 7.1 MHz, 1 mV 30% Mod. af output 0.5 W	300 mV		150-600 mV	
Meter sensitivity	S-9 at 7.1 MHz	100 uV ± 6 dB			
Rf attenuator	0, 20, and 40 dB				
Frequency display	5-digit LED display (MHz/kHz)				
Frequency stability	Within ± 1 kHz after one hour warm up				
Antenna impedance	50-Ω unbalanced type				
Power source	ac 120 V, 60 Hz, dc 12 V negative ground only or internal cells				
Operation temperature	0° C to 40° C				

Table 1. Specifications.

For example, assuming we have tuned to 26.965 MHz, the first local oscillator is at 81.5 MHz and the first mixer output is 81.6 − 26.965 or 54.635 MHz.

The second oscillator 29-MHz output is used in the third mix to produce: 81.6 − 29 = 52.6 MHz. The second mix produces 54.635 − 52.6 = 2.035 MHz which is free of drift. The receiver is fully state of the art and makes a maximum use of integrated circuitry and LED displays for both status and frequency indication.

While the DX-300 comes with a complete operating manual, technically-minded owners may want the optional Service Manual (Radio Shack Part No. 20-204). For the first time—at least in my experience of some twenty years in ham radio—a service manual equals or exceeds the quality of the equipment. Not only do you have full technical data and specifications, but alignment instructions, suggested test equipment, and

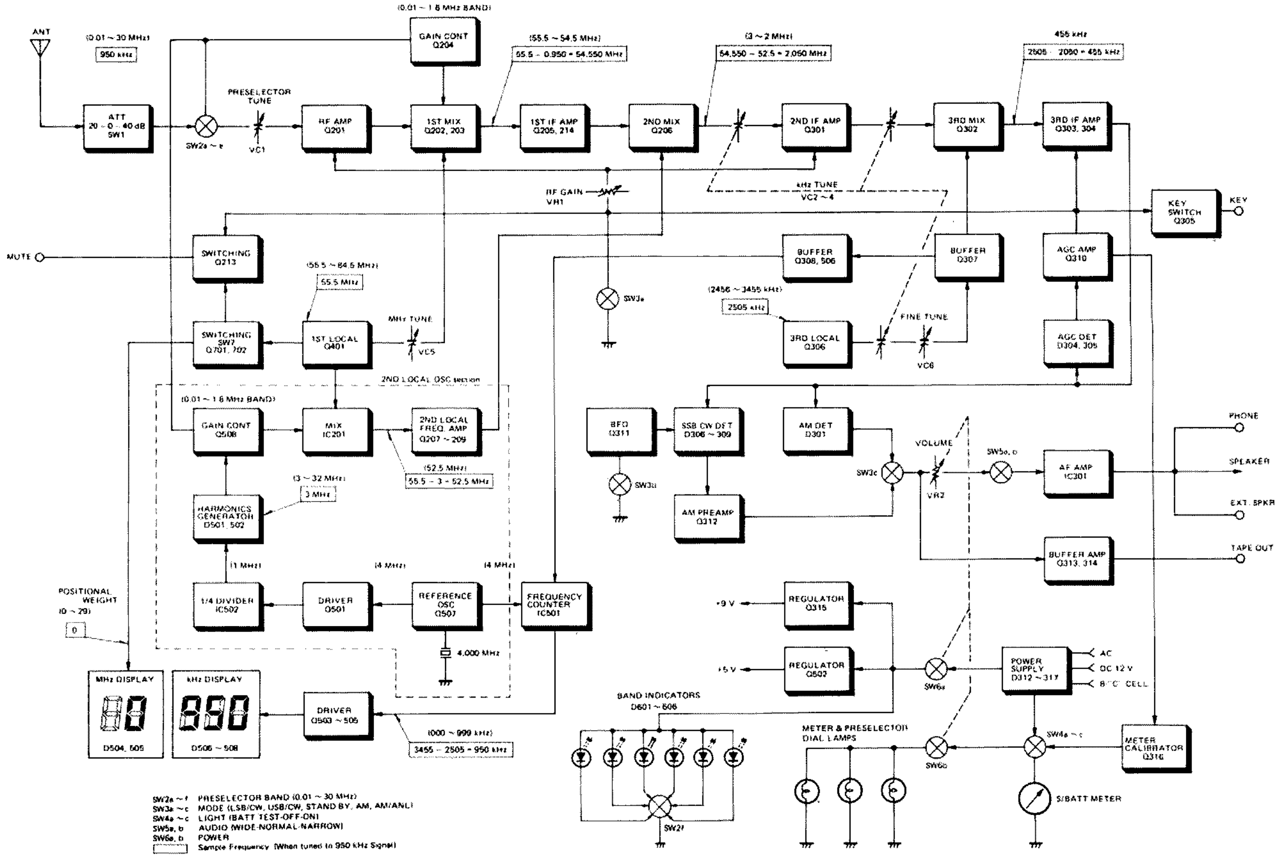

Fig. 1. Block diagram.

a series of tests which use the diagnostic troubleshooting decision-tree approach rarely found with equipment for the home or hobbyist market. Nothing is left to chance; a brief schematic or block representation shows the correct manner to hook up test equipment to the receiver and what points to either measure or inject a corresponding frequency or voltage.

The manual triggered the same positive thoughts and comparisons of that "dream-receiver" we alluded to in the beginning of this review. In a nutshell, the manual is everything you have always wanted to know about repairing and recalibrating but were afraid to ask for because, until now, the methodology was not clear enough. The manual is so clear that I would not hesitate to take the DX-300 to far-off DX locations where I couldn't be assured of parts or of an adequate repair facility. Even the parts list is complete, and included are base diagrams for solid-state devices and a complete set of top and bottom views for the six PC boards which make up the DX-300. As well, there are mechanical drawings and wiring interconnects.

On-the-air tests proved that the receiver sounds as good as it looks. The quality of audio through the internal speaker was clear and undistorted. The attenuator, when used with a coaxial antenna, provided ample rejection of high-powered intruders operating around the frequencies we were interested in. In fact, the audio quality was so good that Radio Shack included a TAPE OUT jack on the rear panel for those broadcasts which one may want to save; during our tests, we were able to make several excellent tapes using a variety of antennas from the enclosed whip to a random-length longwire. In CW modes, the audio bandwidth control functioned better than we anticipated. While it's not a full-blown CW filter and isn't specified as one, it does a more than creditable job on the 40- and 80-meter ham bands.

Considering the price, its frequency range, and other features, it would be hard to define any single segment of the market that the DX-300 is targeted for. Our tests and use showed it to be an excellent ham station receiver, with the facility of full general coverage. Maybe the operator's manual says it all. In a nutshell, the manual is a complete course in the installation, use, selection of, and fabrication of an antenna, and a guide to listening. Radio Shack has long been absent from the ham marketplace, and this new receiver would seem to be the first of what we hope will be many more ham products.

We tried to wring out this receiver and find its shortcomings, but with a total of four hams and one XYL testing it, we could arrive at only two points of contention: the lack of a crystal calibrator (WWV tests found it right on frequency), and a bassy tone with the internal speaker (a subjective opinion at best, and limited to only one evaluator).

If you haven't already guessed, we compared the receiver against what a number of us remember fondly as a workhorse in the military, the R-390; believe me, the DX-300 does it all, with LED display and stability, not to mention cost and weight. And besides, the R-390 didn't offer a built-in code practice oscillator—the DX-300 does! ■

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The Two-Meter Monkey

—not just another linear

My Icom IC-202 is a nice little two-meter SSB radio. Unfortunately, it's rated at only three Watts, which limits it to all but local contacts. This quickly became apparent after several attempts to work long distances and was the natural inspiration for this linear amplifier.

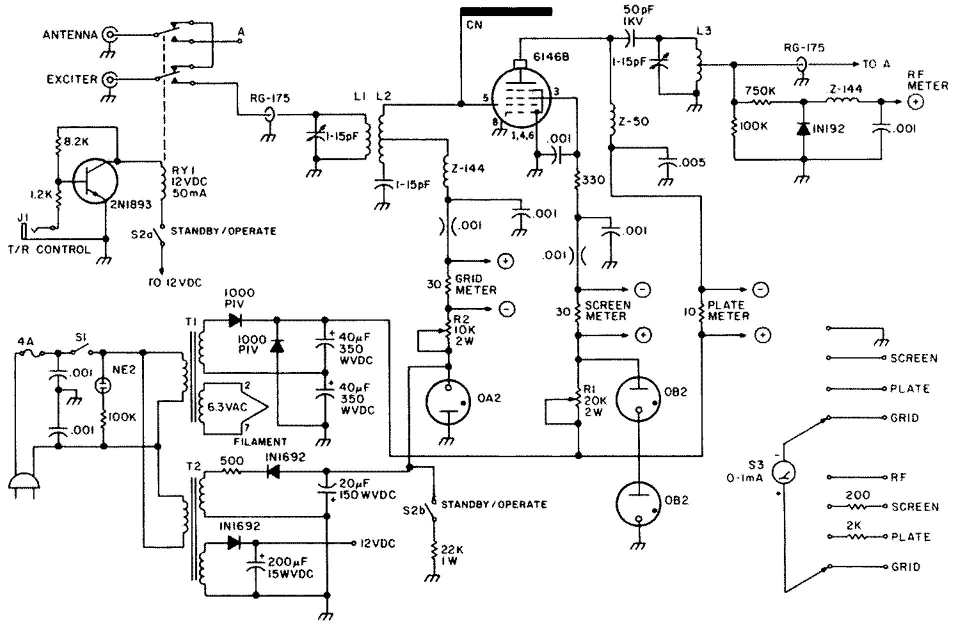


Fig. 1. Two-meter linear amplifier. All resistors ¼ Watt unless noted. T1—pri: 115 V ac; secs: 220 V ac, 250 mA and 6.3 V ac, 2 A. T2—pri: 115 V ac; secs: 115 V ac, 50 mA and 12 V ac, 500 mA. L1—3T, #14, ½" dia., 5/8" long. L2—6 T, #14, ½" dia., 7/8" long with center tap. L3—1T, #14, 3/4" dia.; tap ¼ to ⅓ turn from ground. CN—see text.

Building the amplifier was settled upon easily when it was clear that I couldn't afford to buy a commercial one. A more difficult decision was whether it should be solid-state "state of the art" or tubes. Again, economics came into the decision-making. In comparing the price of parts for a sixty-Watt transistorized amplifier and its power supply (all of which I'd have to buy) against my large 1960s junk box (parts I wouldn't have to buy), the conclusion I drew was that old technology isn't necessarily bad technology. I went with the tubes.

The amplifier described below was built for two meters for the 202. It is hoped that the reader will notice that the basic cir-

cuit will also lend itself to other transceivers and frequencies.

Circuit

The amplifier is a basic 6146B, biased class AB_1 for SSB, at about sixty Watts of input power. The layout of the components is detailed in the line drawing. The amplifier is neutralized by CN, a piece of #14 insulated copper wire five inches long which encircles the base of the 6146. The grid circuits are enclosed within a small minibox which also holds the 6146 socket. Two OB2 voltage regulators keep the screen voltage stiff, which is necessary for linear operation. S2b switches out a resistor, dropping the grid bias from a cut-off −120 V dc in Standby to −50 V dc for Operate. The whole unit is housed in a 10″ × 10″ × 3½″ cabinet.

So far, the circuit is straightforward and not unlike other VHF amplifiers. Just another linear amplifier? A unique part of the design, however, is how this amplifier is switched in and out of the transceiver's antenna line. There are several ways that this could be done, like using rf-sensing diodes or tapping a control voltage out of the transceiver. The first method is okay for modes like FM, but things tend to get messy with anything other than a continuous carrier. Tapping off a control voltage to operate a T-R relay works, too, but you show me a good, safe spot in an Icom to do this (or in almost any other solid-state rig, for that matter). Besides, the following method works much better and doesn't "invade" any of the radio's internal circuits.

There are four wires in the Icom microphone cord, if the mic shield is included. Rearranging these wires as shown in Figs. 2 and 3 will allow the unused side of the microphone PTT switch to be used to control the amplifier. The earphone jack was sacrificed as it is a convenient place to tie the amplifier to

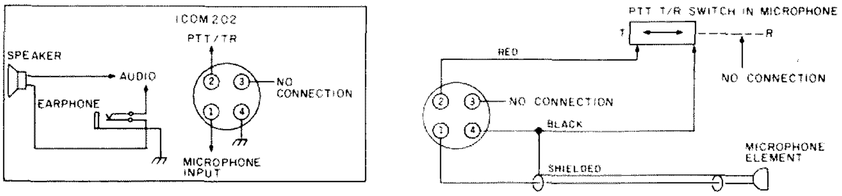


Fig. 2. Unmodified Icom IC-202 transceiver and microphone.

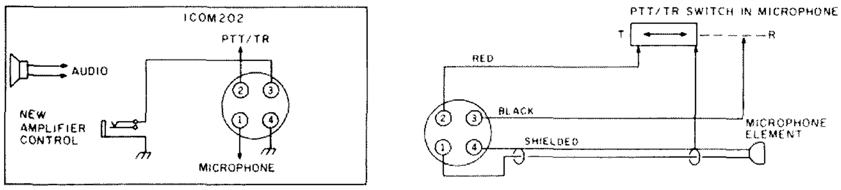


Fig. 3. Modified transceiver and microphone.

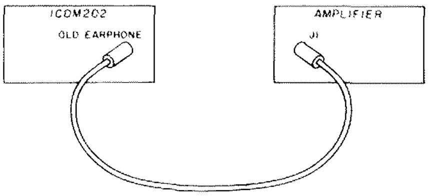
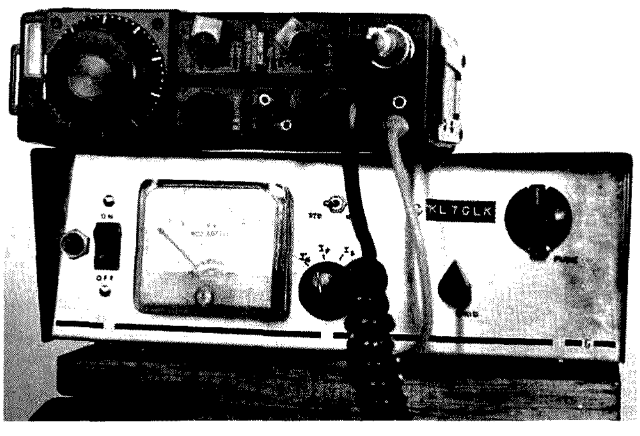
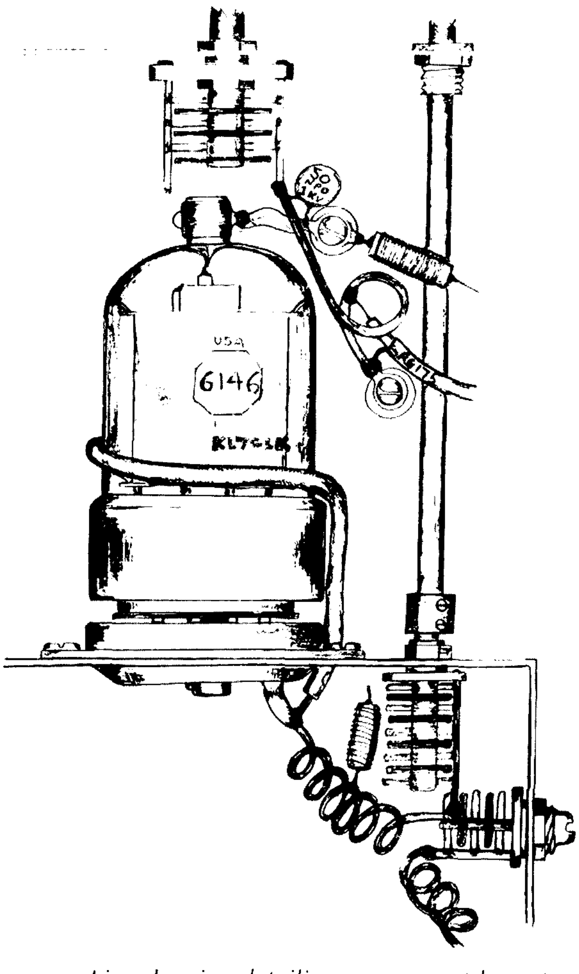


Fig. 4. Hookup between the 202 and the amplifier.



Two-meter linear amplifier with the Icom IC-202.



Line drawing detailing component layout.

pin 3 of the mic socket. With the transceiver in Receive mode, the base of the transistor is at ground and doesn't conduct. When the transceiver goes to transmit, the base goes positive and the transistor conducts, closing the T-R relay, RY1. S2 is a DPDT switch which allows the amplifier to be switched out of the antenna line for "barefoot" operation.

Operation

Initial tune-up operation involves applying power with S2 in Standby. R2 is adjusted to produce 190 V dc at the screen. Without applying a two-meter drive, the amplifier is placed in Operate and R2 adjusted to −50 V dc at the grid. The plate current should idle around 20 mA and the screen at 1-2 mA. Rotate the plate and grid capacitors through their ranges and look for any change in grid current. If neutralization is necessary, reposition CN to another area around the 6146 until no combination of adjustments to either plate or grid produces any change in grid current. Now apply a two-meter carrier and adjust the grid and plate capacitors for maximum rf output. For linear operation on SSB, back off the grid drive to a point that grid current just starts to be drawn. Repositioning the tap on L3 may be necessary to achieve an optimum loading to a particular antenna.

Once tuned up, the amplifier doesn't require retuning over at least a 200-kHz bandspread. The amplifier has given good accounts of itself in the signal reports received. It has proven a good, easy way to extend the communications range of the Icom IC-202. ■

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RTTY QSK

—break in to RTTY operation with a KOR

In its issue of October, 1978, the *RTTY Journal* published an article, "Keyboard Operated Relay," that immediately attracted my attention.

The author, VE3DCX, wrote that ". . . this gadget will put such luxuries as VOX for SSB or break-in for CW in the hands of RTTY enthusiasts . . ." That was no wild claim, as I found out later.

Being basically a lazy person and averse to unnecessary work and effort (except when deliberately engaged in some kind of physical exercise), I lost no time breadboarding and testing two versions of this KOR adapted to my microprocessor-based RTTY setup.

An analysis of the original circuitry revealed that, at least in my case, the circuit was unnecessarily complicated.

The basic idea, as adapted to my uP system, is shown in Fig. 1, illustrating two different configurations: (a) for systems that give a level one for mark, and (b) for systems that give a level zero for mark. It should be clear now that the idea is to have no charge going to the timing capacitor when the rig is in mark-hold condition, and, therefore, the transmitter relay should drop. As soon as transmission begins, the low bits (or the high bits, depending on the case) will cause the circuitry to provide charging current to the timing capacitor, and the relay pulls in.

The circuit shown in Fig. 2 was tested and found perfectly satisfactory for my Digital Group uP, which outputs a level one for mark.

In the schematic, connections are shown for the Kenwood TS-820. If you have a different rig, the collector and emitter of Q2 will have to be inserted in series with the holding coil circuit of the transmitter relay: The collector goes to the hot side and the emitter goes to the cold side of the circuit.

Also, depending on the voltage and resistance already in the circuit, it may be necessary to insert a series resistor to limit the collector current to a safe value for the transistor, but sufficiently high for the relay. However, this is unlikely to be necessary because this circuit must already be limited to a safe value for the coil. For the Kenwood TS-820, this resistor is not necessary, and pins 2 and 3 of the MIC plug may be connected directly to Q2 as shown in the figure.

The timing for dropping the relay will depend on the values of C1 and R1—the higher those values, the longer the delay. The capacitor is charged through the diode (any signal-type diode) and discharged through R1 and the base of Q2. "Fudging" those values, you can adjust the delay to a convenient length. Please note that too high a value for R1 will prevent Q2 from outputting sufficient current to make the relay work. Alternatively, you could use a trimpot for R1. Suggested values are 100k and 5 uF, respectively, for a start.

After breadboarding and testing the circuit of Fig. 2 and finding that it worked to my complete satisfaction, it suddenly occurred to me that using an optocoupler would be cheap insurance against rf feedback into the microprocessor. The circuit of Fig. 3, therefore, was developed. It can be seen that it is basically similar to Fig. 2 except that now the collector current of Q2 will fire up the LED inside the optocoupler, and its phototransistor, in turn, will complete

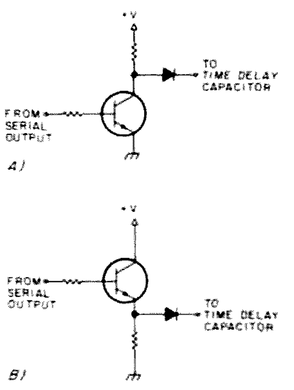

Fig. 1. How to derive the signal from a serial output. (a) Mark is level 1; (b) mark is level 0.

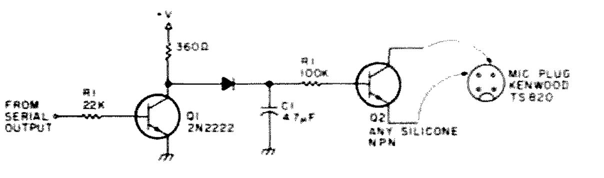

Fig. 2. A simple circuit for microprocessors having level one for mark. For level zero for mark, use Q1 as per (b) in Fig. 1.

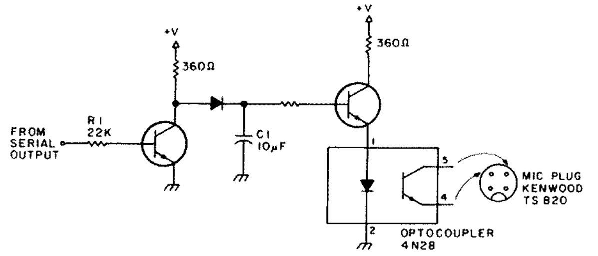

Fig. 3. Guarding against rf feedback. For systems giving level zero for mark, use Q1 as per (b) in Fig. 1.

the circuit for the relay coil.

I used an unknown device with the Motorola logo and a house number that was supposed to be similar to the 4N28. I treated it as such, and the device did not disappoint me.

Again, the timing will be adjusted by means of C1 and R1, but now we face a different situation. Whereas in the circuit of Fig. 1 we could use virtually any NPN transistor, now we need a relatively high current to keep the LED glowing. Therefore, in order to avoid having to use very large values for C1 which might cause other complications, we will have to use a transistor with a current gain of 200 or more, like the 2N2222. I used a BC109C with a gain of 365 and suggest 10 uF and 120k, respectively, for C1 and R1.

The use of this gadget couldn't be simpler: Start typing and the relay pulls in; stop typing and about three seconds after the buffer has stopped outputting signals, the relay drops. That is all! ■

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A Programmer's Potpourri

—fifteen practical programs for hams

Here's a collection of fifteen programs to run on your computer once you tire of playing yet another game of Star Trek. These programs will help you calculate parts values for several popular circuits, print out fancy-looking purchase orders for your parts orders, and even prepare a complete wire list for wire-wrapping or just checking out a printed circuit board layout.

All of these programs are written in BASIC and most can, with just minor changes, be run on most popular computer systems. The wire-list program is written for disk systems, but can be adapted for cassette use with a little work.

555 Timer Calculator

The 555 timer is a popular IC which is used in a variety of ways. Possibly the most popular circuit is the oscillator circuit of Fig. 1. The oscillation frequency is determined by R1, R2, and C, and the output is a square wave whose high (positive) part is always longer than its low part; that is, its duty cycle (the percentage of the time that it is high as compared to the time for one whole cycle) is always greater than 50 percent.

There are two kinds of calculations we often have to do—find the parts values for R1, R2, and C based on what we want the oscillator to do, or figure out what it is supposed to do from the parts values we already have. Program 1 will do either job.

When you start it, the program first asks which you want to do—calculate component values or find out what it is doing with known parts values.

Program 1(b) is a sample run to calculate component values. Since resistors are more easily changed (and a pot can be used to make an adjustable resistance), we always assume a known value for C, but the program is set up so that it repeats itself so that you can try several values for C. If C is too small, the resistor values will be too large to be practical; the sum of R1 and R2 should be less than 5 megohms with a 5-volt supply. In the sample, we find that for a frequency of 1000 Hz at a 75 percent duty cycle (output high ¾ of the time), we should use resistors of approximately 7215 and 3607 Ohms with a 0.1-microfarad capacitor.

Program 1(c) is a sample run to find the frequency and duty cycle when the resistor and capacitor val-

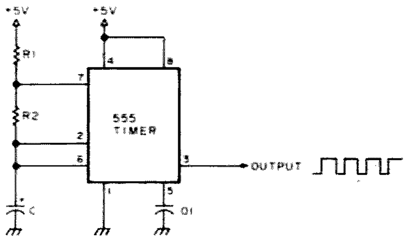

Fig. 1. 555 oscillator circuit.

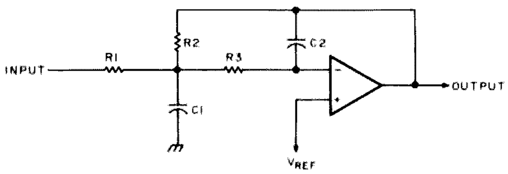

Fig. 2. Low-pass active filter.

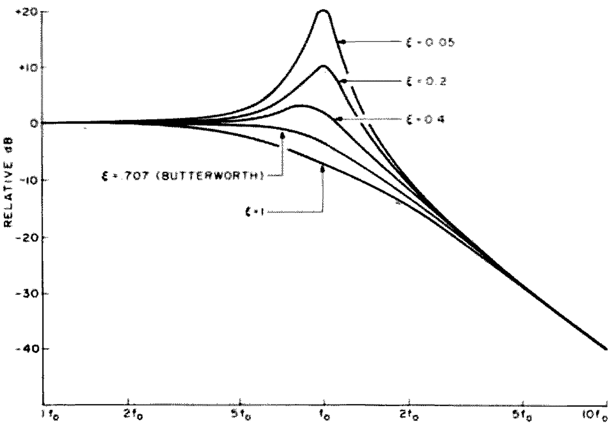

Fig. 3. Comparison of different filters.

ues are known. Thus, with R1 at 10k, R2 at 470 Ohms, and C at 0.1 microfarad, we find an oscillation frequency of 1319 Hz and a duty cycle of almost 96 percent. The program also tells us how long the output is on (high) and off (low).

Low-Pass Active Filter

Fig. 2 is the circuit of a low-pass active filter. An active filter is one that uses just RC components and an amplifier to do what would normally require an LC circuit. (See my article entitled "Low-Pass Filter Primer" in *73 Magazine*, October, 1978, page 98, for a fuller explanation.) This amplifier can have different characteristics depending on the values chosen for the three resistors and two capacitors.

The amplifier is usually an operational amplifier, or op amp, such as a 741. The input shown as going to V_{ref} is grounded if the op-amp power supply consists of a positive and a negative supply, or is connected to a voltage divider if the op amp has just one power supply. The output of the voltage divider should be halfway between ground and the power-supply voltage.

In any case, a low-pass filter is one which passes low-frequency signals, but stops high-frequency signals from getting through. The exact shape of its frequency response curve depends on a quantity called the damping coefficient, represented by the greek letter ζ, zeta. As shown in Fig. 3, if zeta is 1, then the response drops off very gradually near the cutoff frequency, shown as f_o in Fig. 3. On the other hand, if zeta is close to 0, then the response peaks right at frequency f_o.

A filter which has a zeta equal to 0.707 is called a Butterworth filter, or "maximally-flat." This is a filter which is as flat as it can be in the pass region (to the left of f_o), without having any peaking. If zeta is just a bit larger, then the response drops off too soon; if it is just a drop smaller than 0.707, then the response starts to have a tiny peak.

Although the Butterworth filter has this very neat characteristic of maximum flatness, there are many times when we intentionally accept a little peaking in the interests of extending the frequency response with a steeper skirt (steeper drop-off). In any case, the active filter can provide either type of response.

Program 2 allows us to calculate parts values based on the desired stage gain, cutoff frequency, and zeta. Since there are many different combinations which will work, the value of C2 is selected manually first and input into the program. The sample run in (b) shows that for a gain of 5, cutoff frequency of 100 Hz, and a Butterworth filter with zeta equal to 0.707 and C2 equal to 0.5 microfarads, useful values would be approximately: R1 = 450 Ohms; R2 = 2250 Ohms; R3 = 375 Ohms; C1 = 6 uF.

The program calculates these to many digits of precision, but obviously the accuracy depends a lot on available components. We can usually round off to the nearest commercially-available components without affecting the frequency response, although this does often change the stage gain by a small amount.

High-Pass Active Filter

The high-pass active filter is essentially the opposite of the low-pass filter. It, too, has gain and can provide a variety of response curves, depending on its zeta. The frequency response for a high-pass filter would look just like the one shown in Fig. 3, except for being flipped left-to-right. The equations are also somewhat different.

Program 3 allows us to calculate the component values for the desired gain, cutoff frequency, and damping coefficient. This time, the input capacitor, C2, would also be determined manually.

Part (b) of the printout shows a sample run; for a gain of 5, cutoff frequency of 1000 Hz, and a Butterworth filter (zeta = 0.707), we have: C2 = 0.1 uF; R1 = 12381 Ohms; R2 = 1022 Ohms; C1 = 0.02 uF.

Bandpass Active Filter

When high-pass and low-pass filtering are combined in one circuit, the result is a bandpass filter which allows a band of frequencies to pass, but stops frequencies above and below that band. (The full analysis and design of bandpass filters can get quite sticky; for more info, see my article entitled "Design an Active RTTY Filter" in *73 Magazine*, September, 1977, page 38.)

Rather than use zeta,

(a)

```
0010 PRINT "555 TIMER DESIGN PROGRAM"

0020 REM COPYRIGHT 1979 BY P. STARK

0030 PRINT "DO YOU WANT TO CALCULATE COMPONENTS, OR FIND OUT"
0040 PRINT "WHAT THE TIMER IS DOING? - TYPE C OR F"
0050 INPUT A$
0060 IF A$="C" GO TO 110
0070 IF A$="F" GO TO 260
0080 GOTO 30

0090 REM FOLLOWING PART CALCULATES RESISTOR VALUES, GIVEN
0100 REM OPERATING FREQ., DUTY CYCLE, AND CAPACITOR VALUE

0110 INPUT "WHAT IS THE OSCILLATION FREQUENCY F", F
0120 INPUT "WHAT DUTY CYCLE (MORE THAN 50 PERCENT)", D
0130 IF D<=50 GO TO 120
0140 IF D>100 GO TO 120
0150 T1=1/F * D/100                             :REM HIGH PORTION OF CYCLE
0160 T2=1/F - T1                                :REM LOW PORTION OF CYCLE
0170 INPUT "WHAT VALUE OF C (IN MICROFARADS)", C
0180 R2=T2/(0.693 * C/1000000)
0190 R1=T1/(0.693 * C/1000000) - R2
0200 PRINT "RESISTOR FROM +V TO PIN 7 IS "; R1; "OHMS"
0210 PRINT "RESISTOR FROM PIN 7 TO PINS 2 & 6 IS "; R2; "OHMS"
0220 IF R1+R2>5000000 THEN PRINT "RESISTORS ARE TOO BIG"
0230 GOTO 170

0240 REM FOLLOWING PART CALCULATES OUTPUT ON TIME, OFF TIME,
0250 REM AND FREQUENCY GIVEN RESISTOR AND CAPACITOR VALUES

0260 INPUT "ENTER CAPACITOR VALUE IN MICROFARADS", C
0270 INPUT "ENTER RESISTOR FROM +V TO PIN 7 (OHMS)", R1
0280 INPUT "ENTER RESISTOR BETWEEN PINS 7 AND 2/6 ", R2
0290 T1=0.693 * C/1000000 * (R1+R2)
0300 T2=0.693 * C/1000000 * R2
0310 D=T1/(T1+T2) * 100
0320 F=1/(T1+T2)
0330 PRINT "TIME ON (SECONDS) "; T1
0340 PRINT "TIME OFF "; T2
0350 PRINT "DUTY CYCLE "; D; "PERCENT"
0360 PRINT "OSCILLATING FREQUENCY "; F; "HZ"
```

(b)

```
RUN
555 TIMER DESIGN PROGRAM
DO YOU WANT TO CALCULATE COMPONENTS, OR FIND OUT
WHAT THE TIMER IS DOING? - TYPE C OR F
? C
WHAT IS THE OSCILLATION FREQUENCY F? 1000
WHAT DUTY CYCLE (MORE THAN 50 PERCENT)? 75
WHAT VALUE OF C (IN MICROFARADS)? .1
RESISTOR FROM +V TO PIN 7 IS 7215.0072 OHMS
RESISTOR FROM PIN 7 TO PINS 2 & 6 IS 3607.5036 OHMS
WHAT VALUE OF C (IN MICROFARADS)? .01
RESISTOR FROM +V TO PIN 7 IS 72150.072 OHMS
RESISTOR FROM PIN 7 TO PINS 2 & 6 IS 36075.036 OHMS
WHAT VALUE OF C (IN MICROFARADS)?
READY
#
```

(c)

```
RUN
555 TIMER DESIGN PROGRAM
DO YOU WANT TO CALCULATE COMPONENTS, OR FIND OUT
WHAT THE TIMER IS DOING? - TYPE C OR F
? F
ENTER CAPACITOR VALUE IN MICROFARADS? .1
ENTER RESISTOR FROM +V TO PIN 7 (OHMS)? 10000
ENTER RESISTOR BETWEEN PINS 7 AND 2/6 ? 470
TIME ON (SECONDS) 0.000725571
TIME OFF 0.000032571
DUTY CYCLE 95.7038391 PERCENT
OSCILLATING FREQUENCY 1319.01411 HZ

READY
#
```

Program 1. 555 timer calculator. (a) Program. (b) Sample run to calculate component values. (c) Sample run to find frequency and duty cycle.

(a)

```
0010 PRINT "LOW PASS ACTIVE FILTER STAGE DESIGN"

0020 REM COPYRIGHT 1979 BY P. STARK

0030 PRINT "STAGE GAIN SHOULD BE BELOW 10 FOR BEST RESULTS."
0040 INPUT "ENTER THE DESIRED STAGE GAIN", H
0050 INPUT "ENTER CUTOFF FREQUENCY IN HZ", F
0060 PRINT "ENTER THE DAMPING COEFFICIENT; ENTER 0.707 FOR A"
0070 INPUT "BUTTERWORTH OR MAXIMALLY-FLAT FILTER", Z
0080 INPUT "ENTER FEEDBACK CAPACITOR IN MICROFARADS", C2
0090 C2=C2/1000000
0100 R2=Z/(2 * 3.14159 * F * C2)
0110 R3=R2/(H+1)
0120 R1=R2/H
0130 C1=(1 + H) * C2 / Z 2
0140 C1=C1*1000000
0150 PRINT "R1 IS "; R1; "OHMS"
0160 PRINT "R2 IS "; R2; "OHMS"
0170 PRINT "R3 IS "; R3; "OHMS"
0180 PRINT "C1 IS "; C1; "MICROFARADS"
0190 GOTO 80
```

(b)

```
LOW PASS ACTIVE FILTER STAGE DESIGN
STAGE GAIN SHOULD BE BELOW 10 FOR BEST RESULTS.
ENTER THE DESIRED STAGE GAIN? 5
ENTER CUTOFF FREQUENCY IN HZ? 100
ENTER THE DAMPING COEFFICIENT; ENTER 0.707 FOR A
BUTTERWORTH OR MAXIMALLY-FLAT FILTER? 0.707
ENTER FEEDBACK CAPACITOR IN MICROFARADS? .5
R1 IS 450.090558 OHMS
R2 IS 2250.45279 OHMS
R3 IS 375.075465 OHMS
C1 IS 6.00181254 MICROFARADS
ENTER FEEDBACK CAPACITOR IN MICROFARADS?
```

Program 2. Low-pass active filter. (a) Program. (b) Sample run.

(a)

```
0010 PRINT "HIGH PASS ACTIVE FILTER STAGE DESIGN"

0020 REM COPYRIGHT 1979 BY P. STARK

0030 PRINT "STAGE GAIN SHOULD BE BELOW 10 FOR BEST RESULTS."
0040 INPUT "ENTER THE DESIRED STAGE GAIN", H
0050 INPUT "ENTER CUTOFF FREQUENCY IN HZ", F
0060 PRINT "ENTER THE DAMPING COEFFICIENT; ENTER 0.707 FOR A"
0070 INPUT "BUTTERWORTH OR MAXIMALLY-FLAT FILTER", Z
0080 INPUT "ENTER INPUT CAPACITOR C2 IN MICROFARADS", C2
0090 C2=C2/1000000
0100 R1=(2*H+1) / (4*3.14159*Z*F*C2)
0110 R2=Z/(3.14159*F*C2*(2+1/H))
0120 C1=C2/H
0130 C1=C1*1000000
0140 PRINT "R1 IS "; R1; "OHMS"
0150 PRINT "R2 IS "; R2; "OHMS"
0160 PRINT "C1 IS "; C1; "MICROFARADS"
0170 GOTO 80
```

(b)

```
HIGH PASS ACTIVE FILTER STAGE DESIGN
STAGE GAIN SHOULD BE BELOW 10 FOR BEST RESULTS.
ENTER THE DESIRED STAGE GAIN? 5
ENTER CUTOFF FREQUENCY IN HZ? 1000
ENTER THE DAMPING COEFFICIENT; ENTER 0.707 FOR A
BUTTERWORTH OR MAXIMALLY-FLAT FILTER? 0.707
ENTER INPUT CAPACITOR C2 IN MICROFARADS? .1
R1 IS 12381.2295 OHMS
R2 IS 1022.93308 OHMS
C1 IS 0.02 MICROFARADS
ENTER INPUT CAPACITOR C2 IN MICROFARADS?
```

Program 3. High-pass active filter. (a) Program. (b) Sample run.

(a)

```
0010 PRINT "BAND PASS ACTIVE FILTER STAGE DESIGN"
0020 REM COPYRIGHT 1979 BY P. STARK
0030 PRINT "STAGE GAIN SHOULD BE BELOW 10 FOR BEST RESULTS."
0040 INPUT "ENTER THE DESIRED STAGE GAIN", H
0050 INPUT "ENTER CENTER FREQUENCY IN HZ", F
0060 W=2*3.14159*F
0070 INPUT "ENTER DESIRED Q", Q
0080 INPUT "ENTER INPUT CAPACITOR C2 IN MICROFARADS", C2
0090 C2=C2/1000000
0100 INPUT "ENTER FEEDBACK CAPACITOR C1 IN MICROFARADS", C1
0110 C1=C1/1000000
0120 R1=Q/(H*W*C1)
0130 T=R1/(Q*(C1+C2)*W)
0140 B=R1 - 1/(Q*(C1+C2)*W)
0150 R2=T/B
0160 R3=Q*(C1+C2)/(C1*C2*W)
0170 PRINT "R1 IS "; R1; "OHMS"
0180 PRINT "R2 IS "; R2; "OHMS"
0190 PRINT "R3 IS "; R3; "OHMS"
0200 GOTO 80
```

(b)

```
 RUN
BAND PASS ACTIVE FILTER STAGE DESIGN
STAGE GAIN SHOULD BE BELOW 10 FUR BEST RESULTS.
ENTER THE DESIRED STAGE GAIN? 5
ENTER CENTER FREQUENCY IN HZ? 2100
ENTER DESIRED Q? 10
ENTER INPUT CAPACITOR C2 IN MICROFARADS? .1
ENTER FEEDBACK CAPACITOR C1 IN MICROFARADS? .1
R1 IS 1515.76264 OHMS
R2 IS 38.8657088 OHMS
R3 IS 15157.6264 OHMS
ENTER INPUT CAPACITOR C2 IN MICROFARADS?
READY
N
```

Program 4. Bandpass active filter. (a) Program. (b) Sample run.

(a)

```
0010 PRINT "BUTTERWORTH LC LOW PASS FILTER DESIGN"

0020 REM COPYRIGHT 1979 BY P. STARK

0030 INPUT "HOW MANY LC STAGES", N
0040 INPUT "ENTER SOURCE RESISTANCE", R
0050 INPUT "ENTER CUTOFF FREQUENCY IN HZ", F
0060 FOR I=1 TO N
0070     PRINT "STAGE "; I
0080     C=1/(3.14159*F*R)*SIN((4*I-3)*3.14159/(4*N))
0090     C=C*1000000
0100     L=R/(3.14159*F)*SIN((4*I-1)*3.14159/(4*N))
0110     L=L*1000
0120     PRINT "      C IS "; C; "MICROFARADS"
0130     PRINT "      L IS "; L; "MILLIHENRIES"
0140 NEXT I
```

(b)

```
RUN
BUTTERWORTH LC LOW PASS FILTER DESIGN
HOW MANY LC STAGES? 2
ENTER SOURCE RESISTANCE? 600
ENTER CUTOFF FREQUENCY IN HZ? 2500
STAGE 1
      C IS 0.0812079444 MICROFARADS
      L IS 70.5792315 MILLIHENRIES
STAGE 2
      C IS 0.196053632 MICROFARADS
      L IS 29.2352725 MILLIHENRIES

READY
N
```

Program 5. Butterworth LC filter. (a) Program. (b) Sample run.

(a)

```
0010 PRINT "RESISTIVE T AND PI ATTENUATORS"

0020 REM COPYRIGHT 1979 BY P. STARK

0030 INPUT "ENTER INPUT IMPEDANCE IN OHMS", Z1
0040 INPUT "ENTER OUTPUT IMPEDANCE IN OHMS", Z0
0050 T=(SQR(Z1/Z0)+SQR(Z1/Z0-1))^2
0060 M=10*LOG(T)/2.3025
0070 PRINT "THE MINIMUM PAD LOSS IS "; M; "DB"
0080 PRINT "WHAT DB LOSS DO YOU WANT? (MUST BE GREATER"
0090 INPUT "THAN MINIMUM ABOVE", L
0100 L=10^(L/10)
0110 PRINT "T PAD ATTENUATOR:"
0120 R3=2*SQR(L*Z1*Z0)/(L-1)
0130 R1=Z1*(L+1)/(L-1)-R3
0140 R2=Z0*(L+1)/(L-1)-R3
0150 GOSUB 240
0160 PRINT "PI PAD ATTENUATOR:"
0170 R3=(L-1)/2*SQR(Z1*Z0/L)
0180 T=(L+1)/(L-1)/Z1-1/R3
0190 R1=1/T
0200 T=(L+1)/(L-1)/Z0-1/R3
0210 R2=1/T
0220 GOSUB 240
0230 END
0240 PRINT "RESISTOR R1 IS "; R1; "OHMS"
0250 PRINT "      R2 IS "; R2; "OHMS"
0260 PRINT "      R3 IS "; R3; "OHMS"
0270 RETURN
```

(b)

```
 RUN
RESISTIVE T AND PI ATTENUATORS
ENTER INPUT IMPEDANCE IN OHMS? 600
ENTER OUTPUT IMPEDANCE IN OHMS? 600
THE MINIMUM PAD LOSS IS 0 DB
WHAT DB LOSS DO YOU WANT? (MUST BE GREATER
THAN MINIMUM ABOVE? 3
T PAD ATTENUATOR:
RESISTOR R1 IS 102.59851 OHMS
      R2 IS 102.59851 OHMS
      R3 IS 1703.11415 OHMS
PI PAD ATTENUATOR:
RESISTOR R1 IS 3508.82782 OHMS
      R2 IS 3508.82782 OHMS
      R3 IS 211.377475 OHMS

READY
N
```

Program 6. T and pi attenuators. (a) Program. (b) Sample run.

(a)

```
0010 PRINT "SWR CALCULATOR PROGRAM"

0020 REM COPYRIGHT 1979 BY P. STARK

0030 INPUT "ENTER FORWARD POWER IN WATTS", F
0040 INPUT "ENTER REVERSE POWER IN WATTS", R
0050 F1=SQR(F)
0060 R1=SQR(R)
0070 S=(F1+R1)/(F1-R1)
0080 PRINT "THE SWR IS "; S; ": 1"
```

(b)

```
 RUN
SWR CALCULATOR PROGRAM
ENTER FORWARD POWER IN WATTS? 50
ENTER REVERSE POWER IN WATTS? 10
THE SWR IS 2.61803422 : 1

READY
N
```

Program 7. Swr calculator. (a) Program. (b) Sample run.

bandpass filters are usually characterized by their Q, which describes the sharpness of the filter response. A response which is very broad and passes a wide range of frequencies has a low Q, while a very sharp response which passes only a narrow range of frequencies has a high Q.

As you can see from Fig. 5, the diagram of an active bandpass filter is very similar to the low-pass and high-pass filters; the only difference is that each filter has its resistors and capacitors in a slightly different place.

Program 4 is used to calculate component values from desired response data. There is a lot of interplay between capacitor and resistor values, and so the program assumes that you choose the capacitors and it calculates the resistors.

For instance, to get a gain of 5, center frequency of 1000 Hz, and a Q of 10, we need these approximate values: C1 = C2 = 0.1 uF; R1 = 1515 Ohms; R2 = 38 Ohms; R3 = 15157 Ohms.

Butterworth LC Filters

Filters don't have to be active—they can also be passive. That is, instead of using amplifiers and fancy circuitry, they can also use plain LC circuits. Fig. 6 shows a popular LC low-pass filter. Though a passive filter is somewhat bulkier and more difficult to trim than an active filter, it is simpler and can handle large power levels. Moreover, active filters are only useful at relatively low frequencies; they cannot be used at rf frequencies because the amplifiers required to make them work at such high frequencies are simply not available.

This kind of filter will only work properly when the input and output resistances are correct; the equations used in our program assume that the source and load resistances are equal.

As shown in Fig. 6, one stage of the filter consists of one capacitor and one inductor; the filter shown is a two-stage filter, but could really have any number of stages. Each stage adds two poles to the response (see the bandpass filter article mentioned before for an explanation of how poles affect the response curve).

Program 5 is specifically

set up for Butterworth filters. The program shows how calculations are made for a two-stage Butterworth filter for a 600-Ohm line, 2500-Hz cutoff frequency, and two stages.

T and Pi Attenuators

Attenuators or pads are often inserted into a signal path to attenuate the signal going through it. Although a plain pot, connected as a volume control, will often do the job, special circuits called T and pi attenuators are needed when the circuit is required to maintain input and output resistances equal to the line impedance. A common application is in a 600-Ohm telephone line or 16-Ohm speaker system. Broadcast stations, which use 600-Ohm lines for almost all audio paths, use attenuators or pads a lot.

In many cases, an attenuator is used not only to attenuate, but also to match impedances; in this case, it is designed to have unequal input and output resistances.

Fig. 7 shows why these attenuators are called T and pi; the T pad looks like the letter T, while the pi circuit looks like the greek letter pi (π).

Program 6 allows us to calculate all the resistor values for both pads, starting with the desired input and output impedances and the pad loss. The pad loss indicates how much attenuation the circuit should provide and is measured in decibels (dB).

When the input and output line impedances are equal, a zero loss (loss of 0 dB) could be achieved by simply connecting the input and output by wires; hence the minimum pad loss possible is 0 dB, and the attenuator can provide anything above that. When the input and output impedances are not equal, however, then some loss is always necessary because of the impedance-matching requirements of the pad. The sample run indicates that after the input and output resistances are entered, the program outputs the minimum pad loss possible with those impedances. It then asks for a desired loss, which has to be equal to or greater than the minimum, and then computes all resistor values for the two circuits.

Swr Calculator

If you have a "forward and reflected power meter" in your antenna line, you often want to do a calculation of the swr from the forward and reflected powers. Program 7 is a very simple (almost trivial) program which does just this. For instance, it shows that if the forward power going to the antenna is about 50 Watts while the reflected power is 10 Watts, the swr is about 2.6 to 1.

Intermodulation Spurs

Still on the subject of rf, here is a program useful to repeater users and operators. Very often, two repeater signals will combine in some non-linear circuit to produce an output frequency which interferes with some other signal. This is based on the same summing or differencing that we're familiar with in mixers, except that in this case the signals involved may be either the fundamental or a harmonic of one or both of the signals.

That sounds quite abstract, so look at this example. Suppose that two 2-meter FM transmitters are interacting; one of these is at 146.94, the other at 147.00. If the second harmonic of the 146.94 transmitter (which is at 293.88) beats with the 147.00 signal, we get a difference frequency of 293.88 − 147.00 = 146.88, which is often called an "intermod spur" and which could easily

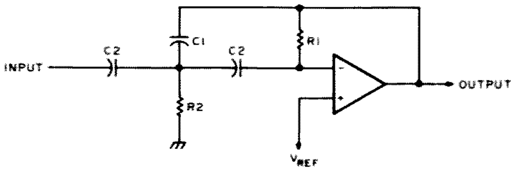

Fig. 4. High-pass active filter.

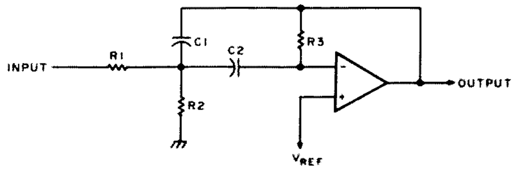

Fig. 5. Bandpass active filter.

cause interference to still another repeater.

The problem, though, is that higher harmonics may be involved than just the second; for instance, the third harmonic of one signal might be beating with the seventh of the other. Sometimes it's hard to find the right harmonic to use in this calculation, especially when we work the problem backwards—we know where the interference is and are trying to find the cause.

Program 8 is a general-purpose program to find causes of intermod spurs. Rather than requiring specific input and output frequencies, it will accept a range of frequencies; if you want to use just a single frequency, enter the same value for both the lower and upper frequency of each range.

The sample run shows an interesting example. Suppose you run a 146.34-146.94 MHz repeater and find that your own 146.94-MHz output is mixing with the output of some other 2-meter repeater to produce an intermod spur on the 146.34-MHz input frequency of your own repeater. Enter 146.94 as the lower and upper limits of input 1, enter a range of frequencies (146.60 - 147.00) as input 2, and enter the 146.34 frequency as the output range. Then run the

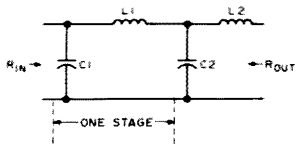

Fig. 6. Passive (LC) filter.

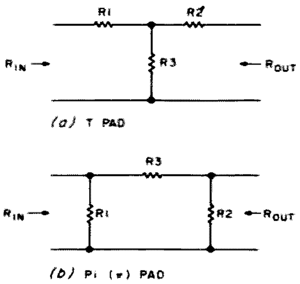

Fig. 7. T and pi attenuators. (a) T pad. (b) Pi (π) pad

program, and you get the five output lines shown at the bottom.

The last line, for example, says 5 * FREQ 1, and 6 * FREQ 2 (* means times in the BASIC language) is one of the intermod products. This means that the fifth harmonic of your own transmitter might be beating with the sixth harmonic of another to produce an intermod spur. Sure enough, when you sit down with a calculator, you find that this occurs when (6 * 146.84) − (5 * 146.94) = 146.34. If you know that there is no repeater output in your area on 146.84 MHz, you can disregard this possibility and look at the other four.

(a)

```
0010 PRINT "INTERMODULATION SPUR ANALYSIS PROGRAM"

0020 REM COPYRIGHT 1979 BY P. STARK

0030 PRINT "ENTER THE LOWER AND UPPER FREQUENCIES FOR INPUT 1"
0040 INPUT L1,H1
0050 PRINT "ENTER THE LOWER AND UPPER FREQUENCIES FOR INPUT 2"
0060 INPUT L2, H2
0070 PRINT "ENTER THE LOWER AND UPPER FREQUENCIES OF THE"
0080 PRINT "OUTPUT RANGE"
0090 INPUT LO, HO
0100 OO=0
0110 M2=0
0120 M2=M2+1
0130 M1=OO-M2
0140 IF M1<=0 GO TO 250
0150 S1 =M1*L1-M2*H2
0160 S2=M1*H1-M2*L2
0170 IF LO-S2<=0 GO TO 210
0180 G4=-S1
0190 S1=-S2
0200 S2=G4
0210 Z=(S2-LO)*(S1-HO)
0220 IF Z>0 GO TO 120
0230 PRINT M1;"* FREQ 1, AND "; M2;"* FREQ 2"
0240 GOTO 120
0250 OO=OO+1
0260 M2=0
0270 GOTO 130
```

(b)

```
 RUN
INTERMODULATION SPUR ANALYSIS PRUGRAM
ENTER THE LOWER AND UPPER FREQUENCIES FOR INPUT 1
? 146.94, 146.94
ENTER THE LOWER AND UPPER FREQUENCIES FOR INPUT 2
? 146.60, 147.00
ENTER THE LOWER AND UPPER FREQUENCIES OF THE
OUTPUT RANGE
? 146.34, 146.34
1 * FREQ 1, AND 2 * FREQ 2
2 * FREQ 1, AND 3 * FREQ 2
3 * FREQ 1, AND 4 * FREQ 2
4 * FREQ 1, AND 5 * FREQ 2
5 * FREQ 1, AND 6 * FREQ 2

READY
#
```

Program 8. Intermodulation analyzer. (a) Program. (b) Sample run.

LC Reactance Calculations

There is a whole set of formulas for calculating the reactance of inductors and capacitors and finding the resonant frequencies of tuned circuits. Program 9 puts them all together into one program which can find any quantity when the others are known.

The program has three parts, for tuned circuits, inductors, or capacitors. Once you choose one of these (see the sample run in Program 9), the program asks for the known data; simply answer 0 for the unknown quantity. It then calculates the unknown and prints it out.

Series-Parallel Calculations

Series or parallel resistors, capacitors, and inductors don't require a computer to find equivalent values, but the program is so simple that it makes a good demonstrator. Program 10 shows how it's done.

Power-Supply Calculations

Calculating the output voltage and ripple for a given transformer/rectifier/filter combination is also very easy, but it's easy to make a mistake by doing the wrong computation. Thus Program 11 is a very useful one.

This program assumes that silicon diodes with a voltage drop of .7 volts are used and is especially useful for low-voltage power supplies. It asks for the secondary voltage of the power transformer and then for the type of rectifier—half-wave, full-wave, or bridge. From these, it computes the peak output voltage from the rectifier, before filtering.

Either a single-capacitor filter or a choke-input filter can be specified. The output voltage and ripple depend on the load current, and the program computes that from the load resistance. It assumes that the transformer and/or choke resistance is very low in comparison with the load resistance and then outputs the dc output voltage and the ripple voltage.

The two sample runs are interesting because they are related to 5-volt power supplies used in digital circuits. Sample run (b) assumes a 12.6-volt CT transformer with a full-wave rectifier, 1000-uF capacitor filter, and a load resistance of 25 Ohms. This gives an output voltage of 6.25 volts with a peak-to-peak ripple of 2.5 volts; this translates to an output which goes 1.25 volts above and below the average dc voltage, so that the ripple goes from 5 volts to 7.5 volts. Since most 5-volt regulators go out of regulation if their input drops below about 7 volts, this circuit would not be suitable for a regulated 5-volt power supply.

In sample run (c), on the other hand, an 8-volt transformer, bridge rectifier, and 5000-uF filter would be good enough for a power supply with a much lower load resistance.

Printing Purchase Orders

Many parts suppliers don't like to deal with individual purchasers. This is so for a variety of reasons, but you can soothe them a lot—and possibly get better service—by sending them an official-looking purchase order rather than a hastily scribbled sheet of paper. If your computer has a printer, you can use it to print up those purchase orders for you, using Program 12. The best way to get acquainted with the program is to look at the sample run in (b).

When the program starts, it asks you to enter the quantity, stock or part number, description, and price for each item, separated by commas. The quantity must be a number, but the stock part number can be a string such as 2N2222 or 74LS00.

If a whole series of items have the same description—the following, for instance—

5, 10k, ¼ W resistor, .10
10, 22k, ¼ W resistor, .10
10, 47k, ¼ W resistor, .10

then entering a period instead of a description will simply repeat the same description as in the previous item.

The price entered is the price each; for instance, in the above example, the price for each resistor. Often, though, there is a group price, like "3 for $1." Rather than try to break this up into $0.33 each and then have the computer print it out as a total of $0.99, you can enter a group price rather than an individual price by entering it as a minus number. For example, the second item on the sample run is entered as −27 to show that it is for the entire group of 10 pieces.

Enter −10,0,0,0 to end your order entry. The program now prints out the total dollar amount of the order, not including sales tax and shipping, and asks whether you'd like a printout of your order.

In the printout, each item is numbered at the left. Once finished, the program asks whether you'd like to make changes. This part is not shown in the sample, but if the answer is YES, it will then ask for the item number and allow you to reenter the entire line again. If the quantity is entered as 0, that item will be deleted from the order.

Once the order has been corrected, the program asks whether there is sales tax on the order; the sales tax applies on in-state purchases, but not on out-of-state deals. The percentage is set in line 750 of the program at 5 percent; change it to your local rate.

Also requested at this point is the date, estimated shipping cost, type of payment, and transportation method desired. The latter two may be strings; you can specify, for instance, COD

(a)

```
0010 PRINT "INDUCTANCE-CAPACITANCE PROGRAM"

0020 REM COPYRIGHT 1979 BY P. STARK

0030 PRINT
0040 PRINT "WHICH PROBLEM DO YOU WANT TO DO?"
0050 PRINT "    1. TUNED CIRCUIT"
0060 PRINT "    2. INDUCTIVE REACTANCE"
0070 PRINT "    3. CAPACITIVE REACTANCE"
0080 INPUT A
0090 PRINT "ENTER THE FOLLOWING; ENTER 0 IF NOT KNOWN."
0100 PRINT "FREQUENCY IN HERTZ";
0110 INPUT F
0120 IF A = 1 GO TO 270
0130 PRINT "REACTANCE IN OHMS";
0140 INPUT X
0150 IF A = 2 GO TO 180
0160 IF A = 3 GO TO 270
0170 GOTO 30
0180 PRINT "INDUCTANCE IN HENRYS";
0190 INPUT L
0200 IF F = 0 THEN F = X / (2 * 3.14159 * L)
0210 IF L = 0 THEN L = X / (2 * 3.14159 * F)
0220 IF X = 0 THEN X = 2 * 3.14159 * F * L
0230 PRINT "INDUCTANCE IN HENRYS IS "; L
0240 PRINT "REACTANCE IN OHMS IS "; X
0250 PRINT "FREQUENCY IN HERTZ IS "; F
0260 GOTO 30
0270 PRINT "CAPACITANCE IN MICROFARADS";
0280 INPUT C
0290 C = C / 1000000
0300 IF A = 1 GO TO 370
0310 IF X = 0 THEN X = 1 / (2 * 3.14159 * F * C)
0320 IF C = 0 THEN C = 1 / (2 * 3.14159 * F * X)
0330 IF F = 0 THEN F = 1 / (2 * 3.14159 * X * C)
0340 C = C * 1000000
0350 PRINT "CAPACITANCE IN MICROFARADS IS "; C
0360 GOTO 240
0370 PRINT "INDUCTANCE IN HENRYS";
0380 INPUT L
0390 IF F = 0 THEN F = 1 / (2 * 3.14159 * SQR(L * C))
0400 IF L = 0 THEN L = 1 / (4 * 3.14159^2 * F^2 * C)
0410 IF C = 0 THEN C = 1 / (4 * 3.14159^2 * F^2 * L)
0420 C = C * 1000000
0430 PRINT "CAPACITANCE IN MICROFARADS IS "; C
0440 X = 0
0450 GOTO 220
```

(b)

```
RUN
INDUCTANCE-CAPACITANCE PROGRAM

WHICH PROBLEM DO YOU WANT TO DO?
    1. TUNED CIRCUIT
    2. INDUCTIVE REACTANCE
    3. CAPACITIVE REACTANCE
? 1
ENTER THE FOLLOWING; ENTER 0 IF NOT KNOWN.
FREQUENCY IN HERTZ? 2025
CAPACITANCE IN MICROFARADS? 0
INDUCTANCE IN HENRYS? .088
CAPACITANCE IN MICROFARADS IS 0.0701952681
INDUCTANCE IN HENRYS IS 0.088
REACTANCE IN OHMS IS 1119.66267
FREQUENCY IN HERTZ IS 2025

WHICH PROBLEM DO YOU WANT TO DO?
    1. TUNED CIRCUIT
    2. INDUCTIVE REACTANCE
    3. CAPACITIVE REACTANCE
? 2
ENTER THE FOLLOWING; ENTER 0 IF NOT KNOWN.
FREQUENCY IN HERTZ? 2295
REACTANCE IN OHMS? 0
INDUCTANCE IN HENRYS? .088
INDUCTANCE IN HENRYS IS 0.088
REACTANCE IN OHMS IS 1268.95103
FREQUENCY IN HERTZ IS 2295

WHICH PROBLEM DO YOU WANT TO DO?
    1. TUNED CIRCUIT
    2. INDUCTIVE REACTANCE
    3. CAPACITIVE REACTANCE
?
READY
*
```

Program 9. Reactance and tuned circuits. (a) Program. (b) Sample run.

(a)

```
0010 PRINT "RESISTORS, INDUCTORS, OR CAPACITORS, IN"
0020 PRINT "SERIES OR PARALLEL"

0030 REM COPYRIGHT 1979 BY P. STARK

0040 PRINT "USE OPTION 1 FOR"
0050 PRINT "     RESISTORS OR INDUCTORS IN SERIES, OR"
0060 PRINT "     CAPACITORS IN PARALLEL"
0070 PRINT "USE OPTION 2 FOR"
0080 PRINT "     RESISTORS OR INDUCTORS IN PARALLEL, OR"
0090 PRINT "     CAPACITORS IN SERIES"
0100 PRINT " *** IMPORTANT ***"
0110 PRINT "MAKE SURE TO USE THE SAME UNITS FOR EACH ELEMENT"
0120 PRINT "     FOR INSTANCE, ALL MUST BE IN OHMS, K, ETC."
0130 INPUT "WHICH OPTION DO YOU WANT", O
0140 INPUT "HOW MANY ELEMENTS ARE THERE", N
0150 S=0

0160 REM ENTER ALL THE ELEMENTS

0170 FOR I=1 TO N
0180      PRINT "ELEMENT NO. "; I
0190      INPUT V
0200      IF O=1 THEN S=S+V
0210      IF O=2 THEN S=S+1/V
0220 NEXT I

0230 REM CALCULATE THE TOTAL

0240 IF O=2 THEN S=1/S
0250 PRINT "TOTAL OF ALL "; N; "ELEMENTS IS "; S
```

(b)

```
RUN
RESISTORS, INDUCTORS, OR CAPACITORS, IN
SERIES OR PARALLEL
USE OPTION 1 FOR
     RESISTORS OR INDUCTORS IN SERIES, OR
     CAPACITORS IN PARALLEL
USE OPTION 2 FOR
     RESISTORS OR INDUCTORS IN PARALLEL, OR
     CAPACITORS IN SERIES
 *** IMPORTANT ***
MAKE SURE TO USE THE SAME UNITS FOR EACH ELEMENT
     FOR INSTANCE, ALL MUST BE IN OHMS, K, ETC.
WHICH OPTION DO YOU WANT? 1
HOW MANY ELEMENTS ARE THERE? 2
ELEMENT NO. 1
? 10000
ELEMENT NO. 2
? 27000
TOTAL OF ALL 2 ELEMENTS IS 37000

READY
*
```

(c)

```
RUN
RESISTORS, INDUCTORS, OR CAPACITORS, IN
SERIES OR PARALLEL
USE OPTION 1 FOR
     RESISTORS OR INDUCTORS IN SERIES, OR
     CAPACITORS IN PARALLEL
USE OPTION 2 FOR
     RESISTORS OR INDUCTORS IN PARALLEL, OR
     CAPACITORS IN SERIES
 *** IMPORTANT ***
MAKE SURE TO USE THE SAME UNITS FOR EACH ELEMENT
     FOR INSTANCE, ALL MUST BE IN OHMS, K, ETC.
WHICH OPTION DO YOU WANT? 2
HOW MANY ELEMENTS ARE THERE? 3
ELEMENT NO. 1
? 100
ELEMENT NO. 2
? .01
ELEMENT NO. 3
? .05
TOTAL OF ALL 3 ELEMENTS IS 8.00833263894E-03

READY
```

Program 10. Series-parallel calculator. (a) Program. (b) Sample run for series resistors. (c) Sample run for parallel resistors.

(a)

```
0010 PRINT "POWER SUPPLY AND FILTERING CALCULATIONS"

0020 REM COPYRIGHT 1979 BY P. STARK

0030 INPUT "ENTER FULL SECONDARY RMS VOLTAGE", T
0040 PRINT "WHAT KIND OF RECTIFIER?"
0050 PRINT "    H = HALF-WAVE"
0060 PRINT "    F = FULL-WAVE"
0070 PRINT "    B = BRIDGE"
0080 INPUT A$
0090 IF A$="H" THEN P=T*1.414-0.7
0100 IF A$="F" THEN P=T*.707-1.4
0110 IF A$="B" THEN P=T*1.414-1.4
0120 IF P=0 GO TO 30
0130 PRINT "WHAT KIND OF FILTER?"
0140 PRINT "    C = CAPACITOR ONLY"
0150 PRINT "    LC = CHOKE INPUT ONE STAGE"
0160 INPUT B$
0170 IF B$="LC" THEN INPUT "ENTER CHOKE INDUCTANCE IN HENRYS",L
0180 INPUT "ENTER FILTER CAPACITANCE IN MICROFARADS", C
0190 C=C/1000000
0200 INPUT "ENTER LOAD RESISTANCE IN OHMS", R
0210 IF B$="C" THEN IF A$="H" THEN H=P/(60*R*C)
0220 IF B$="C" THEN IF A$<>"H" THEN H=P/(120*R*C)
0230 IF B$="LC" THEN IF A$="H" THEN H=P/(3*3.14159^3*F^2*L*C)
0240 IF B$="LC" THEN IF A$<>"H" THEN H=P/(6*3.14159^3*F^2*L*C)
0250 IF H=0 GO TO 130
0260 IF B$="C" THEN V=P-H/2
0270 IF B$="LC" THEN V=2*P/3.14159
0280 PRINT "DC OUTPUT VOLTAGE IS "; V; "VOLTS"
0290 PRINT "PEAK-TO-PEAK RIPPLE IS "; H; "VOLTS"
```

(b)

```
RUN
POWER SUPPLY AND FILTERING CALCULATIONS
ENTER FULL SECONDARY RMS VOLTAGE? 12.6
WHAT KIND OF RECTIFIER?
   H = HALF-WAVE
   F = FULL-WAVE
   B = BRIDGE
? F
WHAT KIND OF FILTER?
   C = CAPACITOR ONLY
   LC = CHOKE INPUT ONE STAGE
? C
ENTER FILTER CAPACITANCE IN MICROFARADS? 1000
ENTER LOAD RESISTANCE IN OHMS? 25
DC OUTPUT VOLTAGE IS 6.25683334 VOLTS
PEAK-TO-PEAK RIPPLE IS 2.50273333 VOLTS

READY
*
```

(c)

```
RUN
POWER SUPPLY AND FILTERING CALCULATIONS
ENTER FULL SECONDARY RMS VOLTAGE? 8
WHAT KIND OF RECTIFIER?
   H = HALF-WAVE
   F = FULL-WAVE
   B = BRIDGE
? B
WHAT KIND OF FILTER?
   C = CAPACITOR ONLY
   LC = CHOKE INPUT ONE STAGE
? C
ENTER FILTER CAPACITANCE IN MICROFARADS? 5000
ENTER LOAD RESISTANCE IN OHMS? 10
DC OUTPUT VOLTAGE IS 9.086 VOLTS
PEAK-TO-PEAK RIPPLE IS 1.652 VOLTS

READY
*
```

Program 11. Power-supply design. (a) Program. (b) Sample run for full-wave rectifier/capacitor filter. (c) Sample run for bridge rectifier/capacitor filter.

or CHECK ENCLOSED for payment type, and UPS or BEST WAY or some other means for the other.

Finally, the program asks for a supplier address of up to five lines, as well as a purchase-order number. Enter as many address lines as needed, and enter a blank for the last. Then make up a purchase-order number.

The purchase order or PO number is important, because suppliers always file your order by your PO number. Their invoicing program also references that number. Besides, it makes the whole thing look official. So make up a PO number and include it.

The very last request is for the number of the output port which has the printer. This is then followed by the PO at the bottom. You must admit that it looks good.

The program itself was written in Percom 6800 Super BASIC and contains only standard BASIC statements. The only feature which may need change for your BASIC is its way of specifying output ports. In line 920, we input a port number Z. Lines 940 and on then use that in a PRINT statement as PRINT #10. If Z equals 1, then printing is done to port number 1 and so on.

Lines 1020-1040 should be modified to contain your shipping address. Please don't send out your orders with mine!

Printing Wire Lists

A wire list is simply a listing of all wires in a system. It is used in industry during system manufacture to allow little old ladies to wire up a system without knowing what it's all about.

See the last few lines of Program 16 for an example of a simple wire list. In the list, each signal gets a name like 5 V, GROUND, or IN-

(a)

```
0100 PRINT "PURCHASE ORDER PROGRAM"

0110 REM COPYRIGHT 1980 BY PETER A. STARK

0120 C=100                                  :REM ALLOW UP TO 100 ITEMS PER ORDER
0130 DIM Q(C),N$(C),D$(C),P(C)
0140 DIM T(C),S$(5)
0150 LINE= 0
0160 PRINT "ENTER QUANTITY, STOCK/PART NUMBER, DESCRIPTION,";
0170 PRINT " AND PRICE EACH."
0180 PRINT "IF GROUP PRICE EXISTS, ENTER THE TOTAL AS MINUS."
0190 PRINT "ENTER 0 QUANTITY TO DELETE AN ITEM"
0200 PRINT "ENTER QUANTITY BETWEEN -1 AND -9 TO BACKSPACE"
0210 PRINT "WHEN DONE, ENTER -10,0,0,0"
0220 L=0
0230 K=1
0240 PRINT K;
0250 INPUT Q(K),N$(K),D$(K),P(K)
0260 IF K>L THEN L=K
0270 T(K)=Q(K)*P(K)                         :REM TOTAL=QUANTITY*PRICE EACH
0280 IF P(K)<0 THEN T(K)=-P(K)              :REM EXCEPT FOR GROUP PRICE
0290 IF Q(K)=0 THEN T(K)=0                  :REM UNLESS QUANTITY IS 0
0300 IF D$(K)="." THEN D$(K)=D$(K-1)        :REM REPEAT PREV DESCR
0310 IF Q(K)=-10 GO TO 400                  :REM QUIT AT END
0320 IF Q(K)>=0 GO TO 350
0330 K=K+Q(K)                               :REM BACKSPACE Q ITEMS IF Q IS NEGATIVE
0340 GOTO 240
0350 K=K+1
0360 IF K<=C GO TO 240                      :REM CHECK FOR OVERFLOW
0370 PRINT "ENOUGH ITEMS; NO MORE."

0380 REM ALL ITEMS HAVE BEEN ENTERED; NOW TOTAL BILL
0390 REM AND CONTINUE

0400 M=0
0410 FOR K=1 TO L-1
0420      M=M+T(K)
0430 NEXT K
0440 PRINT "TOTAL OF ORDER (NOT INCLUDING SHIPPING ETC) $";
0450 PRINT M
0460 PRINT "WANT LISTING OF YOUR ORDER";
0470 INPUT A$
0480 IF A$="NO" GO TO 570
0490 FOR K=1 TO L-1
0500      IF Q(K)=0 THEN GO TO 530          :REM SKIP DELETED ITEMS
0510      PRINT K;TAB(4);Q(K);TAB(10);N$(K);TAB(20);P(K);
0520      PRINT TAB(28);T(K);TAB(36);D$(K)
0530      IF (K-INT(K/10)*10)<>10 GO TO 560
0540      PRINT "HIT C/R TO CONTINUE";
0550      INPUT A$                          :REM STOP AND WAIT EVERY 10 LINES
0560 NEXT K
0570 PRINT "ANY CHANGES";
0580 INPUT A$
0590 IF A$="NO" GO TO 710
0600 IF A$<>"YES" GO TO 460
0610 PRINT "WHICH ITEM";                    :REM ALLOW CORRECTIONS
0620 INPUT K
0630 PRINT K;
0640 INPUT Q(K),N$(K),D$(K),P(K)            :REM INPUT CORRECTED ITEM
0650 T(K)=Q(K)*P(K)                         :REM CALCULATE NEW TOTAL PRICE
0660 IF P(K)<0 THEN T(K)=-P(K)
0670 IF Q(K)=0 THEN T(K)=0
0680 IF K=>L THEN L=K+1                     :REM UPDATE COUNTER IF ADDED ITEM
0690 GOTO 400

0700 REM ALL ITEMS ENTERED AND CORRECTED; GET MORE INFO

0710 PRINT "SALES TAX -- YES OR NO";
0720 INPUT A$
0730 S=0
0740 IF A$<>"YES" GO TO 770
0750 S=M*.05                                :REM .05 IS FOR 5% - CHANGE IF NEEDED
0760 S=INT(S*100+.5)/100                    :REM ROUND TO NEAREST PENNY
0770 PRINT "SALES TAX IS $";S
0780 INPUT "ENTER DATE", Y$
0790 INPUT "ENTER SHIPPING COST", U
0800 INPUT "ENTER TYPE OF PAYMENT", P$
0810 INPUT "ENTER TYPE OF TRANSPORTATION", T$
0820 PRINT "ENTER ADDRESS OF SUPPLIER (UP TO 5 LINES)"
0830 FOR K=1 TO 5
0840      PRINT "LINE ";K;
0850      INPUT S$(K)
0860      IF S$(K)="" THEN GOTO 890         :REM CHECK FOR LAST LINE
0870      S5=K                              :REM COUNT NUMBER OF LINES
0880 NEXT K
0890 INPUT "ENTER PURCHASE ORDER NUMBER", P5
0900 PRINT "ENTER PORT NUMBER FOR OUTPUT AND TURN ON PRINTER"
0910 PRINT "IF NECESSARY."
0920 INPUT Z

0930 REM FINALLY READY TO PRINT ON PORT Z.

0940 PRINT #Z
0950 PRINT #Z,TAB(23);"PURCHASE ORDER              No. ";P5
0960 PRINT #Z : PRINT #Z
0970 PRINT #Z,"TO:";TAB(12);S$(1);TAB(45);Y$
0980 FOR K=2 TO S5
0990      PRINT #Z,TAB(12);S$(K)
1000 NEXT K
1010 PRINT #Z
1020 PRINT #Z,"SHIP TO:";TAB(12);"PETER A. STARK"
1030 PRINT #Z,TAB(12);"P. O. BOX 209"
1040 PRINT #Z,TAB(12);"MT. KISCO, N. Y. 10549"
1050 PRINT #Z
1060 PRINT #Z,"PAYMENT:";TAB(12);P$;TAB(45);"SHIP VIA: ";T$
1070 PRINT #Z : PRINT #Z
1080 PRINT #Z,"QUANT.  PART NO.    DESCRIPTION";
1090 PRINT #Z,TAB(50);"EACH     EXT."
1100 PRINT #Z,"-----  ---------  ---------------------";
1110 PRINT #Z,TAB(50);"----   -------"
1120 PRINT #Z

1130 REM NOW PRINT OUT EACH ITEM ORDERED

1140 FOR K=1 TO L-1
1150      IF Q(K)=0 THEN GO TO 1280
1160      L$=STR$(Q(K))                     :REM CONVERT QUANTITY TO A STRING
1170      L1=LEN(L$)                        :REM USE INSTEAD OF PRINT USING
1180      PRINT #Z,TAB(5-L1);Q(K);TAB(8);N$(K);TAB(20);D$(K);
1190      DIGITS= 2                         :REM PRINT WITH 2 DIGITS AFTER DECIMAL POINT
1200      IF P(K)<0 THEN GO TO 1240
1210      L$=STR$(P(K))                     :REM CONVERT PRICE TO STRING
1220      L1=LEN(L$)                        :REM USE INSTEAD OF PRINT USING
1230      PRINT #Z,TAB(54-L1);P(K);         :REM ALIGN PRICE AND PRINT
1240      L$=STR$(T(K))
1250      L1=LEN(L$)                        :REM REPEAT FOR EXTENSION
1260      PRINT #Z,TAB(63-L1);T(K)
1270      DIGITS= 0                         :REM CANCEL 2-DIGIT PRINT
1280 NEXT K

1290 REM ALL ITEMS NOW PRINTED; PRINT TOTALS ETC.

1300 PRINT #Z
1310 DIGITS= 2
1320 L$=STR$(M)
1330 L1=LEN(L$)
1340 PRINT #Z,TAB(40);"SUBTOTAL:";TAB(63-L1);M
1350 L$=STR$(S)
1360 L1=LEN(L$)
1370 PRINT #Z,TAB(40);"SALES TAX:";TAB(63-L1);S
1380 L$=STR$(U)
1390 L1=LEN(L$)
1400 PRINT #Z,TAB(40);"SHIPPING/INS.:";TAB(63-L1);U
1410 PRINT #Z
1420 L$=STR$(M+S+U)
1430 L1=LEN(L$)
1440 PRINT #Z,TAB(40);"TOTAL:";TAB(63-L1);M+S+U
1450 PRINT #Z
1460 DIGITS= 0
1470 PRINT #Z,TAB(10);"******PLEASE EXPEDITE THIS ORDER******"
1480 GOTO 900
```

(b)

```
PURCHASE ORDER PROGRAM
ENTER QUANTITY, STOCK/PART NUMBER, DESCRIPTION, AND PRICE EACH.
IF GROUP PRICE EXISTS, ENTER THE TOTAL AS MINUS.
ENTER 0 QUANTITY TO DELETE AN ITEM
ENTER QUANTITY BETWEEN -1 AND -9 TO BACKSPACE
WHEN DONE, ENTER -10,0,0,$
1 ? 1,2N2222,TRANSISTOR NPN,.25
2 ? 10,MB525-01,5" DISKETTE,-27
3 ? 3,74LS00,SCHOTTKY NAND GATE,.20
4 ? -10,0,0,0
TOTAL OF ORDER (NOT INCLUDING SHIPPING ETC) $27.85
WANT LISTING OF YOUR ORDER? YES
1  1    2N2222     0.25    0.25     TRANSISTOR NPN
2  10   MB525-01   -27     27       5" DISKETTE
3  3    74LS00     0.2     0.6      SCHOTTKY NAND GATE
ANY CHANGES? NO
SALES TAX -- YES OR NO? YES
SALES TAX IS $1.39
ENTER DATE? 1-18-80
ENTER SHIPPING COST? 1
ENTER TYPE OF PAYMENT? C.O.D.
ENTER TYPE OF TRANSPORTATION? UPS OR BEST WAY
ENTER ADDRESS OF SUPPLIER (UP TO 5 LINES)
LINE 1 ? MONUMENTAL COMPUTER WORKS
LINE 2 ? P. O. BOX 1200
LINE 3 ? WASHINGTON D.C. 20020
LINE 4 ?
ENTER PURCHASE ORDER NUMBER? 11880
ENTER PORT NUMBER FOR OUTPUT AND TURN ON PRINTER
IF NECESSARY.
? 1

                       PURCHASE ORDER              No. 11880

TO:         MONUMENTAL COMPUTER WORKS        1-18-80
            P. O. BOX 1200
            WASHINGTON D.C. 20020

SHIP TO:    PETER A. STARK
            P. O. BOX 209
            MT. KISCO, N. Y. 10549

PAYMENT:    C.O.D.                           SHIP VIA: UPS OR BEST WAY


QUANT.  PART NO.    DESCRIPTION                  EACH     EXT.
-----  ---------  ---------------------          ----   -------

   1   2N2222      TRANSISTOR NPN                0.25     0.25
  10   MB525-01    5" DISKETTE                           27.00
   3   74LS00      SCHOTTKY NAND GATE            0.20     0.60

                                       SUBTOTAL:         27.85
                                       SALES TAX:         1.39
                                       SHIPPING/INS.:     1.00

                                       TOTAL:            30.24

          ******PLEASE EXPEDITE THIS ORDER******
```

Program 12. Purchase-order program. (a) Program. (b) Sample run.

PUT. Next to that name is a listing of all points to which that signal goes. For example, the sample wire list shows that 5 V goes to IC1, pin 5, and to R1, terminal 1.

A wire list turns out to be very useful in many ham radio projects. I have used a wire list when wire-wrapping a computer project; the list gave me a printed listing of every connection to be made, and I simply checked off each as it was made. The result was a project with several hundred wires and not a single error.

I have also used it in checking out a printed circuit board layout. Once the board was laid out, I went back over it and checked off each connection on the list. Again, it allowed me to spot a few layout errors which I had missed on prior checks.

My wire-list programs are written for a disk system. This happens to be the most convenient, since you can

```
0100 REM WENTER - WIRE LIST PROGRAM 1
0110 REM ENTER CONNECTIONS REQUIRED AND STORE ON DISK
0120 REM COPYRIGHT (C) 1979 BY PETER A. STARK
0130 REM ALL RIGHTS RESERVED

0140 INPUT "ENTER FILE NAME", F$
0150 INPUT "ENTER DRIVE NUMBER", D
0160 IF D=1 GO TO 190
0170 IF D=2 THEN F$="2/"+F$ : GO TO 190
0180 GOTO 150                                   :REM IF DRIVE NUMBER IN ERROR
0190 PRINT "NOW ENTER EACH CONNECTION IN THIS ORDER:"
0200 PRINT "   SIGNAL NAME, IC OR REF NO., PIN NO."
0210 PRINT "ENTER 'ZZZ' TO END."
0220 OPEN #10, F$
0230 S$="" : R$="" : P$=""                      :REM INIT NAME, REF, PIN BLANK
0240 FOR I=1 TO 500
0250     PRINT "WIRE NO. "; I;
0260     INPUT A$,B$,C$
0270     IF A$="ZZZ" GO TO 360                  :REM AT END OF DATA
0280     IF A$<>"" THEN S$=A$
0290     IF B$<>"" THEN R$=B$                   :REM CHANGE, IF NEW DATA
0300     IF C$<>"" THEN P$=C$
0310     N=I                                    :REM KEEP COUNT
0320     PRINT #10, S$;R$;P$                    :REM STORE ON DISK FILE
0330 NEXT I

0340 REM IF FILE FULL, PRINT ERROR MESSAGE

0350 PRINT "ERROR - FILE FULL AT ";
0360 PRINT N; "ITEMS."
0370 CLOSE #10
0380 END
```

Program 13. WENTER program.

easily set up a disk file with all the connections, edit it to make changes and corrections as needed, and produce a latest printout as needed. If your system does not have a disk, then it can be modified for cassette files; that part is up to you.

There are actually three wire-list programs, all written in BASIC. WENTER (Program 13) is used to enter each connection from the keyboard and store in the disk file. WSORT (Program 14) then reads that file and sorts it by signal name to get all like connections grouped together. (If you have a text editor, you can edit the sorted or unsorted file with that.) Finally, WPRINT (Program 15) produces a printed listing of the sorted list.

Except for the disk commands (which are for a Percom LFD-400 disk system using Percom Super BASIC on an SWTP 6800 computer), the rest of the programs are just standard BASIC. To aid in converting to a different disk system or to cassette, let's look at the special disk statements.

In Program 13, a filename F$ and drive number D are entered in lines 140 and 150. If drive 2 is specified, then a 2/ is added to the beginning of the file name and the resulting name is used to open a disk file in line 220. That file is numbered 10, and the PRINT #10 in line 320 outputs to that file. A maximum of 500 connections is allowed by the FOR statement in line 240; the reason is that the sort routine in WSORT is limited to that number.

The WSORT program of Program 14 then sorts that file. It reads the file into array N$ which is dimensioned as (250,2), which leaves room for 500 connections. The reason it is broken up into a two-dimensional array is that this BASIC has a limit of 255 on subscript size; this is a trick to get around that limitation. In any case, depending on the memory size of your computer, you may have to cut the array size down even more; the 500-connection limitation is for a fairly large computer. (If you have a different sort routine, you can use that to sort your file and either get around the 500-connection limitation or get even faster sorting.)

Line 250 reads the signal name, reference or IC number, and pin number into A$, B$, and C$. The 380 after the reverse slash means the program will go to line 380 (to close the open disk file) when it reaches the end of data.

Lines 270 through 300 shorten A$, B$, and C$ and then combine them into

```
0100 REM WSORT - WIRE LIST PROGRAM 2
0110 REM SORT WIRE LIST DISK FILE BY SIGNAL NAME
0120 REM COPYRIGHT (C) 1979 BY PETER A. STARK
0130 REM ALL RIGHTS RESERVED

0140 INPUT "ENTER FILE NAME", F$
0150 INPUT "ENTED DRIVE NUMBER", D
0160 IF D=1 GO TO 190
0170 IF D=2 THEN F$="2/"+F$ : GO TO 190
0180 GOTO 150                                   :REM IF DRIVE NUMBER IN ERROR
0190 DIM N$(250,2)                              : REM DIMENSION ARRAY FOR DATA SORT

0200 REM READ DATA INTO N$ ARRAY

0210 R=1 : C=1                                  :REM NEXT ROW AND COLUMN
0220 OPEN #10, F$                               :REM OPEN DATA FILE
0230 PRINT "READING SOURCE FILE"
0240 FOR I=1 TO 500                             : REM READ UP TO 500 CONNECTIONS
0250     READ #10, A$,B$,C$  \ 380              :REM READ LINE
0260     PRINT A$,B$,C$
0270     A$=LEFT$(A$,15)                        :REM COMPRESS TO FIT INTO ONE STRING
0280     B$=LEFT$(B$,15)
0290     C$=LEFT$(C$,5)
0300     N$(R,C)=A$+","+B$+","+C$               :REM SAVE ALL IN ONE
0310     R=R+1                                  :REM INCREMENT ROW POINTER
0320     IF R>250 THEN R=1 : C=C+1              :REM CHECK FOR OVERFLOW
0330     N=I                                    :REM TOTAL NUMBER OF CONNECTIONS
0340 NEXT I
0350 PRINT "ERROR - TOO MANY CONNECTIONS." : END
0360 PRINT "ERROR - END OF FILE." : END

0370 REM FILE READ, NOW SORT IT

0380 CLOSE #10
0390 PRINT "SORTING ... PLEASE WAIT"
0400 M=N
0410 M=INT(M/2)
0420 IF M=0 GO TO 610
0430 K=N-M
0440 J=1
0450 I=J
0460 L1=I+M
0470 R1=I : C1=1                                :REM INIT POINTERS FOR I
0480 IF R1>250 THEN R1=R1-250 : C1=C1+1 : GOTO 480
0490 R2=L1 : C2=1                               :REM IRIT POINTERS FOR L1
0500 IF R2>250 THEN R2=R2-250 : C2=C2+1 : GOTO 500
0510 IF N$(R1,C1)<N$(R2,C2) GO TO 570
0520 A$=N$(R1,C1)
0530 N$(R1,C1)=N$(R2,C2)                        :REM SWITCH IF OUT OF ORDER
0540 N$(R2,C2)=A$
0550 I=I-M
0560 IF I>=1 GO TO 460
0570 J=J+1
0580 IF J>K GO TO 410
0590 GOTO 450

0600 REM N$ IS NOW SORTED, SO WRITE BACK TO DISK

0610 R=1 : C=1                                  : REM SET UP ROW AND COLUMN AGAIN
0620 F$=F$+"S"                                  : RER CHANGE FILE NAME TO NEW NAME
0630 OPEN #10, F$                               :REM OPEN DISK FILE NAME
0640 FOR I=1 TO N                               :REM WRITE BACK N RECORDS
0650     PRINT #10, N$(R,C)                     :REM NEXT ITEM IN SORTED TABLE
0660     PRINT N$(R,C)
0670     R=R+1                                  :REM INCREMENT ROW POINTER
0680     IF R>250 THEN R=1 : C=C+1              :REM CHECK FOR OVERFLOW
0690 NEXT I
0700 CLOSE #10
0710 PRINT "FILE WRITTEN BACK"
```

Program 14. WSORT program.

```
0100 REM WPRINT - WIRE LIST PROGRAM 3
0110 REM PRINT OUT WIRE LIST ARRANGED BY SIGNAL NAME
0120 REM COPYRIGHT (C) 1979 BY PETER A. STARK
0130 REM ALL RIGHTS RESERVED

0140 INPUT "ENTER FILE NAME", F$
0150 INPUT "ENTER DRIVE NUMBER", D
0160 IF D=1 GO TO 190
0170 IF D=2 THEN F$="2/"+F$ : GO TO 190
0180 GOTO 150                                   :REM IF DRIVE NUMBER IN ERROR
0190 INPUT "PRINT ON WHICH PORT", P
0200 LINE= 0
0210 IF P<>INT(P) GO TO 190
0220 IF P<0 GO TO 190
0230 IF P>1 GO TO 190
0240 OPEN #10, F$                               :REM OPEN DISK FILE
0250 N$=""                                      :REM PREVIOUS SIGNAL NAME INIT BLANK
0260 FOR I=1 TO 500
0270     READ #10, A$,B$,C$  \ 380              :REM READ NEXT SIGNAL
0280     IF A$=N$ GO TO 330
0290     PRINT #P                               :REM SKIP TO NEW LINE IF NEW
0300     PRINT #P, A$; TAB(15);                 :REM PRINT NEW NAME
0310     N$=A$                                  :REM MEMORIZE CURRENT SIGNAL NAME
0320     P7=15                                  :REM CURRENT FRIRTHEAD POSITION
0330     IF P7>70 THEN PRINT #P : PRINT #P, TAB(15);
0340     PRINT #P, B$;"-";C$;"    ";
0350     P7=POS
0360 NEXT I
0370 PRINT "ERROA - END OF FILE." : END
0380 CLOSE #10
0390 END
```

Program 15. WPRINT program.

one string, separated by commas. Having the entire connection data in one string makes the sorting much easier and faster than if the three pieces of data were handled separately.

This combined string will eventually get written back out to an output file; when it is read back later by WPRINT, the commas will break up the string back into three separate strings.

```
LOAD "WENTER"

READY
#RUN
ENTER FILE NAME? SAMPL
ENTER DRIVE NUMBER? 1
NOW ENTER EACH CONNECTION IN THIS ORDER:
   SIGNAL NAME, IC OR REF NO., PIN NO.
ENTER  ZZZ  TO END.
WIRE NO. 1 ? 5V,R1,1
WIRE NO. 2 ? INPUT,,2
WIRE NO. 3 ? ,SWITCH,1
WIRE NO. 4 ? GROUND,,2
WIRE NO. 5 ? INPUT,IC1,14
WIRE NO. 6 ? 5V,,5
WIRE NO. 7 ? GROUND,,10
WIRE NO. 8 ? IC1-A,,1
WIRE NO. 9 ? ,,12
WIRE NO. 10 ? ,IC2,7
WIRE NO. 11 ? IC1-B,IC1,9
WIRE NO. 12 ? ,IC2,1
WIRE NO. 13 ? IC1-C,IC1,8
WIRE NO. 14 ? ,IC2,2
WIRE NO. 15 ? IC1-D,IC1,11
WIRE NO. 16 ? ,IC2,6
WIRE NO. 17 ? ,IC3,14
WIRE NO. 18 ? ZZZ
17 ITEMS.

READY
#LOAD "WSORT"

READY
#RUN
ENTER FILE NAME? SAMPL
ENTER DRIVE NUMBER? 1
READING SOURCE FILE
5V              R1              1
INPUT           R1              2
INPUT           SWITCH          1
GROUND          SWITCH          2
INPUT           IC1             14
5V              IC1             5
GROUND          IC1             10
IC1-A           IC1             1
IC1-A           IC1             12
IC1-A           IC2             7
IC1-B           IC1             9
IC1-B           IC2             1
IC1-C           IC1             8
IC1-C           IC2             2
IC1-D           IC1             11
IC1-D           IC2             6
IC1-D           IC3             14
SORTING ... PLEASE WAIT
5V,IC1,5
5V,R1,1
GROUND,IC1,10
GROUND,SWITCH,2
IC1-A,IC1,1
IC1-A,IC1,12
IC1-A,IC2,7
IC1-B,IC1,9
IC1-B,IC2,1
IC1-C,IC1,8
IC1-C,IC2,2
IC1-D,IC1,11
IC1-D,IC2,6
IC1-D,IC3,14
INPUT,IC1,14
INPUT,R1,2
INPUT,SWITCH,1
FILE WRITTEN BACK

READY
#LOAD "WPRINT"

READY
#RUN
ENTER FILE NAME? SAMPLS
ENTER DRIVE NUMBER? 1
PRINT ON WHICH PORT? 1

5V            IC1-5     R1-1
GROUND        IC1-10     SWITCH-2
IC1-A         IC1-1     IC1-12     IC2-7
IC1-B         IC1-9     IC2-1
IC1-C         IC1-8     IC2-2
IC1-D         IC1-11     IC2-6     IC3-14
INPUT         IC1-14     R1-2     SWITCH-1
READY
#
```

Program 16. Sample run of wire-list preparation programs.

The middle part of Program 14, lines 370 through 600, is a Shell-Metzner sort, and the last part of the program writes the file back on the disk. To avoid erasing the previous file, line 620 adds an "S" to the end of the previous file name to produce a new file name and therefore a new file. (For instance, the sample printout of Program 16 sorts a file called SAMPL into a new file called SAMPLS.)

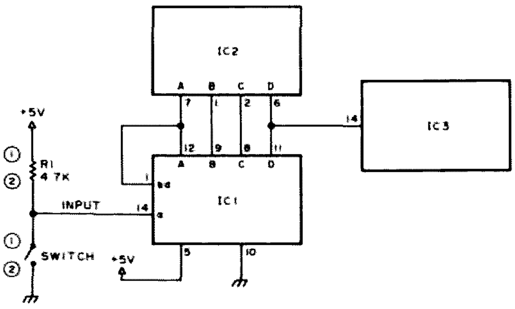

Fig. 8. Sample circuit for preparing a wire list.

The WPRINT program (Program 15) is used last to read the sorted disk file and print the actual wire list. Whenever a connection has the same signal name as the previous connection, it gets listed on the same line; otherwise, it goes on a new line. In this way, all connections with the same signal name get grouped together on a line. The only new nonstandard statement is: 350 P7=POS. POS is a BASIC function which returns the present position of the printhead on the paper. It is used to keep the printout from going into the right margin. Whenever P7 is greater than 70, line 330 forces a carriage return/line feed and goes to a new line.

The best way to understand the working of these three programs is to try an example. Fig. 8 shows a very simple circuit for which we want a wire list; Program 16 is the sample run which shows how the three programs are used to generate it.

Before starting, we have to give each component of the diagram a name. The ICs are simply labelled IC1, IC2, and IC3. The resistor is labelled R1, and the switch could be called SW1 or just plain SWITCH. (In industrial lingo, terms like C1, R1, SW1, and IC3 are called "reference designations.") Any string name could be used, but the shorter the better.

Next, every terminal of every device has to be identified. ICs have pin numbers; switches, resistors, and other components get terminal numbers. These are shown on Fig. 8 as circled—the top terminal of R1 is terminal 1, the bottom is terminal 2. A good convention is to make the top or left terminals number 1, the bottom or right number 2. On transistors, terminals can be called C, B, and E; on diodes, they can be CATH and ANODE, or C and A. Any number or letter code can be used, up to five characters. In digital circuits, this is easy, since most components are ICs and are already numbered.

Third, every signal has to be given a name. This is also very easy to do in digital circuits, a bit tougher to do in others. Names like GROUND and 5 V are easy; the input from the switch is called INPUT. For want of a better name, we call IC1's outputs IC1-A through IC1-D.

All of this looks like a lot of extra work; actually, it is a help because it makes you look critically at your circuit and become more familiar with it. With all this out of the way, we are finally ready to enter all our data into the computer as in Program 16.

First, we run WENTER to enter all data. The program asks for the file name which, in our example, was SAMPL, and the drive number. Next it prompts for the signal name, IC or reference number, and pin number for each connection. For example, for the very first wire we enter 5 V, R1, 1, meaning that terminal 1 of R1 connects to 5 volts. We simply go through the circuit, one component at a time, listing each connection. The program is set up so that any item which is not entered (that is, which is left blank) is simply copied from the previous line. Thus, wire 2 is entered as INPUT,,2, which means that the middle entry should be the same as the R1 on the previous line. This can save a lot of typing.

When we are finished, we are asked to type in ZZZ, which is the code for "end of data." WENTER then finishes the file and stops.

Next, we load WSORT and run it. After giving the program the name of our file and the disk drive number, the program reads the file and prints it out so we can check it. The sort takes a few seconds, followed by printout of the sorted data in the exact form it is in on the disk.

If you have a text editor, by the way, the resulting file could be edited and changed at this point. If, for example, you discover some errors in the listing, you can easily go back and fix them.

The last step is to run WPRINT to print out the actual wire list. As you can see at the bottom of Program 16, all connections are grouped by signal name. If you are wire-wrapping a board, it is a simple matter to just start at the top of the list and work your way down, one connection at a time, until you reach the bottom.

I can't recommend this system too highly. Although there is some preparation to be done before you can prepare the wire list, the savings in troubleshooting time that this allows is much greater. Try it . . . you'll like it. ■

CB to 10

—part XXIX: put that Hy-Gain CB board to use

Penn Clower W1BC
459 Lowell Street
Andover MA 01810

If you've read a ham magazine at all recently, the chances are that you've seen an article about converting a CB set to ten meters. Most of these articles tell you which crystals to replace to move the channels up to some portion of the ham band.

This article is different because it will tell you how to put one CB set on ten meters without buying a crystal. In fact, this rig can be purchased and put on ten meters in a single weekend for a total cash outlay of less than $15—and that isn't just one 40-channel strip of the band, but at least two overlapping segments covering the bottom MHz of the phone band. Also described is what may be the world's simplest bfo addition (two additional components) for CW and SSB reception plus an easy way to put the transmitter on CW down in that end of the band.

The reason the rig is so inexpensive is that you buy the main circuit board, with maybe a few controls, as surplus—the remnants of the Hy-Gain CB operation. These boards are appearing in quantity on the market for prices around $10, but they require initial checkout plus the addition of controls, a microphone, a power supply, and a speaker before they're complete

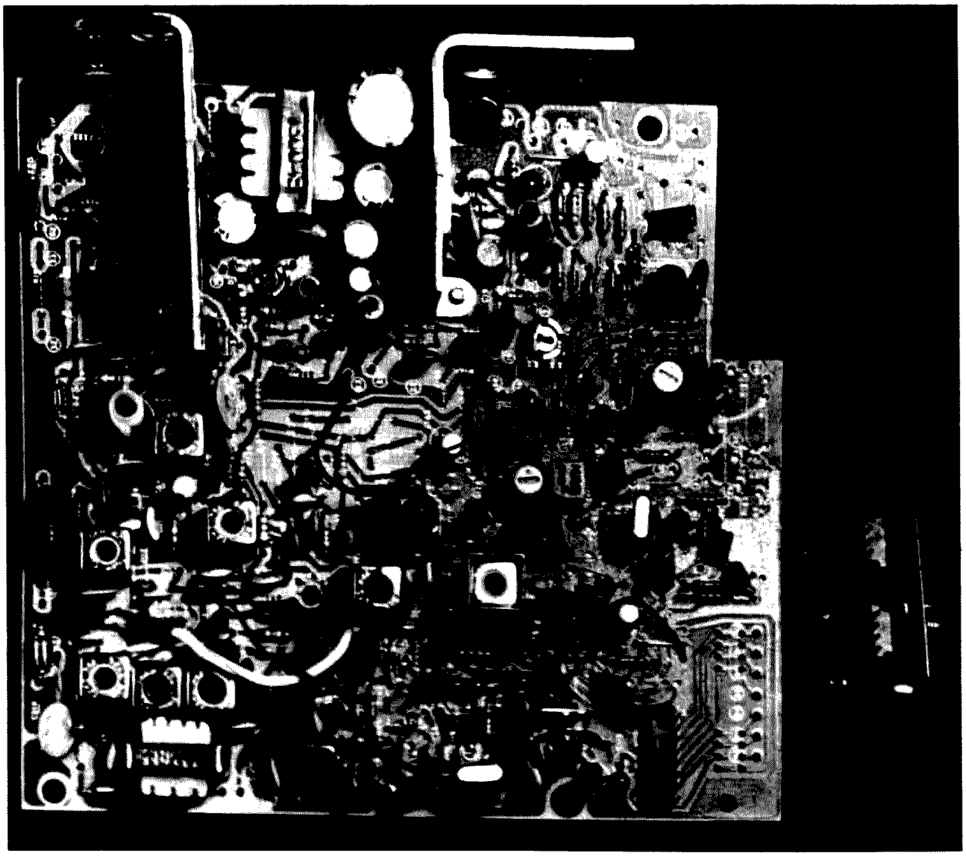

Photo A. The Poly Paks board and channel switch as purchased.

radios. The basic conversion described in these pages requires a two-transistor circuit addition (but no exotic parts) and a few easy hours. The whole secret to the conversion lies in making use of the flexibility designed into the set's phase-locked loop (PLL) synthesizer. The PLL is quite common in two-meter equipment, but few hams have had the opportunity to play with one enough to realize how really easy they are to modify—and that probably explains why earlier conversion articles on sets using this board require a crystal change.[1,2]

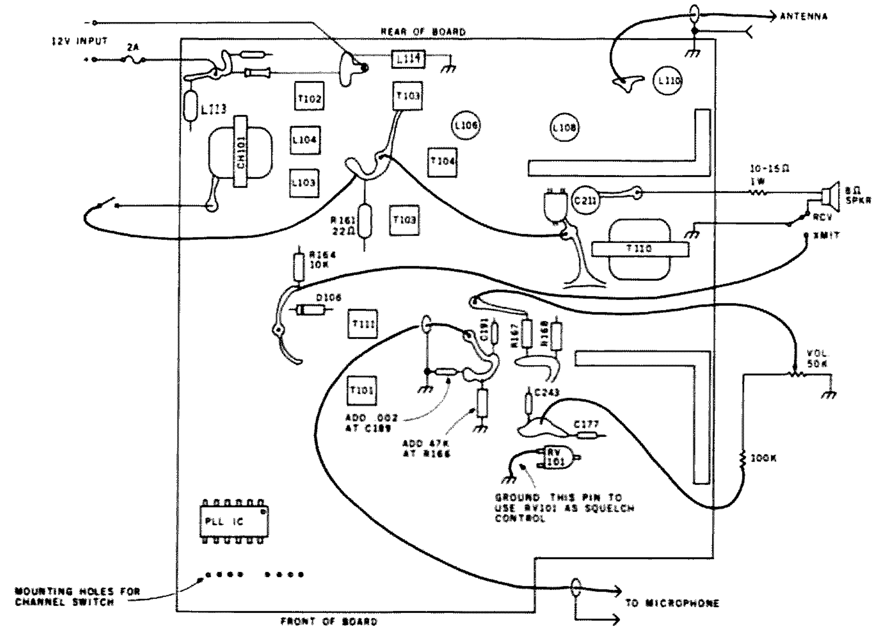

Fig. 1. Board layout showing connections for CB operation.

I bought my first board for $9.00 from John Meshna, Inc. (PO Box 62, 19 Allerton St, E. Lynn MA 01904). That unit was destined to be a trunk-mounted Hy-Gain model 2679A, and in surplus form consisted of the main circuit board surrounded on three sides by a U-shaped metal support bracket to which is mounted the antenna connector, external speaker jack, fuse holder, and the strain relief grommets for the power leads and external microphone/control unit. Also included was the smaller circuit board which contains the circuitry interfacing between the remote microphone and the main board functions.

For another $5.00, I was able to purchase (minus its cord) the remote microphone (which contains the volume, squelch, channel selection, and channel display functions). A word about this control unit: Having all of the controls in your hand is a nice feature, but contrary to some advertising claims, the unit cannot just be hooked up to any set. The interface board contains four ICs, one of them customized and not available, and two of the remaining three are pre-programmed PROMs. If you do not have this board, you can use the control unit only after a lot of design and construction work, so make sure if you want the remote control that you also buy the interface card.

The first unit that I converted worked so well and was so much fun that in November, 1979, I bought two boards, each with a 40-channel switch, from Poly Paks (PO Box 942, South Lynnfield MA 01940) for $12.51. These boards were a different prospect because they were considerably less finished than the first unit. Hy-Gain used the basic circuit board in a whole series of sets (models 2679, 2680, 2681, 2682, and 2683, at least), and, during the manufacturing process, the board apparently was first built to one state of completeness and then held until it was installed in a particular set. Then, depending on that model number, the various functions were connected or added or modified as necessary.

The boards purchased from Poly Paks were of the unfinished variety. Included with each was the 40-channel switch, and that certainly made it easier to get the board running since the switch coding is a difficult function to home brew in a convenient form. To get the board working as a CB set required connecting

Channel	Frequency	P_0	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8
IC input name:		P_0	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8
Pin number:		15	14	13	12	11	10	9	8	7
Freq. Shift value (kHz):		10	20	40	80	160	320	640	1280	2560
1	28.965	0	0	0	0	0	1	1	1	0
2	26.975	1	0	0	0	0	1	1	1	0
3	26.985	0	1	0	0	0	1	1	1	0
4	27.005	0	0	1	0	0	1	1	1	0
5	27.015	1	0	1	0	0	1	1	1	0
6	27.025	0	1	1	0	0	1	1	1	0
7	27.035	1	1	1	0	0	1	1	1	0
8	27.055	1	0	0	1	0	1	1	1	0
9	27.065	0	1	0	1	0	1	1	1	0
10	27.075	1	1	0	1	0	1	1	1	0
11	27.085	0	0	1	1	0	1	1	1	0
12	27.105	0	1	1	1	0	1	1	1	0
13	27.115	1	1	1	1	0	1	1	1	0
14	27.125	0	0	0	0	1	1	1	1	0
15	27.135	1	0	0	0	1	1	1	1	0
16	27.155	1	1	0	0	1	1	1	1	0
17	27.165	0	0	1	0	1	1	1	1	0
18	27.175	1	0	1	0	1	1	1	1	0
19	27.185	0	1	1	0	1	1	1	1	0
20	27.205	0	0	0	1	1	1	1	1	0
21	27.215	1	0	0	1	1	1	1	1	0
22	27.225	0	1	0	1	1	1	1	1	0
23	27.255	1	0	1	1	1	1	1	1	0
24	27.235	1	1	0	1	1	1	1	1	0
25	27.245	0	0	1	1	1	1	1	1	0
26	27.265	0	1	1	1	1	1	1	1	0
27	27.275	1	1	1	1	1	1	1	1	0
28	27.285	0	0	0	0	0	0	0	0	1
29	27.295	1	0	0	0	0	0	0	0	1
30	27.305	0	1	0	0	0	0	0	0	1
31	27.315	1	1	0	0	0	0	0	0	1
32	27.325	0	0	1	0	0	0	0	0	1
33	27.335	1	0	1	0	0	0	0	0	1
34	27.345	0	1	1	0	0	0	0	0	1
35	27.355	1	1	1	0	0	0	0	0	1
36	27.365	0	0	0	1	0	0	0	0	1
37	27.375	1	0	0	1	0	0	0	0	1
38	27.385	0	1	0	1	0	0	0	0	1
39	27.395	1	1	0	1	0	0	0	0	1
40	27.405	0	0	1	1	0	0	0	0	1
							*	*	*	

Note: The three digits above the asterisks are always the same and are the inverse of the last digit.

Table 1. PLL programming—CB frequencies.

that switch, routing 12 volts from a power supply through a filter on the board, and then adding jumpers to get the B+ to various portions of the circuit not reached by printed circuit foil. I also had to add in a volume control, squelch control, and antenna and speaker jacks.

For my convenience, I also added the diodes and resistors necessary to get an S-meter. This job was aided considerably by having converted the previous set. Also indispensable was a Sams Photofact® booklet covering the trunk-mounted version. A good readable schematic is necessary for a successful conversion: A troubleshooting manual may cost several dollars but it is a good investment despite the fact that it adds significantly to the cost of the project.

Firing Up the Basic Board

The connections required to turn the board on are shown in Fig. 1. The channel switch needs to be mounted in the front right-hand corner of the board. The switch that came with my Poly Paks boards had two extra contact pins on the front of the unit that were not needed; they must have had something to do with 23-channel-only operation. I bent them back out of the way and soldered in the switch by the remaining eight pins which fit in the holes provided on the board.

The 12-volt power line enters the board at the rear right-hand corner, goes through a filter, and comes off the board to the power switch. After the switch, the 12 volts goes back to two spots on the board: the supply point for the audio IC (located next to the output transformer, T110) and the supply point for the rest of the radio at the rear end of R161. This resistor is a largish 22-Ohm unit mounted just to the left of T103.

The next step is to route the audio signals around on the board. The squelch-range-adjust control, RV101, has one unconnected terminal. If this terminal is grounded, the small trimmer will work as a squelch control. (Squelch isn't too useful on ten meters, so I just turned it off.) If you want a real control, then find the center arm of RV101 and connect a 10k pot wired as a variable resistor from there to ground.

The receiver's detector output is located at the junction of C177 and C243. This signal is routed through an external 100k resistor and 50k pot to ground, with the pot wiper returning the signal to the circuit board on the rearward end of R167 (27k). The receiver has, if anything, too much audio output, so if you have only a 10 or 25k pot, don't be afraid to use it as the volume control. If for some reason you want more gain, you can always replace the 100k resistor with a smaller value.

The microphone audio goes into the board on the front end of C191. You should add two components in the spaces provided at this point: a .002-uF cap at C189 and a 47k resistor at R166. These spaces were left empty because the trunk-mounted units have a transformer (on the remote control interface board) which drives a slightly different circuit here.

The speaker audio comes

from the output transformer through C211 and goes to the speaker through a 10- or 15-Ohm, 1-Watt (at least) resistor. There is a resistor on the rear of the circuit board to use for this purpose if you wish: R194, an 8.2-Ohm, 3-Watt unit. The speaker audio returns to ground through one side of the push-to-talk switch. The other switch contact is used to turn on the transmitter during transmit, and this connection is made to the junction of R164 (10k) and D106.

The antenna is connected to the output side of L110, and the outer conductor of the coax is tied to the foil ground either directly or through a .005-uF capacitor. (In mobile operation, of course, the unit may be used in either a positive- or negative-ground car, and, for this reason, the practice is to have any external metal parts—antenna connector, metal case, shaft controls, etc.—isolated for dc from the "ground" on the circuit board. Otherwise, you risk losing at least a fuse when you install the unit in your car.)

With these connections made, the unit should operate on CB. If it doesn't, then get out the schematic and start checking to see that all the stages are getting power. Make sure that the squelch is turned off (the wiper of RV101 is grounded). You can check the PLL synthesizer for proper operation by measuring the dc voltage at the junction of R113, R114, and R115 as detailed later. Once the board is off and running, you can start to think about the ten-meter conversion steps, and that means starting with the PLL.

The Basic PLL

Phase-locked-loop operation has been covered elsewhere in more detail than I intend to go into here.[3] The first thing you need to know is how the PLL basically works, and that is diagramed in Fig. 2. The loop shown there serves to control the voltage-controlled oscillator (or vco—which is just a voltage-tuned vfo) so that it has the same stability as the crystal oscillator even though it is running on a different frequency. The heart of the loop is the phase detector.

If the word "phase" bothers you, think of it for the moment as a frequency detector. When the loop is operating normally, the two signals going into the phase detector will be of the same frequency. Coming out of the detector is a signal whose dc value goes up or down if one of the input frequencies starts to get higher or lower than the other. This output signal goes through a low-pass filter and dc amplifier and eventually is applied to the terminal which controls the

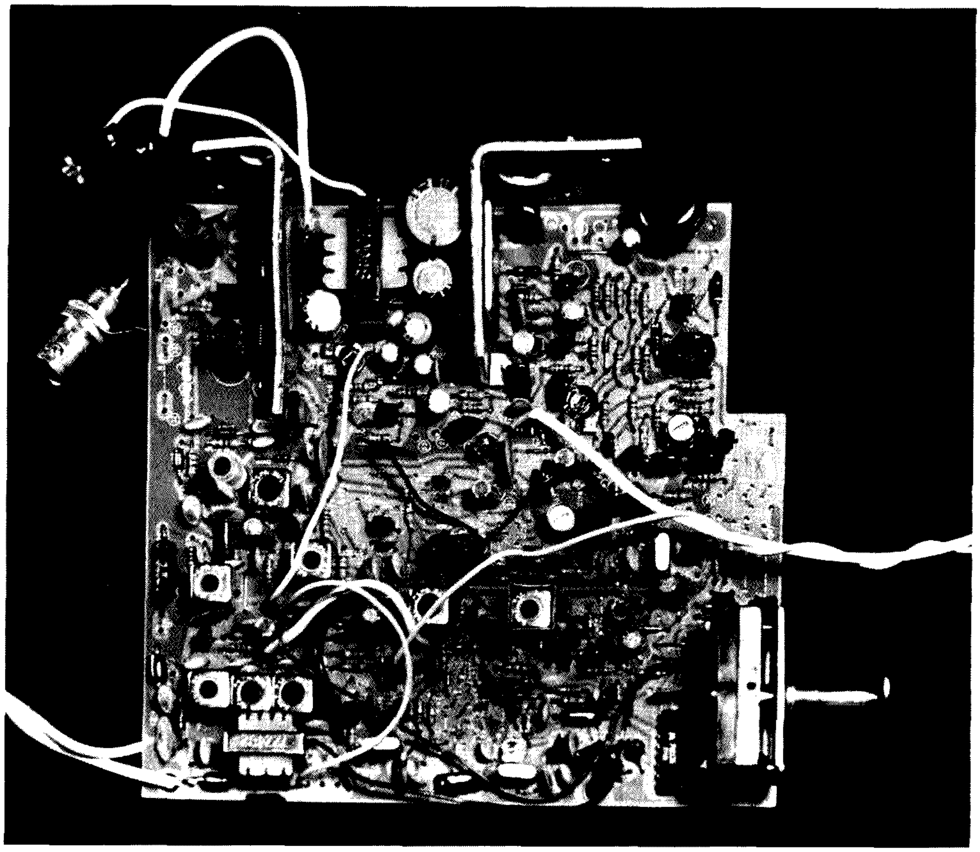

Photo B. The Poly Paks board set up and operating on (gulp!) 11 meters. The twisted wire coming out the front of the board is the mike/transmit cable. The black knob on the lower right is a volume control.

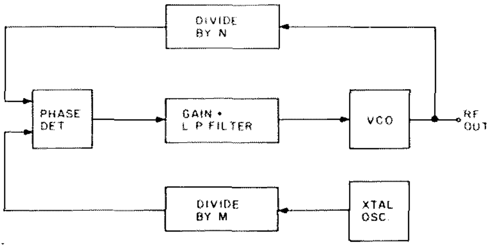

Fig. 2. A basic phase-locked loop.

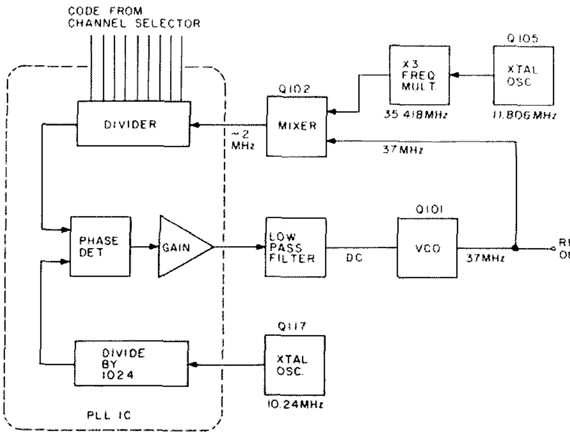

Fig. 3. The Hy-Gain phase-locked loop.

frequency of the vco. The vco output (which in the CB set will be the local oscillator frequency) goes through a digital frequency divider and then becomes one of the phase-detector input signals. That frequency divider is important and we'll consider it in a moment, but, for now, realize that when the vco frequency goes up, the output frequency of the divider (which is f_{vco}/N) also goes up.

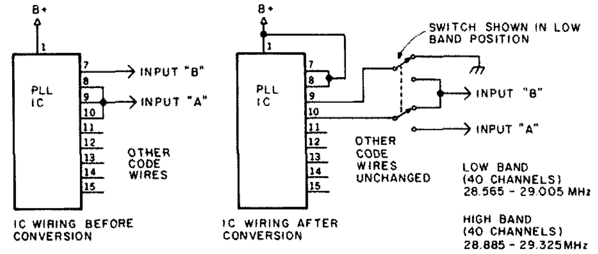

Fig. 4. Modifications in the PLL coding.

Meanwhile, a crystal oscillator whose frequency is divided by M in another divider provides a stable input frequency to the other side of the phase detector. When the loop is operating properly, the two phase-detector input signals are on exactly the same frequency, and that means that f_{vco}/N must equal f_{xtal}/M. Now suppose that because of a temperature or voltage change, the vco frequency starts to drift upwards. The corresponding input frequency to the phase detector also has to drift upwards, and, of course, the phase detector senses this and its dc output voltage changes. This voltage change, after being amplified and applied to the vco input terminal, forces the vco back to the right frequency. Because of the high gain in the dc amplifier and the sensitivity of the phase detector, this correction takes place practically before the drift gets started. In fact, the vco can for all purposes be made as stable as the crystal oscillator.

Now, suppose that the crystal oscillator frequency and the size of digital frequency division M are chosen so that the phase detector reference input is 10 kHz. Then, because the other input in the operating loop must also be 10 kHz, the vco frequency must be exactly N times higher. If, for example, N is 100, then the vco will be on 1 MHz, and if N is changed to 101, then the vco will shift to 1.01 MHz. Clearly, the vco can be moved around in 10-kHz steps simply by changing divider value N, and that's just how it is done in the CB sets. It is a very nice system, since with the PLL guts on a single chip, the whole set of 40 channels can be generated with a single crystal and a cheap switch.

IC input name:		P_0	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8
Pin number:		15	14	13	12	11	10	9	8	7
Freq. Shift value (kHz):		10	20	40	80	160	320	640	1280	2560
Channel	**Frequency**									
1	28.885	0	0	0	0	0	1	0	1	1
2	28.895	1	0	0	0	0	1	0	1	1
3	28.905	0	1	0	0	0	1	0	1	1
4	28.925	0	0	1	0	0	1	0	1	1
5	28.935	1	0	1	0	0	1	0	1	1
6	28.945	0	1	1	0	0	1	0	1	1
7	28.955	1	1	1	0	0	1	0	1	1
8	28.975	1	0	0	1	0	1	0	1	1
9	28.985	0	1	0	1	0	1	0	1	1
10	28.995	1	1	0	1	0	1	0	1	1
11	29.005	0	0	1	1	0	1	0	1	1
12	29.025	0	1	1	1	0	1	0	1	1
13	29.035	1	1	1	1	0	1	0	1	1
14	29.045	0	0	0	0	1	1	0	1	1
15	29.055	1	0	0	0	1	1	0	1	1
16	29.075	1	1	0	0	1	1	0	1	1
17	29.085	0	0	1	0	1	1	0	1	1
18	29.095	1	0	1	0	1	1	0	1	1
19	29.105	0	1	1	0	1	1	0	1	1
20	29.125	0	0	0	1	1	1	0	1	1
21	29.135	1	0	0	1	1	1	0	1	1
22	29.145	0	1	0	1	1	1	0	1	1
23	29.175	1	0	1	1	1	1	0	1	1
24	29.155	1	1	0	1	1	1	0	1	1
25	29.165	0	0	1	1	1	1	0	1	1
26	29.185	0	1	1	1	1	1	0	1	1
27	29.195	1	1	1	1	1	1	0	1	1
28	29.205	0	0	0	0	0	0	1	1	1
29	29.215	1	0	0	0	0	0	1	1	1
30	29.225	0	1	0	0	0	0	1	1	1
31	29.235	1	1	0	0	0	0	1	1	1
32	29.245	0	0	1	0	0	0	1	1	1
33	29.255	1	0	1	0	0	0	1	1	1
34	29.265	0	1	1	0	0	0	1	1	1
35	29.275	1	1	1	0	0	0	1	1	1
36	29.285	0	0	0	1	0	0	1	1	1
37	29.295	1	0	0	1	0	0	1	1	1
38	29.305	0	1	0	1	0	0	1	1	1
39	29.315	1	1	0	1	0	0	1	1	1
40	29.325	0	0	1	1	0	0	1	1	1

Table 2. PLL programming—28.885 to 29.325 MHz.

The Hy-Gain PLL

The block diagram of the Hy-Gain PLL system shows differences from the simple loop just described. The real loop is shown in Fig. 3 and the dotted lines circle the parts of the system which are included in the PLL 02A (or MC145109) IC: the top two dividers, the phase detector, and the amplifier. The major change is that in this case the vco output is mixed down to a lower frequency before driving the divider.

The other mixer input is a 35.4-MHz signal derived from the third harmonic of an 11.806-MHz crystal oscillator. This is the crystal

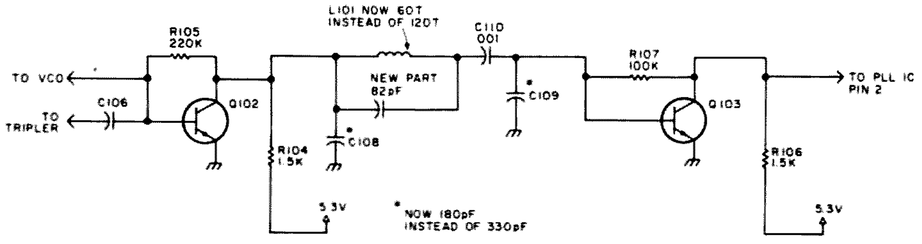

Fig. 5. Mixer output filter modification.

that is usually replaced for 10-meter conversion. If the crystal frequency is moved upwards by 2/3 MHz, then the mixer input frequency moves up by 2 MHz and the vco must move upwards by the same 2 MHz in order for the mixer output to stay the same. The approach used here is to change only the divider programming so that the vco has to move upwards because the divider input frequency must move upwards to maintain a 10-kHz output frequency.

The divider input consists of nine wires, as shown in Fig. 3, although in the CB setup three are tied together so that only seven switched lines are needed. The code on these seven wires is predetermined by the mechanical construction of the channel switch or, in the case of the trunk-mounted version, by the information stored in a read-only memory. What can be changed easily is the wiring between the channel selector and the nine input terminals on the PLL chip. The coding for the original setup is shown in Table 1. With the chip used on the Hy-Gain boards, a logic 1 placed on a particular input causes the divider to divide by whatever binary value that input represents. The frequency value of each of the nine inputs is shown at the top of the table, and if you study the change in frequency that results from a change in coding, the overall scheme of things will quickly become clear.

If, for example, the set is on channel 14 and you want to go up 10 kHz to channel 15, then the code on the P_0 line is changed from a 0 to a 1. To go up 90 kHz to channel 21, both the P_0 and P_3 inputs are set to 1. Note that the most significant input, P_8, has a value of 2.56 MHz, so if the set were on channel 1 but you had taken a soldering iron and wired P_8 to five volts instead of the low level coming out of the switch, then the PLL would try to move the vco (and with it the rig's operating frequency) exactly 2.56 MHz higher to 29.925 MHz. Also note that three inputs, P_5, P_6, and P_7, are connected together on the printed circuit board and always have exactly the opposite value from P_8.

To command the rig to ten meters, all that is required is to cut apart these three inputs and rewire the coding driving them. The change in the wiring is shown in Fig. 4. On my unit, I included a switch so that two overlapping sections of the band could be covered—this gives a continuous range of channels from 28.565 to 29.325 MHz. I don't use the lower band much since the AM activity stays between 29.0 and 29.1 MHz for the most part, but I had the switch in my junk box and the addition was certainly easy enough.

The PLL coding inputs after the modification is made are shown in Table 2 for the "high band," or 28.885 to 29.325 MHz. It is easy to calculate the new frequencies by looking at the change in coding between Tables 1 and 2. For example, on channel 35, the P_6 and P_7 bits have been changed from 0 to 1 for an operating frequency increase of .64 + 1.28, or 1.92 MHz, from 27.355 to 29.275 MHz. This modification is quick and simple, partly because the old channel switching circuitry is retained and only the wiring is changed. It has the disadvantage of skipping an occasional frequency, and

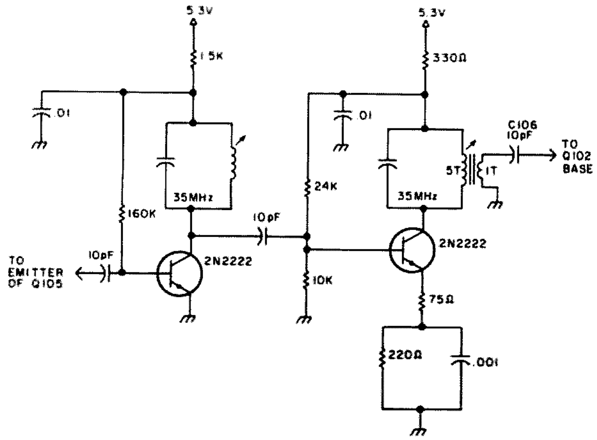

Fig. 6. New circuit—11.8- to 35.4-MHz tripler-buffer.

if that is a detriment or if you want more than 40 channels, you could use external toggle switches or thumbwheel switches or whatever your junk box contains to code in any frequencies you wish.

Now that the programmable division has been increased, the frequency coming out of the loop mixer (Q102) has also been increased by some 2 MHz. For reasons discussed later, there are many frequencies present in the output of this mixer stage; to reject the unwanted ones, the mixer is followed by the low-pass filter consisting of C108, L101, and C109. This filter must be changed to accommodate the higher frequency. The new circuit is shown in Fig. 5. The two capacitors have been reduced to 180 pF each, the coil has been reduced from 120 to 60 turns, and an 82-pF capacitor has been added in parallel with the coil to increase the sharpness of the filter roll-off. In some of the units, the coil is mounted in a small white plastic box, but the cover slides off fairly easily so the turns can be removed without damaging the unit physically.

The Catch

The changes outlined above are all that are necessary to command the phase-locked loop to the desired frequency. Unfortunately, it won't lock there until you remove a shortcut that Hy-Gain got away with in its design. Fig. 3 shows a tripler following the 11.806-MHz crystal oscillator. In fact, this tripler is not shown on the schematic because it is part of the mixer.

A mixer is a nonlinear circuit—that's why it mixes two frequencies instead of just adding the voltages together. When the loop mixer is fed the 11.806-MHz signal from the crystal oscillator, it internally generates the second, third, fourth, and so on harmonics of that basic frequency. It does the same with the 37-MHz vco signal also, and

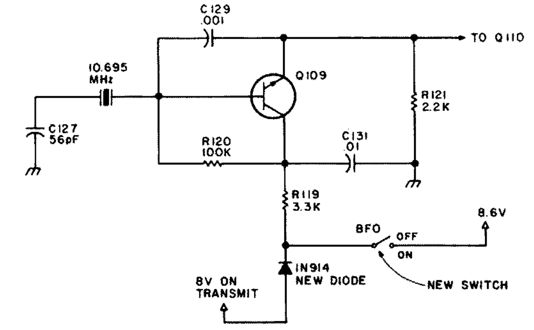

Fig. 7. Bfo modification.

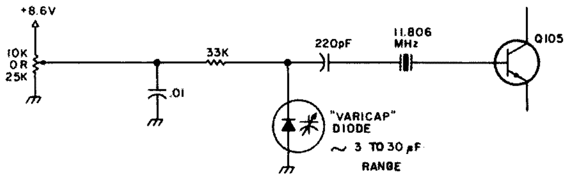

Fig. 8. Fine tuning modification.

the result is that there are a lot of different frequencies present in the mixer output waveform.

The designers at Hy-Gain were careful in picking the right frequencies so that the loop locks on the one they wanted and not on some spurious mixer product. Unhappily, the shift to ten meters upsets things enough so that the loop gets confused and doesn't operate properly. This is where the two transistors mentioned earlier come into the picture, since they are used in the circuit of Fig. 6 to generate a nice, clean 35.4-MHz signal which is fed into the mixer in place of the lower frequency. The circuit is a straightforward tripler-buffer using commonly available parts.

The tuned circuits could be modified i-f transformers or any other small adjustable coils capable of being tuned to the 35-MHz range. The transistors also could be salvaged from an old FM radio if you don't have any 2N2222s on hand. In fact, I make it a practice to collect broken and discarded transistor radios, as I find the parts they contain are often smaller than any I could purchase locally. It's a rare case of recycled parts actually being better than new ones.

The circuit can be constructed on a small circuit board and mounted in any convenient manner close to the mixer (Q102) on the mother board. I was able to fit the addition into the open space existing between the 10.695- and 11.806-MHz crystals. In any case, if you use the transformers, they must be modified so that they resonate on 35 MHz, and this requires some careful work. The easiest thing to do is to remove turns from the coils since the capacitor inside the transformer is very small and it is unlikely that your junk box would have a smaller value in a similar physical size. The coil will have perhaps 7 to 10 turns of very fine wire, and you need about half that number—4 or 5 turns.

To tune the two coils, you need some way of monitoring the 35-MHz output of the second stage. I used a grid-dip meter as a rough guide to resonance while cutting down the coil, and then, in the wavemeter mode, as an indicator of the buffer's output in the operating circuit. If you have access to a wideband oscilloscope, that would be an excellent tool to use in the final adjustment. Another possibility is to use a 35-MHz receiver coupled loosely to the buffer output.

With the addition of the tripler and buffer stages, the loop should lock readily on the proper frequency. The best way to check for proper locking is to monitor the dc error signal controlling the vco, and this signal is available at the common junction of R113, R114, and R115. You might want to watch this voltage a bit while the set is still set up on the CB frequencies so that you can get a feel for proper operation. With my sets, this voltage can be anywhere between 1 and 4.5 volts during normal operation, and the voltage will hold a steady dc value on any particular channel.

When the channel selector calls for a new frequency, the voltage changes since the loop is forcing the vco to a different frequency. As the channel selector is switched progressively higher from 1 to 40, the voltage at this point will smoothly change from its lowest to its highest value—about a 2-volt change in all. There will be a slight bump in the response near mid-scale since channels 24 and 25 are below channel 23 in frequency. The position of the 2-volt excursion within the 3.5-volt operating range can be varied by adjusting the slug in the vco tank coil, T101: This action changes the vco's free-running frequency and so requires the loop to pull by a different amount in getting the vco back on frequency. If this vco adjustment is too far off, the loop is unable to lock and the error voltage will stay at either the high or low limit.

There are some points at which the loop apparently locks on a spurious mixer product. In these cases, the error voltage sits at mid-range and doesn't track the changes of the channel selector. If the tripler or buffer tank circuits are mistuned drastically, the error voltage may bounce around on the upper channels instead of holding steady. Remember that this voltage is the electrical equivalent of a vfo knob and should be rock steady in normal operation, showing only a very slow drift as the loop compensates for temperature or B+-induced vco drift. For the final vco adjustment, select a channel near the middle of the frequency range and set T101 so that the error voltage is around 2 volts. In my sets, the loop can control the oscillator over about a MHz, so that once adjusted, T101 need not be touched up.

With the PLL moved to the proper frequency, the only other adjustments required are in the front-end rf circuits. In receive, the antenna and rf amplifier slugs on T103 and T104 are screwed out a turn or so to peak up the received signals. The local oscillator injection tuning for the mixer, T111, also should be peaked up to the new vco frequency range. This can be accomplished as before with a grid-dip meter, receiver, or oscilloscope. In this case, the frequency change is only about 5%, so you might get away with simply a half-turn counterclockwise of the slug.

On the transmitter side, there are more tweaks to make. The vco signal is mixed with the output of a 10.695-MHz crystal oscillator to produce the ten-meter output frequency. The output of that mixer is cleaned up by a three-stage filter consisting of L103, L104, and T102. The easiest way to adjust these three

coils is with the aid of another ten-meter receiver. Tune it to the transmit frequency and, with a dummy load on the rig, push the transmit button. You should hear a signal, maybe a weak one, in the receiver. As you adjust those three coils, the signal should peak up noticeably although it may still be a bit weak since the output stages are still on 27 MHz. Don't, by the way, hold the key down for long periods until the output stages are resonated. The output tuning is fairly broad and noncritical: Simply adjust T103, L106, L109, and L110 for maximum output. For my rig, that is 3.5 to 4 Watts with a 13.5-volt power supply.

At this point, you should be able to start making contacts. As mentioned before, most of the AM activity is between 29 and 29.1 MHz, and if you don't hear anyone there, don't be afraid to call CQ for awhile.

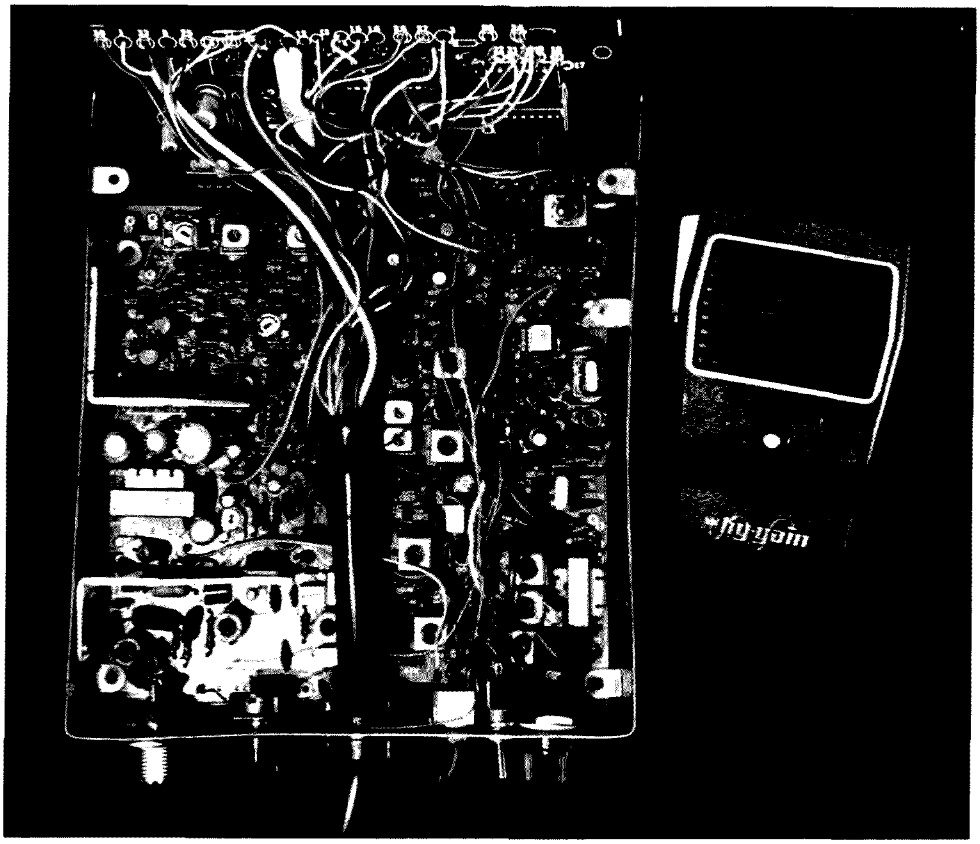

Photo C. The modified trunk-mount rig with remote microphone/control unit. The control-unit interface board has been folded back to show the position of the bandswitch next to the PLL IC. Mounted next to the antenna jack is the ±4-kHz fine-tuning pot; the switch next to the fuse holder is for the bfo.

If you hear some sideband stations on the lower channels, you can be sure that the band is open, so persevere. The AM activity doesn't crowd up its band segment the way the SSB gang does, and people *are* out there listening. Many of the stations you work will be using CB sets, and you will be amazed at how well your low power gets out.

Sideband Reception

There are plenty of AM contacts to be had, but without a doubt, there is more activity on SSB—how about a bfo to detect them? It's already there waiting to be turned on. During transmit, the output frequency is created by mixing the vco signal with the output of a crystal oscillator on 10.659 MHz—the receiver first i-f frequency. If that oscillator is turned on during receive, it provides enough bfo injection to demodulate the SSB signals you are hearing. Technically, it is a bad approach because the bfo signal is injected ahead of most of the i-f gain so that it gets into the agc circuitry and most likely desensitizes the receiver. Practically, it works just fine, especially considering that all the modification requires is the single diode and switch shown in Fig. 7.

Fine Tuning

Once the bfo is working, the difficulty with sideband stations is that few of them are exactly on one of the 40 channel frequencies and the receiver has no provision for fine tuning. There is a trimmer, CT101, that can move the transmit and receive frequencies around by a kHz or so; it was put there to allow adjusting the CB channels to their assigned slots. The easiest way to add fine tuning to the rig is to replace this trimmer with a panel-mounted unit of the 5-to-35-pF variety. Once this is done and the 39-pF fixed capacitor that was in parallel with CT101 is removed, the variable range is between 8 and 10 kHz.

A much neater modification will result if the trimmer is replaced with a diode designed to operate as a variable capacitor. I was able to purchase eight such diodes for $1.30. (Try Solid State Sales, 139 Hampshire Street, Cambridge MA 02139.) As with all surplus components, there was some variation in performance between parts, but I was able to find several diodes which would give a 7-kHz shift when used in the circuit shown in Fig. 8.

After this modification, you will find that it is even possible to contact sideband stations after you zero beat them, and that often the SSB operator won't realize you are on AM unless you tell him. It's only courteous to stay out of the congested end of the band, however, since your other sideband could cause some unnecessary QRM. The technique can be useful, though, when you can't scare up an AM contact and the band isn't too crowded.

CW Modifications

Once the set has a bfo and fine-tuning capability, why not CW? There is a lot of activity on the CW end of the band, and a low-power signal is at a lot less of a disadvantage when using that mode. Two changes are required: The PLL must be reprogrammed, and some means of keying the carrier must be installed.

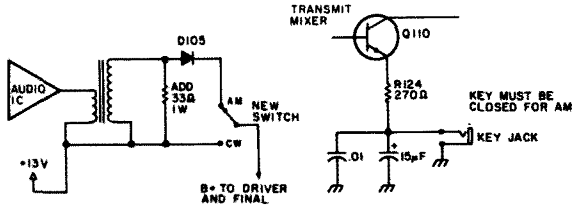

Fig. 9. Modifying the transmitter for CW keying.

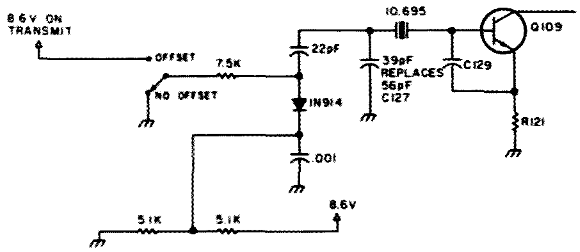

Fig. 10. Transmit frequency offset modification.

One minor disadvantage of the frequency modification is that 28.1 MHz is far enough from 29.1 MHz so that both the receiver and transmitter will have to be repeaked for proper operation. In my particular board, the vco would just make the transition, but it really required a slight adjustment to ensure stable operation. The necessary retuning is easy enough until you mount the board in some kind of enclosure (it's a nice fit in a 7″ × 7″ × 2″ chassis, by the way), so if you plan on a lot of CW operation, you might include access holes in any box you use to allow quick circuit peaking.

Modifying the PLL coding to get the set operating on the CW end is pretty simple. First, the switch shown in Fig. 4 should be in the Low Band position so that channel 1 is on 28.565 MHz. Then, simply tie pin 8 to ground instead of 5 volts, and connect pin 9 to 5 volts instead of ground. This operation moves all the channel frequencies lower by 640 kHz, so channel 8 is now on 28.015 MHz. The lower seven channels can be used for monitoring the illegal operation below the band when you get the urge.

After making these coding changes, go back and check for proper PLL operation by monitoring the error voltage at the junction of R113, R114, and R115. Once again, T101 should be adjusted until the error voltage on channel 20 is about 1.5 to 2 volts. Then peak up the receiver front end and you should start hearing some signals.

Modifying the transmitter for CW is also pretty simple: The changes are shown in Fig. 9. The B+ feeding the driver and final is connected directly to the 12-volt line, thus disabling the modulator, and the carrier is keyed at the emitter of the transmit mixer, Q110. The 15-uF capacitor across the keying lead is a simple but effective means of shaping the waveform to prevent key clicks. One disadvantage of this modification is that the receiver is always zero beat with the transmitter. Since the other operator has a tendency to zero beat with you, he keeps disappearing from your audio, and unless you are aware of what is happening, you may lose the contact or maybe start leap-frogging the other station down the band.

Offsetting the transmitter during CW operation isn't too difficult, however, and the circuit shown in Fig. 10 will move the CW transmit frequency about a kHz below the receive frequency. The switch could be made part of a Phone-CW mode switch or it could be left as a separate control. The amount of offset is fixed by the size of the capacitor added to the oscillator circuit, and this size may need to be varied depending on the desired shift and particular crystal characteristics.

Afterthoughts

Most of the existing CB-to-ten modifications require the purchase of a crystal, and while that is a perfectly valid approach, it means you have to wait for the crystal to be made and accept the band segment that that crystal gives you. I feel that the added flexibility and lower cost of the PLL modification outlined here is well worth considering as an alternative. Not only does it get you on the air quicker, but also you have the freedom of easily putting the 40 channels anywhere you want at a moment's notice.

That freedom opens the door to a lot of weekend experimenting, only some of which I've tried. How about an OSCAR monitor for higher in the band? Or ten-meter FM? The variable tuning modification shown in Fig. 8 could be applied to the 10.695-MHz oscillator, and with an audio controlling signal instead of the potentiometer, the transmitter would be on FM. If the 455 crystal filter were removed, the receiver would probably slope-detect pretty well. It should be possible also to gang-tune the rf stages, maybe with the capacitor diodes, for example. The tuning could be via a front-panel potentiometer or maybe even ganged with a band-switch that changes the PLL coding. Such a setup would make changing from the AM to CW end of the band easier. For CW operation, a sidetone oscillator could be included. The 40-channel switch could be replaced with thumb-wheels or other switches so that no channels would be missing (as in the CB sequencing) or to provide more channels without bandswitching. How about programming the PLL from a digital counter running at some slow rate? Then the band, or some segment, could be scanned automatically for activity just like a VHF scanner. With a little effort, the channel spacing could be changed to 5 kHz (divide the 10.24 input to the PLL by two with a flip-flop and double the values of C113, C114, and C115). Belong to a radio club? You couldn't think of a better or cheaper club project. How about a club net or monitoring frequency on ten?

Have fun, and see you on ten.

Acknowledgements

I owe a thank-you to John Brownhill (almost a Novice at this writing) for introducing me to the bargains available in these CB boards, and also for the loan of his Sams Photofact information. My special thanks to Steve Finberg W1GSL for his suggestions on the text and his help with the photography. Finally, I must give credit for the bfo modification to the unknown local ham using the technique who worked me while I was on ten with my SSB CB set. He was on AM, and sure enough, I didn't realize it until he told me; I'm sorry only that I didn't note the incident in my log so that I could give him proper credit. ■

References

1. Paul Schmidt K9PS, "CB to Ten—part XVIII," *73*, May, 1979.
2. Cliff Wiginton WB5BSG, "CB to Ten—part XI," *73*, Sept., 1978.
3. Lester Earnshaw, "PLL Techniques," *73*, October, 1978.

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Old Receivers Never Die

—but occasionally they do get sick

Having an extra receiver around the shack can be a definite advantage, especially for checking harmonics, SSB suppression, or just plain listening to SWL BC or copying press. I had a need for just such a receiver, and the opportunity presented itself in the form of a Drake 2-B. As many of you may recall, the 2-B was considered one of the finer triple-conversion receivers in its day. It has excellent signal-to-noise ratio, good stability, and one of the best avc and muting systems I've ever encountered.

The former owner of this receiver had contacted the factory, but considering the age of the receiver, the price for repairs was considered too high. It was then taken to a couple of ham friends to see if they could repair it. No luck, and I was fortunate to get it at a very reasonable price.

Here in a nutshell was the problem. The receiver would not mute properly when the front-panel switch was placed in the standby position. In addition, I noticed that the rf gain control and avc functions did not operate smoothly. A look at the schematic very quickly made it clear that normal voltages could not be measured accurately with a VTVM due to the fact that these circuits are designed around extremely high impedance components. For those of you who may not have access to a schematic of the 2-B, Fig. 1 shows the muting and avc portions and should suffice when correcting the above mentioned problems.

The culprit in my receiver was R48, a rear-panel recessed control marked RCVR SENS. Measuring this pot with a VTVM on the high Ohms scale indicated the required 2 megs. However,. the voltages did not measure up to the stated values. (The voltage levels were nowhere near the required values, and this takes into consideration the loading effects of the VTVM, which has 11 megohms input impedance.) Physically look at R48 and note that only the rotor and one side of the pot are used. I changed the left-hand tab connection of the pot over to the right-hand tab. Lo and behold, the correct muting voltage was present and the rf gain control and avc functioned properly.

The moral of this repair is: Never depend upon readings when involved with high-impedance circuits. Substitution of known good components is your best bet. All I did in this case was utilize the unused portion of R48! The correct way, of course, is to replace the pot. My junk box was bare, however; hence the quickie repair.

After the modification has been made, it will be necessary to readjust R48. Proceed as follows to obtain maximum receiver performance: Set the front-panel avc switch to the Slow position. Connect a VTVM (5-to-10-volt dc range) to the avc terminal on the rear apron. The positive prod of the VTVM should be grounded. The rf gain control should be on full, and no antenna should be connected to the receiver. Adjust R48 for 1.5 volts.

Now, using R24, which is accessible from the front panel (above the phone jack), adjust for S1 reading on the S-meter. Remove the VTVM from the avc terminal, and, if the S-meter does not read S1, use R48 to bring it back to S1. The removal of the VTVM is mandatory due to the loading effects of the meter.

Do not be tempted to decrease the avc voltage below −1.5 volts. The receiver may sound hotter, but in reality it can become prone to overloading on very strong signals. I was fortunate in having a 50-kHz signal generator, so I aligned the rf, i-f, and bfo circuits. The additional effort really paid off. The 2-B now performs and compares very favorably with many receivers on the market today.■

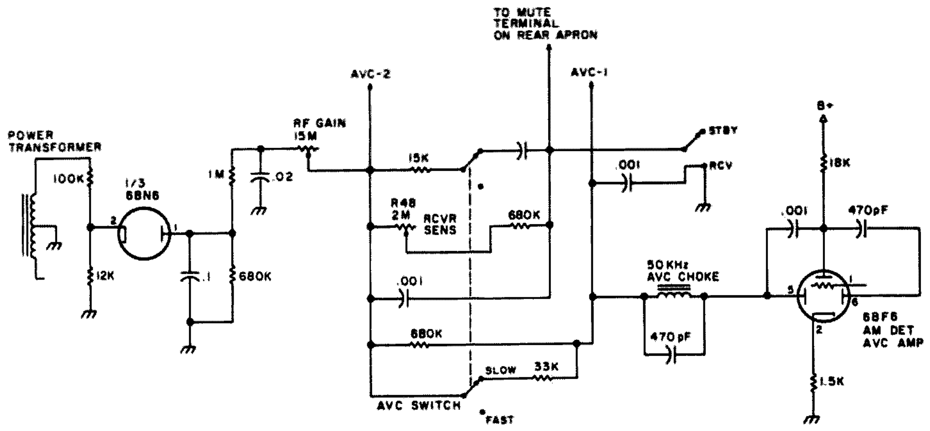

Fig. 1. Partial schematic of the Drake 2-B—avc and muting circuits.

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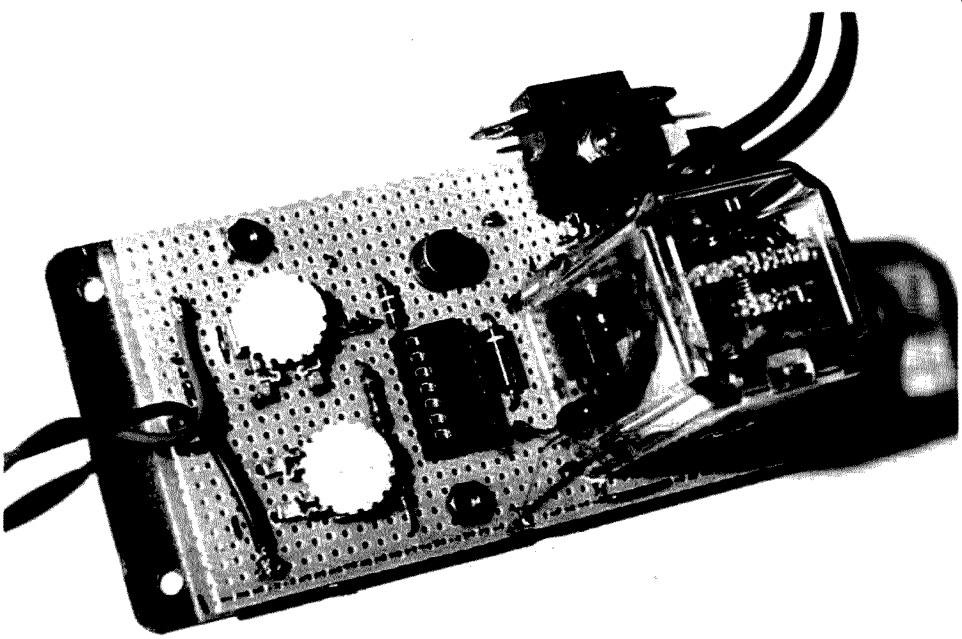
The Battery Minder

—a real turn-on for chargers

A car battery with an ac charger is an easy way to power those all-solid-state rigs. Such an arrangement is not expensive and can deliver the often-required high peak currents. It also makes a nice emergency supply when the ac fails, as it often does here during the winter.

One question that keeps coming up is when to charge the battery. It is a nuisance to have to check the battery voltage and connect and disconnect the charger accordingly. The circuit presented here was designed to make life with such a supply just a little bit easier. It is a simple, reliable circuit that is easy and quick to build. There are no difficult or tricky "gimmicks." All parts are readily available; substitutions can be made with good results.



The Battery Minder.

The circuit is based on the LM339 voltage comparator. (See Fig. 1.) A 6-volt zener and a 4.7k resistor form a reference voltage for the 339's minus input. The 339's plus input is connected to the tap of a 10k pot that is connected across the battery. This pot is set so that the plus input is near 6 volts.

Now, as the battery voltage falls, the plus input will fall below the reference 6 volts at the minus input and the 339 output will go low and turn the transistor and relay on. Note that

when the 339 output is low, the plus input is pulled even lower through the 100k feedback pot. It now will require a higher voltage across the 10k pot (and battery) to make the relay go off. The amount of this hysteresis is set by the 100k pot. It should be set to turn the charger on and off at the voltage the builder desires.

A bit of experimenting may be required to get the on and off voltages best for your battery. The settings will depend on the condition of the battery and the output voltage of the charger. The low-voltage turn-on point is set with the 10k pot while the 100k pot is at its maximum resistance. Then the high-voltage turn-off point is set by adjusting the 100k pot. I set my Battery Minder to turn on at 11.5 volts and to turn off at 13.3 volts. The relay controls the 110 ac to the charger. An LED indicates when the battery is being charged.

The parts used in my Battery Minder were those on hand. Just about any voltage comparator will work if it will operate from a single-ended power supply. The zener diode can be any voltage from about 4 to 8 volts, with an appropriate adjustment of the 10k pot. The 10k and 100k pots can be just about any value that does not load the circuit. As a starting place, the feedback pot should be about 10 times the value of the voltage divider pot. The relay can be just about any one that will handle 110 ac, but note that it must be able to operate at the lowest voltage to which the battery is allowed to discharge. It could be an SPST relay. The transistor is any general-purpose PNP type that will handle the relay and LED current. The total current through mine was about 45 mA.

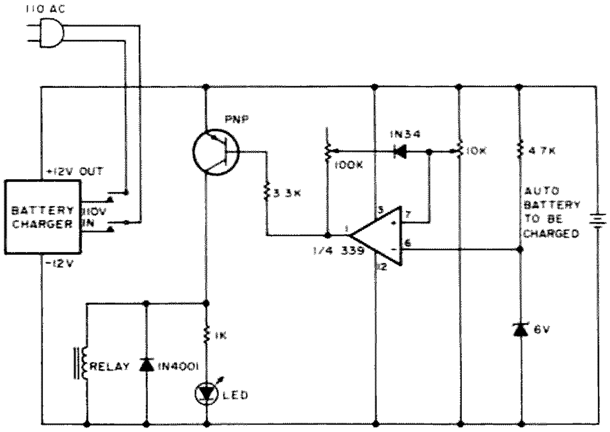


Fig. 1. Schematic diagram.

Construction of the Minder is very simple using perfboard. The photo shows the parts placement that I used. Wiring was simply point-to-point using component leads. It is recommended that the relay be one of the enclosed types; they go much longer without the points fouling. My unit was mounted in a plastic box, with a 110-volt receptacle into which to plug the charger.

The Battery Minder keeps the "power supply" charged at all times, reduces the nuisance factor, and ensures that the 2-meter rig has emergency power when the ac fails. ■

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Working in Wood

—a tilt-over home-brew for $2 a foot

Having the good fortune to be the recipient of a quad-antenna gift, my thoughts naturally turned to how best to support it. My requirements were: (1) accessibility of the antenna for installation, tuning, repairs, etc.; (2) an antenna at least one-quarter wavelength and preferably a half-wavelength above ground at 20 meters; and (3) expenses for this which would be easy on the wallet.

Commercially-available towers met the first two requirements but not the last. A search of available literature showed several designs, but none that appeared as an economical or practical possibility. I therefore decided to design my own, and the result is shown in Fig. 1.

Construction

The base of the tower is a rough-cut 6 x 6, 24 feet long, with its bottom 5 to 6 feet anchored in a block of concrete approximately 1½' square. The base of the 6 x 6 is mounted on a 1"-thick concrete block to help keep moisture out of the beam.

The tilt-over part of the tower is made up of 2 x 4s having a total length of thirty-eight feet, as shown in Fig. 2. A steel pipe was added at the top, along with a rotator, to put the boom of the quad up at about forty-three feet. Also, note in Fig. 1 that there are stay wires that run the entire length of the tilt-over portion to form a truss. The eyebolts in the center should be as long as possible for this truss. Don't omit the truss, as the tower will not handle the tilt-over load without it.

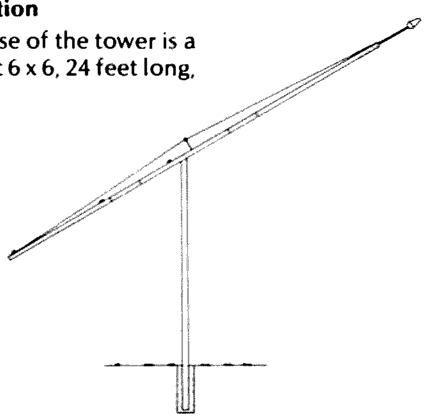

Fig. 1. The completed all-wood, tilt-over tower.

The tower is bolted and glued together, with the exception of the 2 x 4 cross supports which are screwed and glued to the 2 x 4 frame. The 2 x 4s are spliced together with about a three-foot brace piece at the splice. Along with the glue, five 1/4-inch round-head bolts with washers and two nuts are used on each side of the butt joint.

The pipe mast is anchored to both 2 x 4s by using U-bolts around the pipe and through the 2 x 4s. Alternate these to each side for a total of about 8 U-bolts. The tilt-over section is pivoted on a ½" carriage bolt with washers and two nuts. Another similar bolt was used at the bottom to pin the tower in place.

It goes without saying that the best grade of wood you can get should be used, within cost constraints, of course. Douglas fir was used as it was within my budget, available, and reasonably strong. Oak would be better, but probably out of sight costwise.

In the interest of aesthetics and neighborhood goodwill, I stained my tower with some dark oak stain which I had available. It was then covered with three coats of polyurethane spar varnish for weather protection. (The lower part of the 6 x 6 also was treated with a wood preservative before varnishing and received an extra three coats of the polyurethane varnish.)

Installation

Putting up the 6 x 6 was a simple matter—with the aid of three friends. It was dropped into the hole, centered, and guyed in a vertical position. I used approximately 1,000 pounds of concrete and allowed it to cure over about a week's time; then the tilt-over section was erected using muscle power (again, friends or a crane are necessary).

The method used was to place the base of the tilt-over section at ground level of the 6 x 6, where one person held it. A line was placed over the top of the 6 x 6 from a point above the pivot point of the tilt-over section and run out to another person, who pulled. Two others then were able to walk the tilt-over section up into position. The cross supports and the person at the bottom kept it from going past the vertical. It then was raised about a foot, and a ladder was used to climb to the pivot point and insert the pivot carriage bolt.

With the addition of a ro-

tator and the antenna, it is not easy to tilt the tower back to vertical. To help, I strapped a large cement block to the base of the tilt-over section as a counterweight. This helped ease the effort immeasurably. Future plans call for a small boat winch to be added at the bottom of the 6 x 6 for even easier raising and lowering. Another recommended addition is some form of guying as near to the top as possible, for protection in high winds. Using nylon lines to my house and two convenient trees, my tower has remained firm through some recent gusty winds of up to 60 knots.

My total investment for the tower was less than $100 (using some items on hand), which is a lot less than the $400 plus for a comparable commercial unit. It works, looks good, and best of all, I can say I made it myself. ■

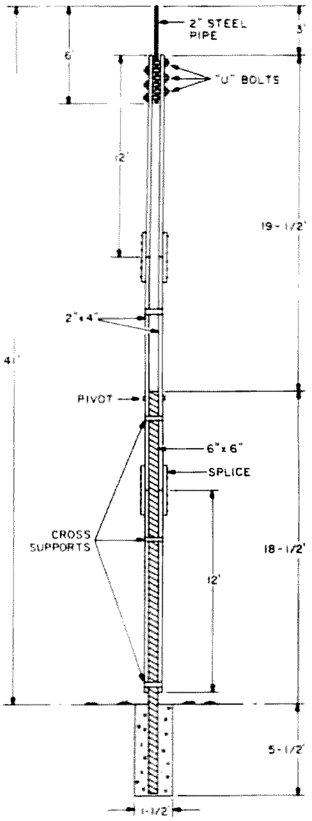

Fig. 2. Construction details.

✓ Reader Service—see page 195

The Two-Hour Audio Amp

—quick to construct, easy to use

Arvid G. Evans K7HKL
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Orangevale CA 95662

Do you ever have need for an audio output stage which can be assembled from your junk box, yet will provide several Watts of clean audio? This is not a weekend project—it should not take over two hours to assemble, test, and appreciate this unit!

The heart of the design is an op amp (preferably a dual type) and a complementary pair of transistors (2 A, 30 V) which do not need to be matched. If you have a selection of power transistors available, the two which exhibit the highest current gain will make life easier for the op amp, but anything with a gain of 40 or more is adequate.

Fig. 1 shows the basic design. The op amp is used as a unity gain driver for the complementary pair. This transistor pair is included inside the feedback loop of the op amp to minimize the crossover distortion introduced by the deadband condition which exists at 0 ± 0.7 volts. In fact, it compensates so well that you will find no visible crossover anomaly with your scope on the output! If you have looked closely, you already have noted that this circuit is dc-coupled in and out. There are no capacitors to affect the frequency response!

The design in Fig. 2 shows how gain may be introduced in the single op amp version. The conventional dual-supply layout is shown in (a), and (b) demonstrates a method of operation utilizing a single supply. The penalty paid for use of this single power source is that coupling capacitors must be used here for dc isolation. This increases the component count and allows the chance of freqency roll-off unless ade-

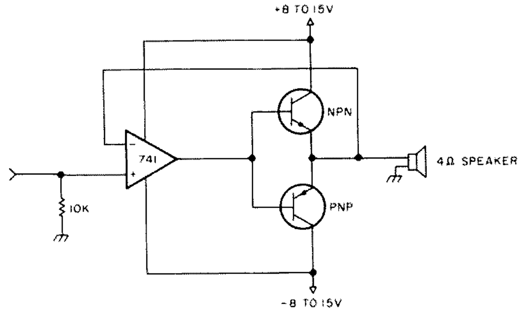

Fig. 1.

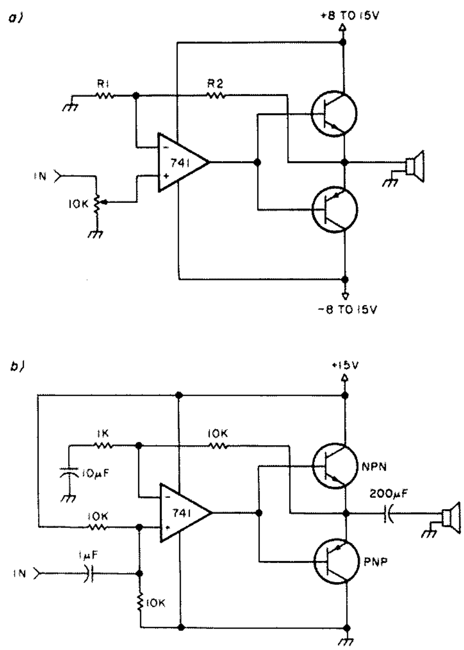

Fig. 2.

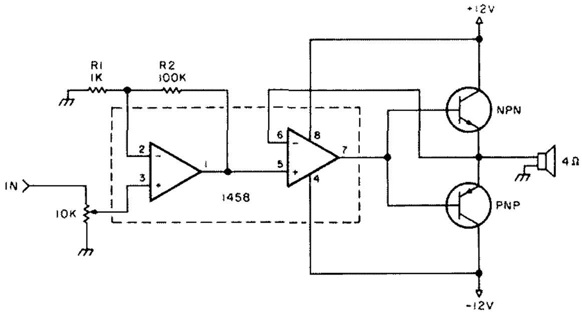

Fig. 3.

quate capacitance is employed.

Fig. 3 shows the method to which I have graduated. Since dual amps (1458 type) are becoming inexpensive and readily available, I use the first stage as a programmable gain unit and the second stage as the voltage follower/driver for the complementary pair.

Here at my location, you will find this circuit in several units including a signal tracer, two experimental receivers, and a heterodyne frequency meter.

If this has inspired your interest in this type of audio output stage (you will like the wide frequency response and unconditional stability), but you feel the need to upgrade to a larger unit, like 50 Watts, then you might contact Intersil, Inc. (10710 N. Tantau Ave., Cupertino CA 95014), for information on their ICL8063 power transistor driver-amplifier. ■

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Power × 2 . . . Plus!

—an improved two-battery auto electrical system

For several years I have used dual batteries in my Chevrolet van. In a short article in the February, 1979, issue of *73*, Harry Miller described a simple system for adding that second battery. The system I have used for over four years has some additional features which I have found to be handy.

The charging system is essentially unchanged from that described by Miller, except that my vehicle has a voltage regulator within the alternator. Fig. 1 reflects how the diode assembly and the second battery can be connected to this type of charging system.

I have a half-dozen electronic devices in my van, including three rather power-hungry General Electric Progress Line™ transceivers, and more than once I have experienced the inevitable by forgetting to turn one of them off. Besides, I hate to spend ten minutes or so turning all of my radios on and off each time I enter and exit the vehicle.

To allow all of my equipment to be turned on and off with the flick of a single switch, I installed a solenoid-type relay (K1, Fig. 1) with the contacts placed in series with the output of the second battery (B1) ahead of the radio equipment. The positive terminal of the coil of the relay is connected to a switch (S1) at a convenient location in the vehicle, and S1 is connected to the positive terminal. Make S1 a key-operated switch, and the key can be removed at car washes, garages, etc., to prevent unauthorized use of the equipment as required by FCC regulations!

I also placed a red panel light (L1) in the dash and wired it, as shown in Fig. 1, to indicate when power is on. If that is enough to remind you, great! It wasn't enough for me, so I added an audible warning device (Z1) to the circuit so that if the radio circuits are energized when the driver's door is open (S3 closed), the device will give me a not-too-gentle warning. Any kind of buzzer or other alerting device can be used—I used a small 12-volt buzzer marketed by Radio Shack. An automotive buzzer of the type used for ignition-key-removal warning can be used if you prefer a softer warning. For those who need something guaranteed to wake the dead, a Sonalert™ would be perfect.

Other interesting additions for those who like extra gadgets would be two ammeters, one in series with each line from the diode assembly to each battery, and a voltmeter connected to each positive battery terminal so that the respective status of each battery can be monitored.

Now that you have your second battery to keep your radios from running down your primary vehicle battery, the first thing you'll do is leave your headlights on and run it down anyway! It's embarrassing to have a fully-charged secondary battery and no jumper cables to start your car. While you are wiring in that second battery, therefore, buy a Ford starter relay (K2) and connect it in series between the positive terminals of B1 and B2.

Theory says that the connection between the two batteries should be as short as possible and that the wire used should have the same or a larger cross section than that of the original battery cables. My secondary battery is mounted just ahead of the left rear wheel, and the original battery is at the right front of the vehicle, requiring a cable run of 12 feet. The cable I used was a #2, and I have had no problems with that installation. As with K1, the positive terminal of the coil of K2 is

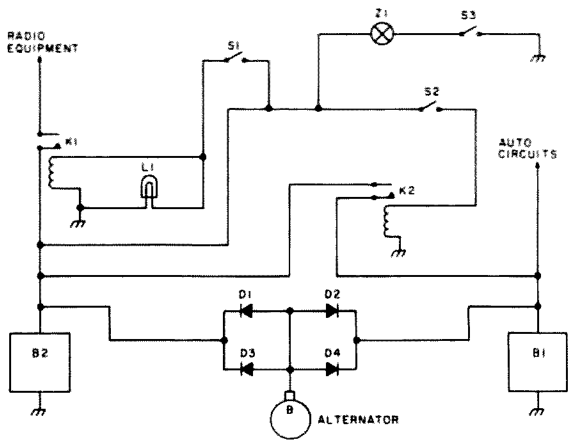

Fig. 1.

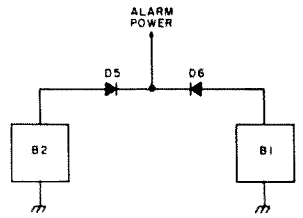

Fig. 2.

connected to switch S2, and S2, in turn, is connected to battery positive. A momentary switch must be used to avoid the possibility of forgetting to disconnect the batteries after starting. Now you have a space-age backup system, and it may be hoped that you never again will have to get a boost from someone else on those cold winter mornings.

If your vehicle has an alarm system, a diode arrangement as shown in Fig. 2 will provide full power to the alarm even if only one battery has a charge, or if a thief disconnects one battery! A note of caution if you don't already own a second battery and plan to buy one: If a standard auto battery is repeatedly and fully discharged, the plates will warp and the battery will soon be useless. The best battery for use as a secondary is one sold for that purpose; it's called a "deep-cycle" battery. The deep-cycle battery is made for recreational vehicles and fishermen's trolling motors, and will stand use and abuse much better. ■

Parts List

D1-D6 – Silicon diodes, stud-mounted, 60 piv, 25 Amp
S1 – SPST toggle switch or key-operated SPST
S2 – SPST normally-open, momentary, push-button
S3 – SPST normally-closed, dome-light switch
K1 – Any heavy-duty relay rated 25% above the maximum current draw of all radios used
K2 – Ford solenoid-operated starter relay, Borg-Warner S-63 (or any heavy-duty relay rated 100 Amps or more)
B1 – Original battery
B2 – Deep-cycle secondary battery
Z1 – Buzzer – Radio Shack #273-051, #273-060, or Sonalert™.

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The Little Thinker

—a quick puzzle project

Photos by Kris Thorp

Back in '62 (when we lived in New Jersey), one summer evening I met my dad at the bus stop. He worked in New York City, and he always gave me a smile as he got off that bus.

That night, I got more than his smile. He brought me a book—green, black, and white cover, paperback, Gernsback Library No. 70.*

"Thought you might enjoy this; picked it up in Port Authority," Dad said. "It's titled *Electronic Puzzles and Games*. What do you think?"

Now, to be honest, a twelve-year-old would rather covet a large silver box of Big Bang Roll Caps, an old piece of mechanical gadgetry his office was discarding or that a building handyman "donated," or additions to the foreign coins I had squirreled away that he had gotten in change at Nedick's or Chock Full o' Nuts, but a *book*? I thanked him and thumbed through the stiff, heavy pages.

I read the book at the dinner table. You made the game boards from wood, the switches from tin cans, and the buzzers and bells from magnet wire wound on a large bolt. The games were simple but devious and could outwit a grown-up. That book started to look real good as its pages frayed.

After eating, I was down in the cool basement hunting up the components of the game that really had me dreaming. It was "The Little Thinker," and the introduction read like this: "An interesting type of puzzle in which the player is pitted against the puzzle and where specific moves must be made by the player in order to win. The player has a choice of removing one, two, or three pegs at a time. When he has done so, the machine will indicate how many pegs it wants removed. Whoever is left with the *last* peg loses."

I was hooked! I read on. "Either the player or the machine can have the first move. If the player moves first, he removes up to three pegs, as desired. He then depresses the button at the bottom of the panel. One of the lights at the right (marked one, two or three) will then light up, indicating the machine's choice. The number of pegs requested by the machine are then removed. The player then removes his selection of pegs and again depresses the button to indicate that he has made his choice. This continues until either the player or the machine is left with only one peg."

The machine was diabolical, though, and you really only had one chance to win, but this wizard of tin and wood and telephone wire wouldn't give you the pleasure. It would "know" before you and it were half way through and lit a Concede lamp!

By sundown I had sawed up a berry crate from the Newark Farmers' Market for the game board, located the spider's nest of telephone wire scraps Dad had brought home from the office one day, and borrowed tin snips from a neighbor to transform a Hi-C can into switches. The nuts, bolts, and wood screws (no two the same) were found under the workbench in my kid brother's used baby food jars.

The only things I bought

Electronic Puzzles and Games, Matthew Mandel, Gernsback, January, 1961.

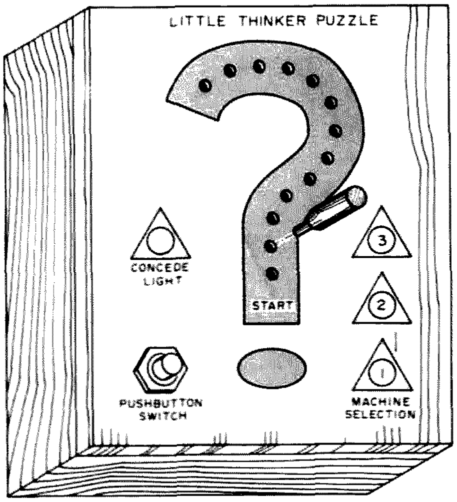

Fig. 1. Little Thinker Puzzle.

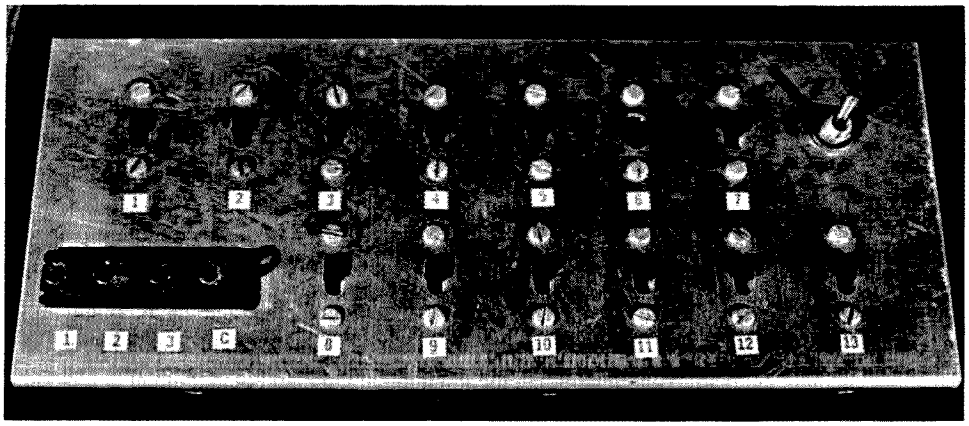

Photo A. The Logic Game.

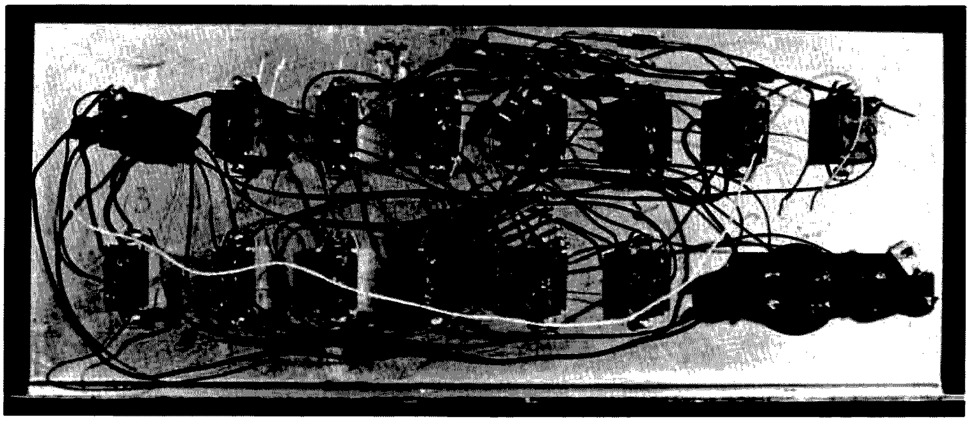

Photo B. Rear view of the Logic Game.

were the bulbs, sockets, and a piece of wood dowel from the lumberyard (for the pegs). The holes for the pegs were drilled by Dad with bit and brace; otherwise I flew solo. It wasn't the fanciest little thinker, but we had fun!

The book never lost its appeal for me, and years later while I studied digital electronics, it stimulated a game using the same principle with an integrated circuit as the "brain." Of course, the game board was done on a milling machine, the switches slide now, and the bulbs and start button are up to military specs. The integrated circuit sits in a wire-wrap socket, and the resistors are low-noise types. However, you can make the game in a cigar box with the ingredients from a "grab bag" and it'll still work. In fact, if you have a berry crate and a Hi-C can . . .

Play the game using Matthew Mandel's instructions for the original game. Use LEDs with a 300-Ohm (or thereabouts) current-limiting resistor, if you can't scrounge 5- or 6-volt low-current lamps. I would try to stay close to the 330-Ohm hold-down resistors on the inputs of the 7438 IC. You can use any switches that will electrically move one contact (or pole) between two others. Single pole-double throw slide switches are fine and cheap.

The normally open switch (NO) starts the game and chooses how many switches to slide down for the machine. If you want to go first, slide down one, two, or three switches and push the start switch for the machine's choice. Push the switch first if you want the machine to move first, and push down the number of switches it requests.

You can't win if you go first, but I should have let you find that out! If you are going to win, the Concede light will admit that you're good . . . or just lucky?

By building the game you will learn about ICs, but by playing it I'll confess you'll only have fun! ■

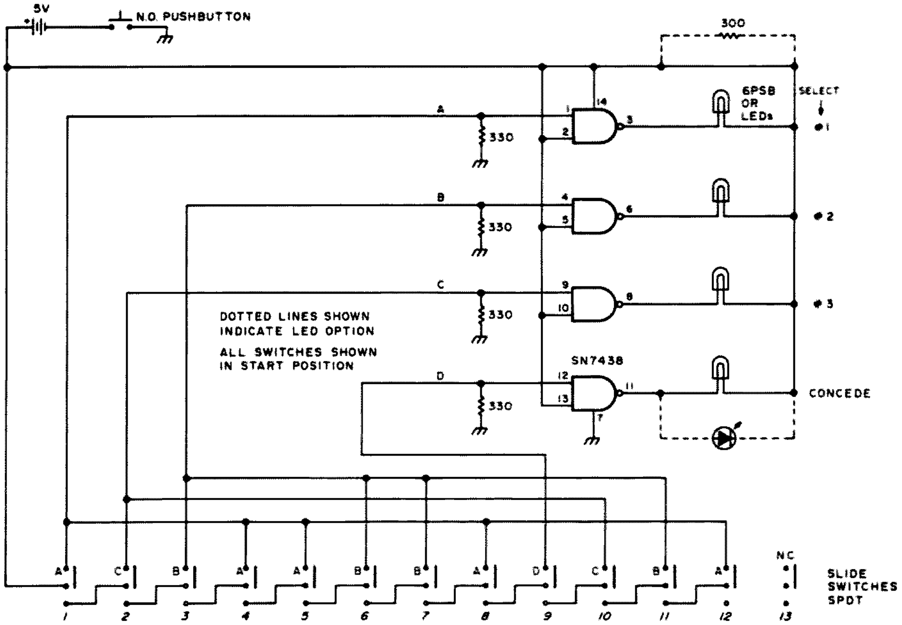

Fig. 2. Logic Game circuits.

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A Conversion with Gusto

—throw your weight around on six

It is my observation, after DXing on 50 MHz for several years, that the most likely way to be enthralled by what may be achieved on VHF is to erect the largest, highest antenna possible and then run a kW into it. Honestly, there is no way one can fully appreciate the 50-MHz band, especially during this peak in Cycle 21, without running QRO. As I write this, six meters is open from the eastern US to Europe—as it has been nearly every day for the past several weeks—and in another few hours we'll be hearing W6s and KL7s. A few hours after that, the West Coast gang will be working JA. The fellows running kilowatts will be the ones heard longest and best, to be sure!

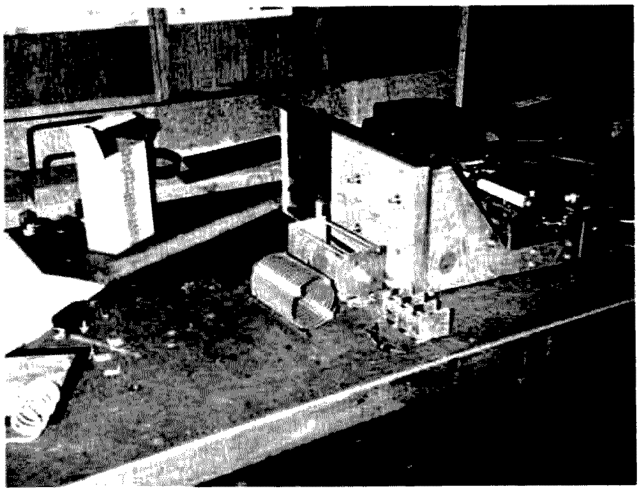


Photo A. The NCL-2000 with old tank components removed.

Even during quiet sun years, a kW and a large antenna allow one the privilege of working long-haul tropo nightly, and meteor-scatter work, one of my favorite pastimes, is a breeze with high power.

Although I have built a few high-powered VHF amplifiers from scratch, I cannot avoid being intrigued by the prospect of modifying commercially available gear to operate in the six-meter band. One superbly suited amplifier which is owned by dozens of hams here in the Northeast (and hundreds nationally) is the now-extinct National NCL-2000, marketed for several years as a companion amplifier to the famous NCX-5 transceiver. The NCL-2000 is a husky amplifier capable of running 1-kW dc input power nearly indefinitely; this, coupled with the fact that the original design calls for RCA 8122 tetrodes, forced-air cooled, external-anode types rated for full input to 500 MHz, compelled me to use an NCL-2000 as a well-conceived frame around which I could build a 2-kW PEP amplifier for 50 MHz.

Once I commenced the modification, I found it to be extraordinarily uncomplicated, and the completed, modified amplifier worked so well that I could hardly keep the news to myself!

As NCL-2000 amplifiers seem to be readily obtainable second-hand at very reasonable prices (the one purchased for this modification was about $300 in 1972), I would recommend that the prospective six-meter QRO operator purchase one with the sole intention of converting it for 50-MHz use. Following is a complete, step-by-step procedure for those fellows who really wish to be heard on six meters.

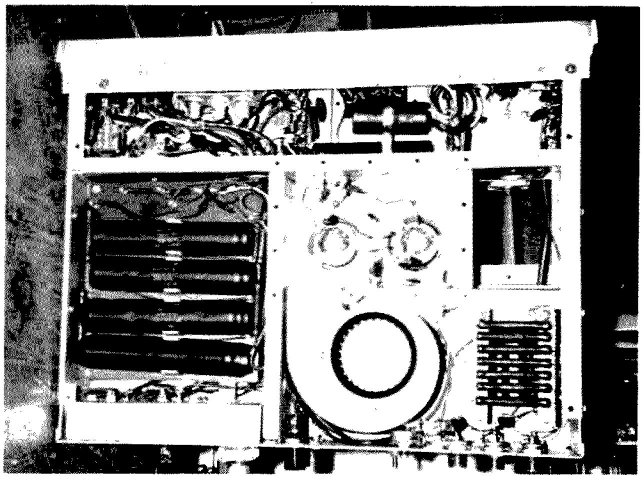


Photo B. NCL-2000 bottom view. The screen bypass caps, C24-C29, must be replaced.

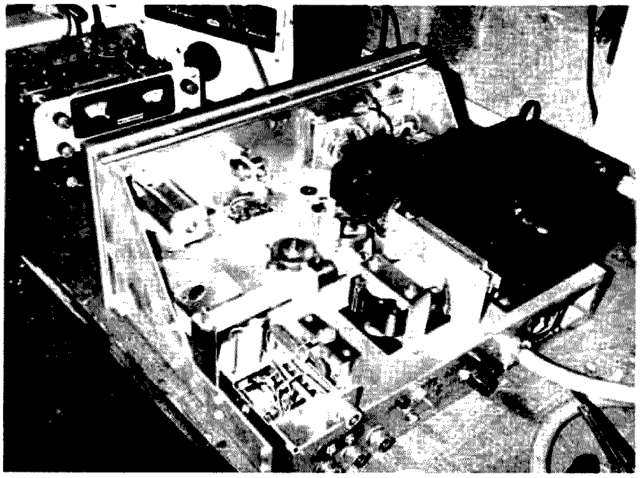


Photo C. The new plate-tune and -load capacitors and modified choke L2 are installed.

1. Completely remove the entire amplifier plate-tank circuit assembly, including C42 (Plate Tune), C43 (Plate Load), and L4. Also remove bandswitch S5 and auxiliary loading "doorknob" capacitors C45, C46, and C47.

2. Remove Z1 and Z2, the plate parasitic suppressor assemblies. Temporarily remove the 8122s (V1 and V2) and the delay-relay tube (K4) and store in a safe place. If necessary, polish the 8122 anode areas with silver polish such as "Twinkle" silver cleaner. The same may be done for the 8122 plate connector rings, if they are very discolored. Remove and store the 8122 ceramic chimneys in a safe place: They are fragile.

3. Carefully remove the plate choke (L2) by dismounting it from its brackets and unsoldering both end connections.

4. Unwind choke L2 carefully, leaving only ¾" of winding on the ceramic form. If you have access to an inductance bridge, then measure the inductance of L2. It should be about 15 uH, but this isn't very critical. Store L2 for future installation.

5. Unsolder and remove C24 through C29, the six 500-pF, 1-kV ceramic screen bypass capacitors; be very careful not to damage the tube sockets or pins.

6. Install six new 220-pF, 1-kV ceramic disc capacitors in place of the six just removed. Use high-quality X7R dielectric capacitors; avoid type Z5U or Y5V or other very high-K dielectrics, as they tend to drift in value with temperature and age. Use the shortest possible leads on these capacitors! I was able to clip off all but 1/8" of each capacitor lead and still install the new bypasses satisfactorily. If you can see the capacitor leads after the parts are installed, they are too long!

7. Inspect your work thus far: You should have removed *all* original plate-tank circuit wiring. There should be nothing mounted to the front panel but the meter function switch, S4, the meters, power switches, and indicator lamps.

8. Clip off any remaining bus wires interconnecting components in the 8122 plate area. The chassis in the original plate-tank area should be bare but for a few ceramic standoff pillars and the bias-regulator transistors, Q1 and Q2. Be sure you have removed the shaft which originally coupled to the Plate Load capacitor, C43; in fact, you may now remove the panel bearing, as it will not be used.

9. Install three #6 solder lugs beneath the blocking capacitor, C48 (a .001-uF, 5-kV "doorknob" type). Reinstall C48, screwing it tightly into its ceramic pillar. Atop C48 install one #6 solder lug with the lug body facing the front panel, and tighten a #6 ¼" screw into the top of C48.

10. Reinstall the 8122 plate rings after fitting a ceramic chimney above each socket between the ceramic pillars. Under each #8 bolt head (those which hold the plate rings to the ceramic standoff pillars) install a #8 solder lug.

11. Remove and discard the plate-ring clamping screw assemblies (which consist of a long #6 bolt, a short metal pillar, and a wing-nut). Use in their places a #6-32 ½" plated bolt and lock-nut for each ring assembly.

12. Install plate choke L2 in the same manner as it was originally installed, dressing the high-voltage feed end along the ceramic form down to the high-voltage feedpoint which is the junction of R43 (15 Ohms, 12 Watts) and C44 (.001 uF, 6 kV). Strip the new end with a sharp knife, tin the exposed conductor, and solder to the high-voltage feedpoint lug near the high-voltage interlock. Then use "Q-Max," or high temperature coil dope, to hold the remaining choke winding in position.

13. Use #20 bus wire to connect the tube end of L2 to one of the three solder lugs beneath C48, the plate blocking capacitor. Using ¼" wide copper strap or the braid from RG-58/U, complete the connections from the other two solder lugs to the two 8122 plate-ring solder lugs nearest the center pillar. Keep these straps fairly short; mine were about 1" long.

14. Install an E. F. Johnson-type #167-12, 200-pF variable capacitor in the hole previously used for the plate-tune capacitor, C42. Install a Hammarlund MC-20-SX, 20-pF, 2.5-kV variable capacitor in the hole previously used for the bandswitch, S5. Be sure to use internal-tooth lockwashers on both capacitor bushings, and tighten bushing nuts until they're *very* tight. Note: The capacitors called for here are not the only types which will work, but they *do* work well, and I happened to find them at a local flea market. Avoid large, bulky, air-variable caps such as those originally used by National for 80-10 meter operation, as they tend to cause prob-

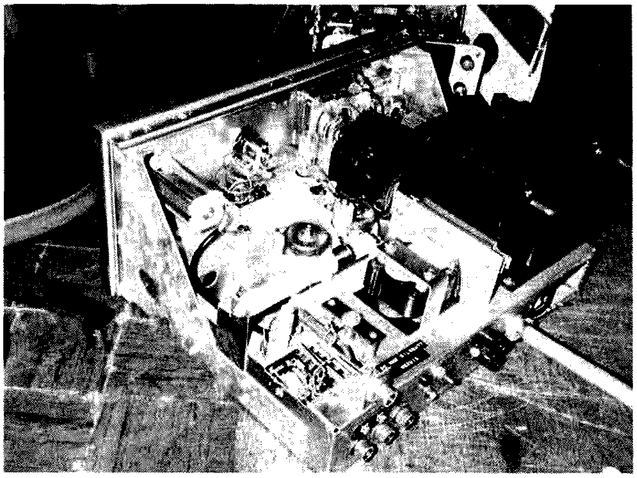


Photo D. The tank inductor, output straps, and output cable (connected to plate-load capacitor) are installed.

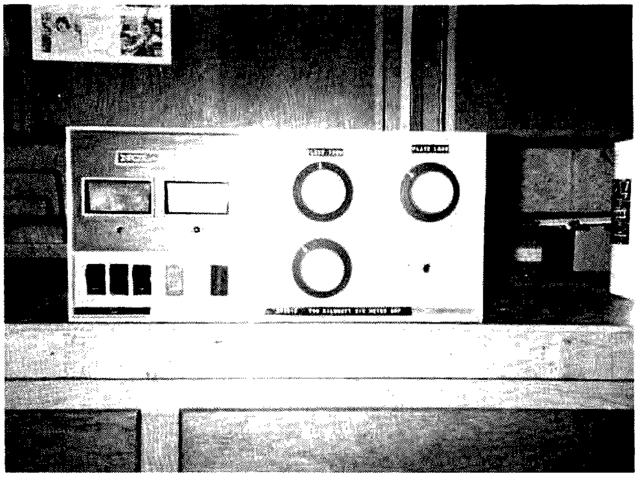


Photo E. Front panel of six-meter kilowatt. Plate tune is on the left, plate load on the right. You can always cement a knob over the remaining hole!

lems with parasitic resonances, intermittent ground paths, etc. A pair of 3" teflon-insulated copper or brass discs would be a good substitute for the MC-20-SX.

15. Install the plate conductor as shown in the photographs, from the top of C48 to the right-hand (as viewed from the rear of the amp) stator lug of the MC-20-SX plate tuning capacitor. This conductor should be at least ¼" wide strap, about five inches long. I used the flattened braid from RG-59/U; the braid from RG-8/U might be a better choice. Half-inch wide copper flashing also would work well.

16. The plate inductor may now be built; mine is 3¼ turns of #10 solid copper wire, 1½" diameter, 2½" long. This size coil, used with the capacitors specified, will resonate the plate tank at about 50 MHz. My design values for the tank circuit were for an output impedance of 50 Ohms and a Q of 12. These goals were obtained with the subject amplifier. For *your* final trial, install the 8122s in their sockets and tighten plate-ring assemblies. Install the tank inductor, soldering it between the stator posts of the new tuning and loading capacitors. Allow the coil to self-support, hanging in the air about three inches above the chassis. Check tank resonance by setting the plate-tuning capacitor at mid-range, then coupling a gdo to the tank coil; tuning the plate-loading capacitor through its range should yield a dip at about 50 MHz. Spread or compress the turns of the tank inductor until the plate-tuning capacitor can resonate the tank above and below 50 MHz. You may wish to use a larger conductor than #10 wire for the tank coil; I suggest using nothing smaller. A good hint regarding the dimensions of the inductor: Use a winding length that does not much exceed the winding diameter, to keep Q high.

17. Solder the output coaxial cable to the stator post of the new plate-loading control and a nearby ground lug. Install delay-relay tube K4. Check all wiring. *Install amplifier chassis in its cabinet before attempting to apply plate voltage!* The interlocks will only blow fuses, anyway.

It should be mentioned that the NCL-2000, with its passive grid circuit, may create high IMD products if overdriven; also, its rf second and third harmonics will be disgracefully high (down less than 20 dB) if the grids of the 8122s are driven to conduction. This is typical of any class AB2 amplifier, and for this reason I recommend operation in the AB1 region only (no grid current). The slight increase in output power derived from class AB2 operation is not worth the troubles which might be created, both with your fellow hams for in-band "splatter," and with your neighbors for TVI.

Running the modified NCL-2000 at 50.1 MHz into a Heath "Cantenna" through a Bird model 43 coupler/meter using a type 1000B slug, I recorded the data shown in Table 1. It works!

Note that the 80 Watts drive power does not appear at the 8122 grids; the NCL-2000 has an internal resistive attenuator which absorbs most of the signal. I used a Heath SB-110A transceiver as the exciter for these tests, and it happens to have 80 Watts output. Any exciter in the 25-to-100-Watt (output) region should work quite well.

Remember to keep grid current low (0 to 1 mA) for the nicest sounding signal, and keep screen current low (per NCL-2000 instruction manual) to ensure long tube life. You may note that the new plate-load control has quite an effect on screen current; tune it for the most output which coincides with the lowest possible screen current. In the model amplifier, I was able to achieve over 700 Watts rf output with nearly no screen current.

I invite further inquiries related to this article and shall be glad to help prospective builders in any way I can. Unfortunately, the amplifier I modified does not belong to me, so it is no longer available for me to look at; however, the memories of this modification are vivid enough so that I probably can be of help to anyone needing it.

Good DXing on six! ■

SSB/CW Switch	SSB
E_p	2.8 kV no-load/2.2 kV full-load
I_p	225 mA idling/535 mA driven (2-tone)
I_g	0
I_s	5 mA (driven)
P_{in}	80 Watts to rf connector
P_{out}	760 Watts rf

Table 1. NCL-2000 controls/meter readings.

Jim Hyde WB4TYL
511 Izlar Street
Waycross GA 31501

The Confidence Builder

—a CW speedometer

So you've been building your code speed by copying signals "off-the-air"? But you can't get W1AW much because of QRW or perhaps you have to be elsewhere while the code-practice session is on? How will you ever know just how fast you are, or whether you're quite ready to face the examiner?

Why don't you try this little fun box—my "Confidence Machine"? It not only is an excellent code-practice oscillator, but it also can tell you the number of words per minute being sent or received. On top of that, it filters out pops, snorts, whistles, roars, and other background noises so that you hear only an easy-to-copy, clean musical tone. If you can get the signal at all, you'll hear only 599s from each station.

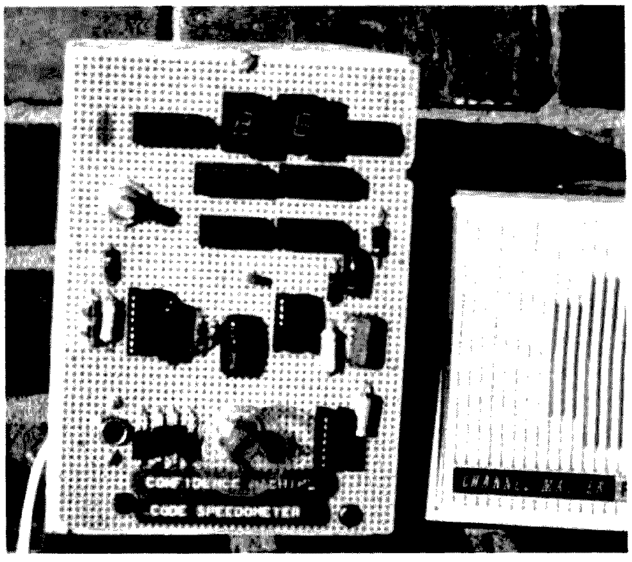


Photo A.

Even more, once the parts are assembled, this is a one-evening construction project with a cost running less than $10 if you use your junk box. The values of the resistors and capacitors are not sacred, so if your junk box has something within 25%, use it. An assumption has been made that the people most interested in building this project will be Novices or Techs looking for their General tickets. For this reason, construction details are kept as simple as possible. Also, there is no attempt at scholarly discussion about how everything works. Just build it and have fun!

How It Works—An "Unscholarly" Discussion

The Confidence Machine is a simple counter which counts the number of taps of the key and then translates the count into words per minute. In sending everyday English by Morse code, you must tap the key an average of 2½ times for each letter and 12½ times for each average 5-letter word. Count the taps for a minute, divide by 12½, and you have the number of words per minute. (Sounds like that old Texas joke about the midget who figured the number of cows in a herd by counting legs and dividing by 4!)

Design of an electronic device that will divide numbers by 12½ is complicated, but dividing *time* by the use of a 555 IC timer is easy. This means that we can divide a minute by 12½, and the number of taps during this shortened period represents the number of words per minute.

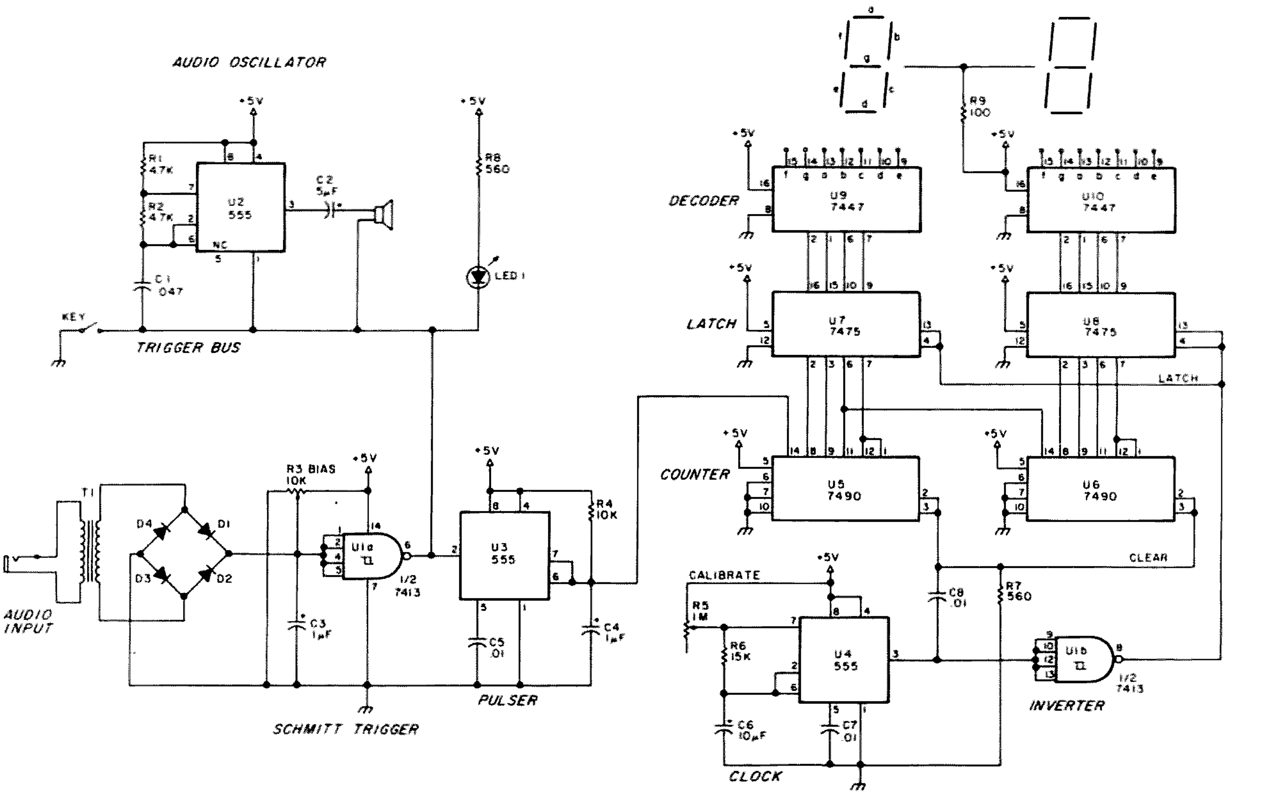


Fig. 1. The "Confidence Machine," a code-practice oscillator with code speedometer.

(Don't spend a lot of time trying to think about that, George. Just trust me and read on.)

We can count either the taps of the key or the bursts of CW tone from a receiver. If we are going to count the dots and dashes coming out of a receiver, we'll need something which will convert each burst of sound into a single electrical pulse. Since the receiver puts out varying levels of alternating current at the phone jack, we can rectify this current and apply the positive pulses to the input of a NAND gate Schmitt trigger. The Schmitt trigger can then trigger the audio oscillator and the pulser the same as a key does. (A NAND gate is an inverter. If all inputs are positive, the output is zero—it turns off. But if any one of the inputs is zero, the output is positive—it turns on.)

So, when we apply a positive pulse to the input of the NAND gate Schmitt trigger, the output drops to zero (ground), triggering both the audio oscillator and the pulser. The audio oscillator produces a tone, and the pulser produces a positive pulse which goes to the counter chain.

Each of the counter chains has a decade counter, a latch (for temporary storage of the count), and a BCD-to-seven-segment decoder (to translate the binary-coded count into a readable number in the display).

The decade counters are controlled by pins 2 and 3. They will count when either pin 2 or 3 is at ground, and they will clear when both pins 2 and 3 are made positive. In a similar fashion, the latches are controlled by their pins 4 and 13. A positive pulse at these control pins causes the latches to store or remember what the count was at the time the positive pulse arrrived. A second pulse will cause the latches to forget the previous count and store a new count.

The pulses which cause the counters to clear and the latches to store the count are generated by the clock (U4). This is a 555 IC timer set up to deliver a positive output for 4.8 seconds followed by a drop to zero (or ground) for about .1 seconds. As the output of the clock goes positive, a positive pulse is delivered to the control pins of the counters (through C8), clearing the counters. The voltage to the control pins immediately drops low through R7 and the counters are able to start counting again.

Part of the output from the clock is fed to the inverter, shown as U1B. A positive input to a NAND gate causes a zero output from the gate. On the other hand, a zero input causes a positive output. During the tenth of a second that the clock has a zero output, the output of the inverter is positive. This positive pulse is delivered to the control pins of the latches and the count is stored.

The combination of all this action causes the device to count continuously, and at the end of each 4.9-second period, it will display the count made during the previous period.

The LED tied to the trigger bus serves no really useful purpose, but it does provide visual monitoring. You may want to eliminate it, but every science-fiction movie fan knows that all computers are supposed to have blinking red lights on the front. Besides, it does look impressive when you're showing off to visitors in the shack.

Construction Hints

Construction should begin with the power supply. The requirement is for about 240 mA at 5 volts. ICs in the 7400 series require at least 4.5 volts and simply will not operate if the

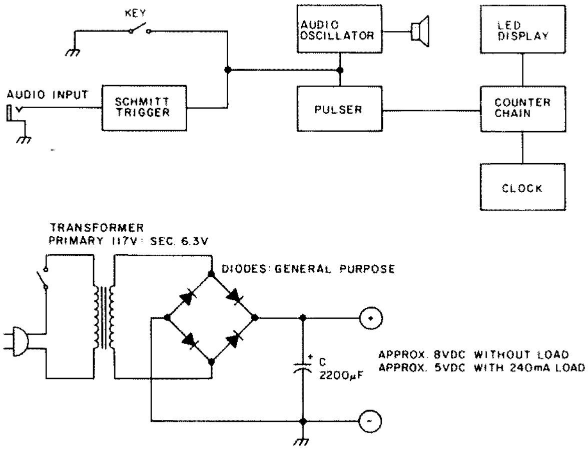


Fig. 2.

Parts List

Component		**Price***
R1,R2	4.75k Ohms, ¼ Watt	5 for .25
R3	10k Ohms, variable (trimmer MDL TR11)	.35
R4	10k Ohms, ¼ Watt	5 for .25
R5	1 megohm, variable (trimmer MDL TR11)	.35
R6	15k Ohms, ¼ Watt	5 for .25
R7,R8	560 Ohms, ¼ Watt	5 for .25
R9	100 Ohms, ¼ Watt	5 for .25
C1	.047-uF disc	5 for .30
C2	4.7 uF/16 V	.14
C3,C4	1 uF/16 V	2 @ .15 = .30
C5,C7,C8	.01-uF disc	5 for .30
C6	10 uF/16 V	.14
D1-D4	diodes 1N4006	10 for 1.00
U1	SN 7413 dual Schmitt trigger	.40
U2,U3,U4	LM555 timer	3 @ .39 = 1.17
U5,U6	SN7490 decade counter	2 @ .45 = .90
U7,U8	SN7475 quad latch	2 @ .49 = .98
U9,U10	SN7447 BCD-to-7-segment	2 @ .59 = 1.18
Readouts	MAN-81 common anode	2 @ .99 = 1.98
Speaker	2"-3" Radio Shack 40-247	1.89

Options

LED 1	LED monitor may be any small LED	
Perfboard	.10 spacing 4½ × 6, Radio Shack 276-1394	1.29
Input Transformer	Radio Shack 273-1380	.99
IC sockets:	8-pin wire-wrap	3 @ .39 = 1.17
	14-pin wire-wrap	3 @ .39 = 1.17
	16-pin wire-wrap	4 @ .43 = 1.72

Parts for Power Supply

Filter capacitor	2200 uF/16 V	
Filament transformer	117/6.3 V Radio Shack 273-1384	1.99
Diodes—any general-purpose diodes		

*Except where Radio Shack parts are specified, all prices are from the 1979 catalog of Jameco Electronics, 1021 Howard St., San Carlos CA 94070. (Add 5% for shipping and 75¢ for insurance. Minimum order, $5.00.) Delivery time 8-10 days.

Keep your cost down by substituting when possible. For instance, you need only one of the .047-uF disc capacitors, but you must order a minimum of five. Use the balance of them for C5, C7, and C8 instead of the .01 uF called for. Also, the Radio Shack catalog lists ½-Watt resistors at 2 for 19¢. This is a slightly higher cost per resistor, but you can buy a minimum of two.

voltage rises much above 5.5 volts. Despite this narrow operating range, the power supply need not be complicated. Four C or D cells in series will do, or you can make a power supply from a 6.3-volt filament transformer as shown in the drawing. Use just about any general-purpose diodes in the bridge rectifier. (You can probably get a package of a dozen or so for a dollar at Radio Shack.) The filter capacitor need not be exactly 2000 uF; use whatever you have that's close.

The measured output from the power supply above will be about 8 volts without a load. However, under the load presented in this device, the output drops to a little over 5 volts.

The power supply should be mounted on the base of the cabinet. Be sure to leave room for mounting a small input transformer—as will be discussed later.

Construction will be greatly simplified by using a perforated board with .10-inch spacing. The ICs can be mounted on this board without drilling. The input terminals, the speaker, the readouts, and the LED monitor will need to be mounted on the face of the cabinet. In my own construction, I used the perfboard as the face of the cabinet and mounted everything in plain sight.

However you may decide to do it, you may lay the parts out in much the same configuration as is shown in the schematic. You will need to provide for three common points of connection: a positive bus, a negative or ground bus, and a trigger bus.

Except for R5 and C6, the values of the resistors and capacitors may be varied up to 25% without seriously affecting performance. Use your junk box. I strongly recommend the use of IC sockets. They make construction and troubleshooting much easier. The wire-wrap type of socket is slightly more expensive, but it is easier to work with.

The cheapest way to provide for the input is to leave wires hanging from the two inputs which then may be connected to the key or the receiver. The wire for the input from the receiver should be provided with a plug for the phone jack of your receiver.

The input transformer (T1) is a voltage step-up transformer and may not be needed with your receiver. Measure the output voltage at the phone jack of your receiver by inserting a phone plug connected to your volt ohmmeter. Tune a CW signal. If you have at least 3 volts peak ac at the phone jack, you may eliminate the input transformer, but better performance will be obtained from all receivers if the transformer is used. If a transformer is needed, use any step-up transformer you have. I used an output transformer from an old receiver, connected backwards so that it stepped up the voltage.

The bias control (R3) and the calibrate control (R5) need be set only once, so they may be mounted inside the cabinet.

Put a 100-Ohm resistor in series with the common anode or common cathode of the LED displays. Be sure to determine whether you are using a common-anode or a common-cathode type of display before ordering your BCD-to-seven-segment decoders. A common anode requires a 7447 and a common cathode requires a 7448. Of course, the common anode is tied to the positive bus (through the limiting resistor) and the common cathode is tied to the negative bus (through the limiting resistor).

The choice of LED displays should be governed by cost and availability. The MAN-71 (red) or MAN-81 (yellow) fit nicely into a 14-pin IC socket and

cost about a buck each. The FND-70 costs about 70 cents, but is available only in the common-cathode type.

Calibration and Operation

Turn the power on and rotate the bias control (R3) until a continuous sound is heard from the speaker. Then reverse the rotation of the bias control until the sound just stops. Leave the control set here.

If no tone is heard, check wiring to U1 and U2. If the volume is too low, increase the value of C2; if it is too high, decrease the value of C2. If you desire to raise the pitch of the tone, you may place another resistor in parallel with R2.

Connect a key to the key input and tap it a few times. There should be an audio output and a reading should appear. After a few seconds more, the reading should drop to zero. This indicates all systems are working.

Begin tapping the key with a steady rhythm, counting the taps for a full minute. Multiply the count by .08 and this will be the number of words per minute. (For instance, if the count is 77, multiply 77 by .08 to arrive at 6.16 or 6 words per minute.) Again tap the key with the same steady rhythm and rotate the calibrate control (R5) until the readings correspond to the computed words per minute. (Using the above example, the readings should show 6. If the machine is set perfectly, and if the timing of the taps is perfect, the machine should read 6 most of the time. But, since we obviously are not dealing with exactly 6 wpm, the reading should jump up to 7 a couple of times during the test minute.) You can get better calibration by trying several times at different speeds.

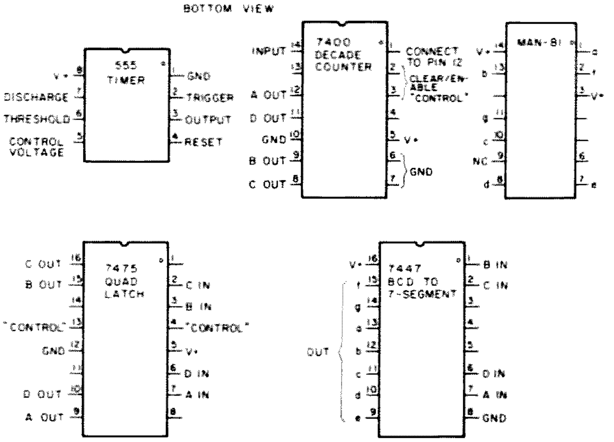
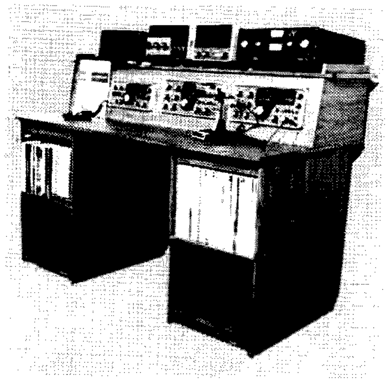


Fig. 3.

Now turn on the receiver and tune a good CW signal. Connect the receiver input of the Confidence Machine to the phone jack of the receiver. Start with the volume low and increase it until you begin hearing clean dots and dashes. Too high a setting of the volume will cause a continuous tone and also cause the trigger to be tripped by noise. This gives a false count. So keep the volume as low as possible.

The Confidence Machine is intended to be a learning tool only, and it is doubtful if it can be used in an actual QSO. However, it is fun to build and is certainly fun to use. Try it; you'll like it! ■



Contests

from page 20

families shall not be eligible to participate herein.

WASHINGTON STATE QSO PARTY
0100 GMT September 13 to 0700 GMT September 13
1300 GMT September 13 to 0700 GMT September 14
1300 GMT September 14 to 0100 GMT September 15

The fifteenth annual contest sponsored by the Boeing Employees' Amateur Radio Society (BEARS) is divided into 3 operating periods as shown. All amateurs are invited to participate. Use all bands and modes, but no CW QSOs are allowed in the phone bands. Stations may be worked once on each band and mode for contact points and more than once each band/mode if they are additional multipliers.

EXCHANGE:

QSO number, RS(T), and state, province, country, or Washington county.

FREQUENCIES:

Phone—1815, 3925, 7260, 14280, 21380, 28580; CW—1805, 3560, 7060, 14060, 21060, 28160; Novice—3725, 7125, 21150, 28160.

SCORING:

Washington stations score 2 points for each phone contact and 3 points for each CW contact, including contacts with other Washington stations. Multiply QSO points by the total number of different states, Canadian provinces, and other foreign countries worked. All others score 2 points for each phone contact and 3 points for each CW contact with a Washington station. Multiply QSO points by the total number of different Washington counties worked (39 maximum). There will

Results

RESULTS OF THE 1980 MARAC COUNTY HUNTERS SSB CONTEST

Fixed Station Scores

N7TT/2	4,469,304
K1NWE	3,820,064
AG9S	2,069,262
WA3YEY	1,555,200
WD5EYM	1,466,059
WD4FGW	960,918
K5IID	603,120
W3ARK	280,434
WB3CFD	263,493
W7JYW	239,760
VE1RQ	206,976
K9DAF	199,906
N8BGF	117,420
WAØRJJ	49,470
WA2WCW	30,960
WB8MDG	8,723
WD8QOY	5,130
WB9SMU	4,104
WB8WEZ	1,955
K9GTQ	1,491
K9GDF	333
K5XY	250

Mobile Scores

N4UF	575,340
WØQWS	343,295
WB5BBS	234,360
K3KX	135,125
W5VQR	131,376
W4OWY	54,240
WB4FBS	27,186
VE3IR	1,566
K4ZT	1,554
W1EXZ	540
K9DAF	243

DX Scores

WB5KEA/KP4	1,787,832
G2AFQ	206,778
I2PHN	83,681
VK4VU	72,900
CT4SL	9,460
JH1BBU	6,322
SMØCHA	2,600

Results

RESULTS OF APRIL 1980 QSO PARTY SPONSORED BY QRP ARCI

State/ Prov./ Country	*Call*	*Points*	*Mult.*	*Score*
Ala	K4JXS	69	16	5,520
Ark	AD5F	116	28	3,248
Cal	WA6POC*	359	81	87,237
Col	WBØQQW	151	37	16,761
Conn	WA1TRY	150	38	33,500
Del	KA3CDB	30	13	585
Fla	WA4PHM	282	62	34,968
Ga	AA4RF	241	52	25,064
Ill	WB9HPV***	343	69	71,001
Ind	W4JKC/9**	360	69	74,520
Ia	WBØURA	272	61	48,708
Ky	WD4IVF	97	29	8,439
La	AB5N	35	9	945
Me	WB2GNX	167	36	18,036
Md	N3PM	425	69	29,325
Mass	W1PWK	195	46	26,910
Mich	WD8MFP	399	60	47,880
Minn	KBØN	281	62	52,266
Mo	WBØWIW	321	61	58,743
Mont	KL7FDO/7	28	9	756
Neb	KAØO	128	33	6,336
Nev	KA7DVR	122	31	5,673
N. J.	WA2GTJ	247	53	39,273
N. Mex	W5VBO	272	47	38,352
N. Y.	W2EZ	467	80	56,040
N. Car	W4OMW	261	66	25,839
N. Dak	KBØL	116	34	7,888
Ohio	W8AC	119	27	9,639
Ore	WA7ZBL	153	19	8,721
Penn	WB3FLK	218	35	22,090
R. Is	KA1EGZ	32	10	320
Tenn	K4EXC	229	54	37,098
Tex	N5QQ	348	63	65,772
Utah	N7ARE	261	30	23,490
Vir	K4KMS	146	45	19,710
Wash	AA7O	123	23	8,487
W. Va	WA8CNN	298	64	28,608
Wisc	WB7OJV/9	554	89	49,306
Alta	VE6ER	107	39	12,519
B. C.	VE7EMX	60	17	3,060
N. S.	VE1BQQ****	162	37	17,982
Sask	VE5AAD	137	29	11,946
England	G4BUE	139	46	19,946
Puerto Rico	KP4DJ	140	29	12,180

****Overall winner***
*****2nd place overall***
******3rd place overall***
*******overall winner in Canada***

be an extra multiplier of one for each group of 8 contacts with the same Washington county for all non-Washington stations.

AWARDS:

Certificates will be awarded to the highest scoring station (both single and multi-operator) in each state, Canadian province, foreign country, and Washington county. Additional certificates may be issued at the discretion of the Contest Committee. Worked Five BEARS awards are also available to anyone working 5 club members before, during, or after the QSO party (unless previously issued). All QSO party entries will be screened by the Contest Committee for possible Worked Five BEARS awards. Worked Three BEAR Cubs awards are also available for working 3 Novice members.

ENTRIES:

Logs must show dates/times in GMT, stations worked, exchanges sent and received, bands and modes used, and scores claimed. Include a dupe sheet for entries with more than 100 QSOs. Each entry must include a signed statement that the decision of the Contest Committee will be accepted as final. No logs can be returned. Results of the QSO party will be mailed to all entrants and an SASE is *not* required. Log sheets and summary sheets must be postmarked no later than October 15th and sent to: Boeing Employees' Amateur Radio Society, c/o Contest Committee, Willis D. Propst K7RS, 18415 38th Avenue S., Seattle WA 98188.

EUROPEAN DX CONTEST — PHONE

Starts: 0000 GMT September 13
Ends: 2400 GMT September 14

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operations out of the 48-hour period are permitted for single operator stations. The 12 hours of non-operation may be taken in one period (but not more than three) at any time during the contest. Operating classes include single operator, allband and multi-operator, single transmitter. Multi-operator, single transmitter stations are only allowed to change band one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 through 28 MHz. A contest QSO can only be established between a non-European and a European station. Each station can be worked only once per band.

EXCHANGE:

Exchange the usual five-digit number consisting of RS and progressive QSO number starting with 001.

SCORING:

Each QSO counts 1 point. Each QTC (given or received) counts 1 point. The multiplier for non-European stations is determined by the number of European countries worked on each band. Europeans will use the last ARRL countries list. In addition, each call area in the following countries will be considered a multiplier: JA, PY, VE, VO, VK, W/K, ZL, ZS, UA9/UA0. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. The final score is the total QSO points plus QTC points multiplied by the sum total multipliers.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to a European station. It can only be sent from a non-European station to a European station. The general idea is that after a number of European stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported, e.g., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. Only a maximum of 10 QTCs to a station is permitted. You may work the same station several times to complete this quota, but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported. Europeans may keep the list of the received QTCs on a separate sheet if they clearly indicate the station who sent the QTCs.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules or unsportsmanlike conduct or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the Contest Committee are final. It is suggested to use the log sheets of the DARC or equivalent. Send a large SASE to get the wanted

Results

RESULTS OF THE 20TH ALL ASIAN DX CONTEST — CW

Continental Winners
(Multiband, Single Operator)

Africa	EL2FY	7332
Europe	UR2QI	136240
Oceania	VK3AEW	18270
S. America	LU8DQ	234220
N. America	N6RO	151632
Asia	UV9AX	219432

Continental Leaders
(Multiband, Multi-Operator)

Europe	UK4WAR	299468
Oceania	DU1MRC	95432
S. America	LU1DZ	212256
N. America	K7FD	15939
Asia	UK9OAC	182710

USA

	Entries	Pts.	Mult.	Score
AE6U	1.9	6	5	30
W7DRA	3.5	27	12	324
K7WA	7	258	37	9546
K4RZ	14	103	44	4532
K5GA	14	83	34	2822
WA6VNR	14	45	18	810
W6NNV	14	57	11	627
WB7SQM	14	29	15	435
W1OPJ	14	7	6	42
K6LL	21	257	41	10537
AI6E	21	89	31	2759
W6SZN	21	79	30	2370
K1KI	21	74	23	1702
AA1M	21	49	28	1372
N6RO	M	972	156	151632
K6NA	M	897	157	140829
N6AW	M	685	140	95900
N5JB	M	509	117	59553
K3TW	M	474	108	51192
K5RC	M	435	109	47415
K4JYS	M	333	87	28971
W8UVZ	M	280	94	26320
WA0TKJ	M	354	70	24780
K2CL	M	238	78	18564
N7AM	M	251	72	18072
W9OA	M	222	75	16650
W4MM	M	176	70	12320
N8FU	M	147	56	8232
K3VW	M	147	54	7938
W5OB	M	104	56	5824
WA4QMQ	M	93	48	4464
K4BAI	M	46	28	1288
K7FD	Mop	231	69	15939
W7DG	Mop	221	68	15028

number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than October 15th; North American residents may send their applications and logs to: Hartwin E. Weiss W3OG, PO Box 440, Halifax PA 17032 USA.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HB0, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1346, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, 9H1.

CAN-AM CONTEST

Phone

Starts: 1800 GMT September 13
Ends: 1800 GMT September 14

CW

Starts: 1800 GMT September 27
Ends: 1800 GMT September 28

Multi-operator stations can operate the full 24-hour period. Single operator stations can operate a maximum of 20 hours with a maximum of two rest periods totaling a minimum of 4 hours.

The contest is sponsored by the Ontario Contest Club and Canadian DX Association to increase the friendship among Canadian and American amateurs and to provide a means of measuring the performance of their operating skills and equipment.

Operating categories include: 1) single operator—all bands with station operated by the station licensee; 2) multi-operator, single transmitter—stations operated by more than one operator, or single operator other than the licensee, or club station; 3) club competition.

Use all bands, 160 through 10 meters. USA General portion of the bands is recommended. The same station can be contacted once on each band. Stations operating from outside of their own call area must sign slash and the area they are operating from.

EXCHANGE:

RS(T) plus sequential QSO number starting with 001 and multiplier (MX) area abbreviation (in that order). Multiplier area abbreviation is the usual two letter postal abbreviation for 50 US states, CN—for Caribbean (KC4, KG4, KP1, KS4, KV4), PC—for Pacific (rest of US possessions). Canadians will use: NF = VO1 and VO2; NB = VE1 New Brunswick; NS = Nova Scotia; PE = Price Edward Isl.; SI = Sable and St. Paul I.; PQ = VE2; ON = VE3; MB = VE4; SK = VE5; AT = VE6; BC = VE7; NW = VE8 NWT; and YU = VY1 Yukon.

SCORING:

The multipliers are the 50 US states, 2 US possessions (Caribbean and Pacific), 10 Canadian provinces, 2 territories (NWT and YU), and 1 island (Sable or St. Paul). Total of 65 multipliers per band; maximum possible on all 6 bands is 390.

QSO points for Americans to Americans or Canadians to Canadians is 2 points per QSO. American to Canadian and vice versa counts 3 points per QSO. The final score is the result of the total QSO points from all bands multiplied by the sum of the multipliers from all bands. Phone and CW sections of the contest are considered separate contests. However, combined score for phone and CW will be used for overall competition. Combined scores will be calculated by the contest committee as a result of the addition of the phone and CW scores.

AWARDS:

First place certificates will be awarded in each multiplier area on both modes in single operator categories. Top five multi-operator stations will receive certificates for high claimed phone and CW scores. All scores will be published in *CQ Magazine*. Free one year subscription to *Long Skip*, the CANADX bulletin, will be awarded to the 5 US stations. Additional trophies and plaques will be awarded the overall winners for the Canadian and American champion on phone, CW, and combined. Also, an award for the club having the highest score as a result of adding the 5 best scores on phone and CW by its members. A club officer must submit the summary showing the callsigns and scores. Each station is eligible for one trophy only. In cases where one station qualifies for another trophy, the less significant trophy goes to the next eligible station.

ENTRIES:

All times must be kept in GMT. Indicate multipliers the first time only on each band. Log must be checked for duplicate contacts, correct QSO points, and multipliers. Do not use separate logs for each band. Rest periods must be clearly marked in the log. Each entry must consist of log sheets, summary sheet showing all scoring information, category of competition, operator's name and callsign, address of the station, and signed declaration. Entries with over 200 QSOs must include check sheets for each band. Official logs, check sheets, and summary sheets with multiplier tables are available from the contest chairman; a large SASE with Canadian stamps (or US stamps *not glued* to the envelope) will bring you samples. Usual disqualification rules apply and the decisions or actions of the CAN-AM Contest Committee are official and final. All entries must be postmarked not later than 30 days after the contest and mailed to: VE3BMV, PO Box 292, Don Mills, Ontario, Canada M3C 2S2.

As a trial, certificates will be issued to high scoring QRP stations running less than 10 W input and also to the monoband entries. Any band can be selected; all monoband entries will be lumped together. You are encouraged to use the official forms—they considerably help with "bookkeeping" and processing the results. Please send logs regardless of how small!

PENNSYLVANIA QSO PARTY

1700 GMT September 13 to
0400 GMT September 14
1300 GMT September 14 to
2200 GMT September 14

Sponsored by the Nittany Amateur Radio Club, this is the 23rd annual event. Stations may be worked once on each band and on each mode. Mobiles may be reworked as they change counties. Repeater contacts *do not count*.

EXCHANGE:

RS(T), 3-digit sequential serial number, and ARRL section or PA county.

FREQUENCIES:

SSB—3980, 7280, 14280, 21380, 28580; CW—50 kHz up from bottom of CW bands.

SCORING:

Count 1 point for SSB QSOs, 1.5 points for CW QSOs, and 2 points for 80-meter CW QSOs. PA stations multiply QSO points by the total number of sections plus the total number of PA counties worked. Mobiles in PA calculate their total for each county then add these county totals together for the final score.

AWARDS:

Handsome plaques will be awarded to the top PA entrant and the top out-of-state entrant. Certificates for section winners and the 10 top PA entrants with a minimum of 10 QSOs. Special club award—an engraved gavel donated by W1PL will be awarded to the PA club whose members score the highest aggregate scores in the contest. Be sure to indicate club affiliation on your logs!

ENTRIES:

Dupe sheets are required for entries with 100 QSOs or more, except for mobiles who are exempt from this rule. Mail logs, dupe sheets, comments, and SASE (for results) by October 15th to: Douglas R. Maddox W3HDH, 1187 S. Garner Street, State College PA 16801.

NORTH AMERICAN SPRINT

Starts: 0100 GMT September 14
Ends: 0500 GMT September 14

Sponsored by the *National Contest Journal*, the contest is open to all licensed radio amateurs. The object is to work as many North American stations (and/or other stations if *you* are in North America) as possible and as many multipliers as possible during the 4-hour contest period. Entries must be single operator only—no helpers or spotting nets are permitted. All contacts must be made on the 80-, 40-, or 20-meter bands using CW only. A station may be worked once on each band. If any station solicits a call by sending CQ, QRZ, etc., he is permitted to work only one station in response to that solicitation. He must thereafter move at least 1 kHz before he works any other station, or at least 5 kHz before he again solicits other calls. Regardless of the number of licensed callsigns issued to a given operator, one and *only* one callsign shall be utilized during the contest by that operator. For the purposes of this contest, a North American station is as defined by the rules of the *CQ* Worldwide DX Contest.

EXCHANGE:

To have a valid exchange, you must send all of the following information: his call, your call, serial number (starting at 001), your name, and your state (or VE province/country).

FREQUENCIES:

Suggested frequencies are:

3530-3550, 7030-7050, and 14030-14050.

SCORING:

Multiply the total valid contacts by the sum of states, VE provinces, and other North American countries to get the final score (do not count USA and VE as countries). KH6 is not counted as a state and is not a North American country. VE multipliers are maritime (VE1, VO1, and VO2) and VE2 through VE8 (8 total). Non-North American countries do not count as multipliers.

AWARDS:

A trophy shall be awarded to the highest scoring entrant. Certificates of merit shall be awarded to the highest scoring entrant from each USA call area, Canada, and other country; to each of the ten highest scoring entrants; to each member of the winning team; and to the highest entrant on each team.

ENTRIES:

Entries must be sent to: Rusty Epps N6SF, 235 Montgomery Street, Suite 2600, San Francisco CA 94104.

Entries must be received not later than 30 days after the Sprint to be eligible for trophies and awards. An entry consists of 1) a summary sheet showing valid contacts by band, total multipliers, total score, name, callsign and address of the operator, station callsign, and station location; 2) a complete, legible log of all contacts (including dupes marked as such) with indication by numbered sequence of each multiplier claimed; and 3) a separate check sheet for each band. Logs, summary sheets, and check sheets may be home-made or patterned after those shown in the *National Contest Journal (NCJ).*

Team competition is limited to a maximum of 10 operators as a single entry unit. Clubs having more than 10 members may submit more than one team entry. To qualify as a team entry, the name, callsign of each operator, and callsign of the station operated (should the operator be a guest at a station other than his own) must be registered with N6SF. The team information may be contained either in a letter, which must be received by N6SF before the start of the Sprint, or it may be contained in a Western Union mailgram dated at least 24 hours before the start of the Sprint. There are neither distance limitations nor meeting requirements for a team entry. The only requirement is pre-registration of the team.

Any entry may be disqualified for illegibility, incorrectness, or illegal or non-ethical operation. Such disqualification is at the discretion of the *NCJ* Contest Review Committee.

DARC CORONA 10-METER RTTY CONTEST
Contest Period:
1100 to 1700 GMT September 27

This is the third of four tests during the year sponsored by the DARC eV to promote RTTY activity on the 10-meter band. Each of the four tests is scored separately. Use the recommended portions of the 10-meter band.

EXCHANGE:

RST, QSO number, and name.

SCORING:

Each station can be contacted only once. Each completed 2X RTTY QSO is worth 1 point. Multipliers include the WAE and DXCC lists and each district in W/K, VE/VO, and VK. Also count each different prefix as a multiplier. The final score is the total number of QSOs times the total multiplier.

AWARDS:

Plaques will be awarded to the leading stations in each class with a reasonable score present. Operating classes include Class A for single or multi-op and Class B for SWLs.

ENTRIES:

Logs must contain name, call, and full address of participant. Also show class, times in GMT, exchange, and final score. SWLs apply the rules accordingly. Logs must be received within 30 days after each test. Send all entries to: Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee, West Germany.

The last contest period is on November 15th.

EX-KZ5 REUNION
Starts: 0001 GMT September 27
Ends: 2400 GMT September 28

An on-the-air reunion, sponsored by the Canal Zone Amateur Radio Association, Panama, to foster continued friendship among former KZ5s. Use A1 and A3 modes only; no cross-mode operation allowed. No power limitations within legal limits.

Two categories of participants. Former KZ5s licensed under authority of the Panama Canal Zone Government will count only contacts with other former KZ5s. Total points will be based on 2 points for each A1 contact and 1 point for each A3 contact. All other stations wishing to participate are encouraged to contact a minimum of 5 current CZARA members to qualify for the Balboa Award.

EXCHANGE:

Former KZ5 operators will send signal report, the last two digits of the first year licensed as a KZ5, and former KZ5 callsign. Others will provide signal report and state/country.

FREQUENCIES:

Listen within the lowest 25 kHz of the CW and Phone segments of the US General class portion on each band.

AWARDS:

Prizes for the top three former KZ5s currently operating from the Republic of Panama as an HP-licensed operator. Also, prizes for the top three former KZ5s currently operating elsewhere, worldwide. Certificates for all other former KZ5 entries.

ENTRIES:

Send extract of contest logs by October 31st marked either "Reunion" or "Balboa Award" to: John B. Barham HP1XOG, PSC Box 4481, APO Miami FL 34001. Former KZ5s who choose not to submit entries are encouraged to provide current callsign and address via QSL or postal card to the above address.

Review

HIGH FREQUENCY CIRCUIT DESIGN
by James Hardy

Depending on publications written expressly for amateur radio operators is frustrating if you are seeking information about the more theoretical aspects of our hobby. On the other hand, many "theory" books are filled with mathematical proofs and long-winded technical descriptions of "ideal" circuits that are of little use. *High Frequency Circuit Design* by James Hardy is one book that falls somewhere in between application-oriented amateur texts and rigorous theory books. Although it is intended primarily for electronics technology students, the author expresses his hope that it may be of use to practicing rf designers *and* radio amateurs.

Many hams consider rf circuit design to be a sort of black magic that is practiced by a few experts. Instead of trying to understand the workings of an oscillator or amplifier, we often build a project hoping for the best but not really knowing why it was designed the way it was. *High Frequency Circuit Design* concentrates on the basics that make up any rf circuit, whether it is centered around tubes or the latest power FET device. First the terminology needed to understand noise, amplitude, and phase is discussed. Then the author describes how simple components like resistors and capacitors behave when used in rf circuits. Once the fundamentals are taken care of, the book explains the secrets of impedance matching, filter design, amplifiers, and oscillators.

There is no way to gain a thorough understanding of rf circuitry unless you are exposed to the mathematics that governs it. The author does not expect his readers to be experts in calculus—all the math is at an algebra level.

The latest FCC Extra class study outline lists items like preselector design and the use of Smith charts. Your favorite amateur references may have a paragraph or two on these topics, but *High Frequency Circuit Design* has many pages. If you are looking for a schematic diagram for a high-powered amplifier, you will be disappointed, but if you are genuinely interested in what makes an rf amplifier work, this book just might hold the answer.

If theory is not your bag, then this 340-page book will probably sit on your shelf unread. If, however, you already have a solid background in circuit fundamentals but are still itching to find out how the "magicians" designed your rig, then *High Frequency Circuit Design* may be of interest. Published by Prentice-Hall, a hardcover copy costs $19.95.

Tim Daniel N8RK
73 Staff

DX

from page 14

path, 50 David Ave., Manurewa, New Zealand; FW0DD confirmations come from Canad-X Club Station VE3ODX, PO Box 717, Postal station Q, Toronto, Ontario M4T 2N5, Canada.

John Ackley KP2A completed his Asian operations as CR9A the last three weeks of June, under the auspices of the International DX Foundation, which provides just the QSL support and publicity for Ackley's work. The considerable travel costs are not picked up by IDXF. CR9A cards to WB2KXA.

Incidentally, IDXF's East Malaysia 9M6MU operation in May turned out almost 20,000 contacts in six days of operation. About 25% were on CW, about 30% overall with North America. And band conditions were abysmal then, too.

OH2BH and OH2MM appeared right on schedule from the Sudan, signing 6T1YP from the Children's Youth Palace. They then drove south with Mr. Fadul Kabbar ST2FF to put the south Sudan on for several days as ST2FF/ST0. Martti OH2BH and Willi OH2MM were invited to Khartoum to discuss amateur radio training in the Sudan and to make final adjustments to the 6T1YP station, which was a gift of North Korea.

George Wagner K5KG vacationed in Finland's Aland

GLORIOSO

Editor's note: This article is published unedited in order to retain its special flavor.

Do you remember your last DX adventure, when you reached right away HB0XXX on your first call in the biggest pileup? Quite a success! How about following us on our DXpedition—but a bit further—just turn your beam toward the Indian Ocean, northeast of Madagascar. The island of Glorioso is even on sea maps only a small spot.

We thought, with our licenses, we would have no further difficulties. Bull! On arrival our difficulties started. Nobody of the local authorities could be reached. Hours and days passed, and we were still sitting on the island of Mayotte. No wonder that hours before we departed and even after our return there were doubts that we had been there.

Everybody who listened to our traffic on the "Safari Frequency" could feel how exciting the last days had been, before we went on our trip. All of the "Safari Family" know each other and they wanted us on Glorioso and Geyser Reef for any price (donations are welcome!).

Anne DF3KX got the call FR0ACB/Iles Glorieuses; this call should give the YL-hunters and CW freaks worldwide their points. FR0ACC/Iles Glorieuses was DK9KX, Hans-Walter, who handled the SSB traffic...he was a main operator. Gero DJ3NG held FH0FLP and FR0FLP/Iles Glorieuses, and used also FR0ACC. Wilfried DJ5RT was also along and the doctor of the expedition.

Our main CW operator was Baldur DJ6SI, member of FOC who also used FR0ACB/G. Help was given by many OMs of the "Safari Round" from Cologne over Kenya to Mayotte.

Special thanks to the Northern California DX foundation and all the other donators who helped to get us there.

Our outfit included 5 HF transceivers of different makes, as well as two beams, several dipoles, and a DX-Butternut. All the antennas were donations. Last but not least, we should not forget our pilot, Rainer FH8OM, and our airplane "Bongo Banjo," a Partenavia P68V, with two engines and six seats, an ideal plane for short runways. Special thanks to an OM from Condor Airways in Frankfurt who got us VIP treatment; the antennas were not only bulky but heavy as well.

On arrival in the morning of April 12, 1980, in Mombasa, we got our first feeling of the hot and tropical climate of Africa. That's where our difficulties started. Just before the airport was closed due to a visit of a foreign statesman, Rainer landed at the airport with "5 Y BBE" which was a borrowed replacement for his own plane, which had engine failure.

So we had to stay for one night in Mombasa in the Castle Hotel, with slow-turning fans and a temperature of 95 degrees F (38° C) in the shade. We put up the Butternut 6P antenna and contacted the OMs in Germany and told them of our delay. We were not finished yet as already the first CW calls came in. Then we handled the first calls under 5Z4NG/4, the call of DJ3NG, on CW! We could only get Baldur DJ6SI away from his key by putting a plate of excellent food under his nose.

Next day we left for Mayotte, a five hour flight above open sea. We arrived on Mayotte April 14, 1980. On April 16, we finally left for the Island of Glorioso, direction Geyser Reef. Understandably, we could not land on Geyser Reef, but we used it as a marker to get to Glorioso. The maps did not show the position correctly. We had to fly 20 minutes in several directions to find it. In fact, we found three small sandbanks where we could dock with a boat. But we did not have any luck; the only available boat had an engine break down, so "1G" next time!

Now further direction Glorioso. We were told there had to be a beacon. No good! No beacon to hear. It was out of order, so we had to fly visual. After 25 minutes, still no Glorioso. We got nervous.

Finally, there was a flat island to see and after 32 minutes we landed on Glorioso Island. The four people on the island without contacts (except radio) for 120 days were obviously pleased to see us. Two hours after our arrival, stations and beams were ready and we could make our first contact. First reaction on the band: "Are you really there?"

Now we got the first congrats approximately 1400 GMT under the call FR0ACB/G. Conditions were hard, 100% humidity, 98 degrees F in the shade. The one and only policeman was soon assured that we were not spies and we got on friendly terms.

Baldur gets up to his best and works 180 stations per hour. The commercial operator of the island group gives up after ten minutes of listening. SSB was not much lower; one op at the mike, one at the logbook, we worked within two hours 120 stations per hour on 10 and 20 meters. The 28-MHz band was open 14 hours a day, especially to the Pacific area during the daytime and Europe in the morning. 40 and 80 we did not have any luck; no contacts.

Discipline was generally good, with few exceptions. We worked mostly split frequency, and we had signals as high as S9 +40 dB spread for 40 kHz.

Sorry we could not reach all the OMs calling us; we would have needed weeks to do that, but we did work 15,000 stations within the four and a half days we could stay on Glorioso Island. Two stations were always operating. Weather was not always good, so that our allowed stay (3 days) had to be extended for 36 hours. Storms, lots of water, and thunderstorms did not make our job easier.

Three times a day we had to recharge our batteries with the big generator. Even so, our sixty Amps battery was out of order after our fourth day. After that we had to work with reduced power.

On the morning of the 22nd of April, we left the island and our new friends, the next expedition in mind for September. So watch your DX infos. With your QSL card or SWL card and a few IRCs or a small donation to our manager, DK9KD, you would help us get there. Until then, good DX!—Dieter Loffler DK9KD.

(Reprinted from The DX Bulletin, *Vernon CT)*

Islands, making over 3,000 contacts as K5KG/OH0. He stayed at the home of Kee OH0NA, who was the lighthouse keeper for neighboring Market Reef from 1965 to 1977, and who now accompanies each expedition to the reef to ensure ham operations don't interfere with the reef's solid-state control systems for the lighthouse.

Cocos-Keeling VK9 appears all too infrequently, and always for a very short duration. VK9CCT made some contacts early in June, using the usual setup—low power and a 20-meter dipole. The Australian Air Force runs missions to Cocos, always unannounced, sometimes having a ham technician on board, occasionally affording time for a few hours of ham radio. VK5CT comes on 14195 the day a mission leaves to make the announcement if a ham is making the trip, but it is not known if an amateur radio operation will take place until the crew has done its work on Cocos and time remains. When the sunspots go back to wherever they come from (in a couple of years), the VK9CCT signal (weak in '79-'80) will probably just not make it at all. But VK5CT has been working on some sort of "package station" to be taken along each time, possibly with a small breakdown beam for 20 meters.

LA5KC was in the Republic of Guinea to set up some commercial radios in early June and made a handful of contacts on 15 SSB. This may have been using the commercial radios themselves, as taking amateur equipment into Guinea is virtually impossible due to mistrust on the part of officials. LA5KC just may be back there early In September and if he operates, it would likely be at 21250-21300 on SSB.

Bob Dreher W6RZO departed from California on June 22 to operate from a number of Asian spots, including (tentatively) VS6 Singapore Aug. 15-21, YB Indonesia through Aug. 28, W3WYP/DU2 Philippines through Sept. 4, Peking, China through Sept. 11, and JH1ARJ Tokyo, Japan through Sept. 18. If you work any of the callsigns listed during the time frames above it was probably Bob, and QSLs go to him: R. Dreher, USICA MGT/TCE, Rm. 320, 1776 Penn Avenue, Washington DC 20547 USA.

Jim Hewitt W8LMB, an associate of W6RZO, left in mid-July for Africa, hoping to operate from some spots. His itinerary included 5N2 Nigeria, TY Benin, TN8 Congo, TJ Camerouns, TL8 Central African Republic, 9Q5 Zaire, TT8 Chad, 9U5 Burundi, 9X5 Rwanda, 5Z4 Kenya, S79 Seychelles, ET3 Ethopia, and 6O1 Somalia. The lengths of stay at various stops was not known. QSLs for any operations go to W2TK.

Finally, Karl Renz K4YT also left for Africa in mid-July, with planned stops at 5T5DX, K4YT/6W8, D4, J5, C5ACO, 3X, 9L1, 9G1, TU2, TY9ER, TZ, XT, 5U7AG, and 5V. QSLs for these operations also go to W2TK. These fellows in many cases will have no idea if they can operate the radio until they arrive and make contacts with the authorities in the various countries. The only hope of catching them is to listen constantly and/or get one of the weekly published DX bulletins. W1AW's on-the-air bulletin on Friday morning UTC (Thursday evening in North America) may also carry late developments. Check *QST* for the schedule.

Next month we will carry the results of a countries-needed survey conducted by *The DX Bulletin*, reflecting the needs of over 900 subscribers. If you don't have it it's rare, but the top spots on the list should make for good dreaming by would-be expeditioners.

You'll be getting *that* issue of *73* just as radio conditions pick up from the summer slump they're now in. Does it seem to you that this summer's doldrums are worse than those of the past couple of summers? Sure gives that impression here, but I think it is our imagination. Back when there were no sunspots and wintertime conditions were marginal at best, when 10 died and 15 went flaky in the summer it wasn't much of a change from the rest of the year. Now, 10 is dead and 15 is flaky and it's a big letdown from the spectacular conditions of the winter of '79-'80. Oh, well, a little abstinence never hurts, and it will feel *so* good to hear those JAs on 10 again come October!

Meanwhile, keep letters and photos coming. Hope your summer has been a good one, DX- and otherwise.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

eight second waits for pictures to unfold can get boring...particularly if it is the third time you've seen those girl photos from Miami or the *Playboy* centerfolds from Venezuela. The pits is waiting for someone with a slow scan typewriter to put a dozen words on your screen.

The first few days you point your camera at yourself and smile at your contacts. This gets old by the second contact with each chap. Then you rig up a menu board so you can send a QSL over the air for the contact. This keeps you hopping, putting the other station's call on the board...then changing it for calling CQ...etc.

It doesn't take long before you get the impulse to work up a program for the fellows. You get together pictures of your wife, children, home, ham shack, yourself, etc., and put them all on tape. It takes several days of work, but eventually it looks pretty good. Now you get on the air and show off the program. Great! Everyone enjoys it. But a funny thing happens...interest in repeat performances is minimal.

Eventually, when you've seen everyone else's programs and they have seen yours, you go back to DXing or RTTY...and SSTV fades away for you. It is just too much work getting new programs together and it kills the fun.

Suppose we could get the cost of SSTV equipment down ...way down. And then suppose we got away from trying to make complete contacts with slow scan and just used it as a way to swap a picture or two... no more? I'd like to see what the person I'm talking with looks like...and so might you.

Slow scan is sent by means of a series of audio tones, so there is nothing very complicated about it. Much of the cost of the equipment has been due to the small production quantities made rather than the complexity of the circuits. Just by way of getting this concept across, may I remind you that eight-inch television (black and white) sets cost $250 back in 1948. That's equivalent to about $3,500 in today's dollarettes. You can buy a much better set today for $59 (saw an ad on TV last night).

The slow scan camera could be replaced by a simple PROM which could be made by your nearby ham dealer. He would sit you down in front of his camera (or use a glossy photo) and pop a PROM, putting your photo in the memory chip. One or two chips more would give you a simulated SSTV camera, all for a few bucks.

The monitor is simple, as I said. In quantity most of the circuitry needed could be put on a single chip, leaving only the small CRT and power supply required. It could come well below $100. First costs will be higher since we will be needing a 16K memory chip to hold the slow scan picture and display it with fast scan for easy seeing.

Once we build the system into a transceiver, we can use the scope not only for seeing the people we are working, but also to tune in stations, as a display for a panoramic view of the band, as a way of monitoring your transmitter quality, etc. Even the call letters could be displayed on the scope. By adding a cassette recorder to the system...or an output for one ...we can save pictures of the people we work on tape.

BUS-ORIENTED RIGS

If our ham transceivers were built-in modules like computers, we would be able to buy a rig and then add to it as money and interest dictated. By the use of a

common bus structure for the system, it might be possible to build a rig with end panels which are removable so further modules could be added.

For instance, the DI module could have a small panel space for its control and just screw onto the end of your transceiver, interfacing with it automatically via the power and audio lines.

Next, we might want to add a Morse keyer/converter . . . then a RTTY keyer/converter. This would have output for a printer via RS-232C standard or to a TV monitor. If you later added the slow scan scope system, it would read the RTTY or Morse code, if you desired.

This type of design would allow a ham rig to be almost infinitely expandable, interfacing with your computer, the phone lines, other control units, etc.

Needless (I hope) to say, articles are hereby solicited for any developments along this line. It would be nice to work up a standard bus structure for ham gear so that small firms could be formed to make esoteric addons, much as the S-100 bus system has made it possible for hundreds upon hundreds of boards to be made for S-100 oriented computer systems.

Let's see what you can do!

THINK SOLAR

With *73* growing, it is getting time for us to plan for a headquarters building which will hold everything we are doing. The old mansion, though it has forty rooms, filled up and overflowed into the town's largest motel. Now that, too, is full and something has to give.

Peterborough has run out of office space so we're going to have to start thinking in terms of a new building. Keeping in mind the problems of heating and cooling, my inclination is to plan on something which would be built into the side of a hill, facing south so that it could be heated entirely . . . or almost entirely . . . via solar energy. The ground temperature year around, once you get down a few feet, is 57°, so it shouldn't be difficult to keep a building like that warm enough or cool enough.

Getting information on similar buildings is not simple, so if you come across anything comparable, I'd appreciate knowing about it. Should we allow for skylights, or would we do better to be further under the ground and use sunlight-type fluorescents? I've seen some interesting buildings which have solar panels which automatically fill with tiny plastic beads at night to prevent radiation of the heat.

With a projected staff of about 200, we would need a minimum of 50,000 square feet of space. This would not only provide space for the growth of our computer publications, but would also allow for room for a headquarters for lobbying for amateur radio on both a national and international basis . . . something which has been badly needed.

It may be that government regulations would not permit something new like this to be built, but if it is possible and practical, I'd like to tackle it.

LETTERS

from page 18

come around and told us it didn't matter that we had worked hard and long and done our best at driving for 20 years, but we could no longer drive on the freeway and had to take the back streets only from now on. That the freeway was being set aside now for automotive engineers and designers to have exclusive use of and unless we could pass engineers' and designers' types of examinations, we might as well forget about the long trips (DX) and be happy they still let us use the back streets.

To make a long story short, after about a week of discussing it on the air, the pileup on our QSOs began to sound worse than the Clipperton DXpedition. So was born the AARA, American Amateur Radio Association. Since I was then in the Army at Fort Benning GA and centrally located in the southeast, I was elected to be the director of the AARA effort for the southeastern states. It was a completely nonprofit, loose-knit, nationwide group of several hundred amateurs who were interested in keeping the integrity of the bands as they were. We worked at it as hard as we could. We made hundreds of tapes of our aims and goals to put on the nightly nets and mailed thousands of cards all over the country to be signed and sent to the FCC. Those of us actively involved in the AARA effort took the entire expense in time and money, equipment, and postage out of our own pockets. We even tried to get Barry Goldwater to go to bat for us in Washington. He was sympathetic to our cause but was unable to become involved for various reasons.

The big guns in Connecticut won out and about the time I shipped out to go fight the war in Viet Nam, the hammer fell. We lost. Amateur radio lost. There were other good options for incentive licensing besides segregating the bands. I, for one, am still "unhappy" with it and there will be rain forests in Siberia before I'll knuckle under and join the elite. There are still a lot of us Generals working the unsegregated parts of the bands who can rock along at 35-40 wpm even though it does get a little crowded once in awhile. We manage because we are darn good operators with darn good technique and at least it's some consolation to know that the big guns with their "California kilowatts" are off at the edges of the band where they won't be clobbering us with their 20-kHz-wide signals.

I sure am sorry I missed Field Day this year. First time in 15 years. No amateur radio here in Saudi Arabia. It's banned. Guess they're afraid somebody will QSO an Israelite or something. If I'm lucky, I may get to give someone a good DX shot. I am a pilot here and get an air mobile crack at it once in awhile on the HF SSB rig in the aircraft. 500 Watts to a 50-foot long-wire up 15,000 feet gets an occasional laugh.

I'm not a subscriber. *73* is on the newsstand here a month before I could get it in the mail. I'll subscribe when I get back to the States.

Keep up the good work. You're the only ones in print who really know what amateur radio is all about.

Orvill B. Wolf WA4IXN
Jeddah, Saudi Arabia

FORGOTTEN?

Your views in *73* seem to reflect mine up to a point. Your view on 220 MHz is a bit narrow; however, it seems justified when you see what happened to the last band of frequencies taken from hams. Look, though, at the possibilities of a compromise on the issue.

Let the CBers have 220 MHz and give us back 27 MHz. All that is on 220 is a glorified CB operation anyhow. Let them run their illegal power on 220 rather than on 27 MHz. They won't get into the TVs and toasters and tape recorders quite so bad, and they won't get around the block either.

If, as you say, we are going to lose it, then let's put a few strings on it, such as when the 220 MHz CB band opens, the 27 MHz band closes in 365 days. Don't say it can't be done—just remember what happened to double sideband marine communications a few years back.

Then put in the stipulation that 730 days after 220 MHz CB starts, the 27 MHz band becomes an amateur band. This will give us a shot at regulating our testing. The US was built on the idea of a compromise, so instead of getting mad and starting a big uproar, let's sit down and work things out a bit.

The other view is one that I am surprised to see you print. You actually agree with the ARRL's position of going out and getting more amateurs. I also agree—but put a string or two on that idea. If you do bring someone into ham radio, at least spend the time to teach him the do's and don'ts. The next time I hear an "old-timer" complain about the WDs or KAs, I'll give him a piece of my mind,

since they were the ones who got us interested, helped us get licensed, and then forgot us. If you have no background and no one will tell you, how in the hell do you find out?

I hear the old-timers grumble and say, "Oh, well, I'll just turn it off or go do something else." If you ignore a problem, it will only get worse—that is a proven fact. If you hear something wrong, pull the man over to the side and tactfully tell the man the right way. We "newcomers" look up to you "old-timers" and all we see is closed eyes, deaf ears, and mute mouths. If you don't tell us, how will we know? We want to enjoy your company.

John F. Hauser KA4DLC
Pensacola FL

BUY AMERICAN

I just read your FB editorial in the July, 1980, issue of *73* and noted the enjoyment and kindly thoughts that occurred to you in carrying and contemplating your fine Casio calculator watch.

I also just re-read some 1952 and subsequent issues of *QST*. It's fascinating reading.

I don't think that it was just Kahn's or Orr's personal whims that gave us incentive licensing. The idea was in (and on) the air for years before it happened, as the result of a logical, quite gradual, and rather sane development. (The way the democratic process worked then, as it is now, is well illustrated by Docket 10237 of ill fame which proposed "calling and listening" frequencies and related inanities. It was soundly rejected and defeated, as, I am sure, you well know.)

It was unfortunate that American ham radio had to "stagnate" for so long when incentive licensing came into formal existence in 1963. But it was only natural that, after such painful surgery, the stunned patient had to rest, to pause, to recover, and to work through what had happened.

And true enough, there have been casualties. Some proud names have suffered or perished. Some wounds perhaps will never heal.

But where would amateur radio be today without incentive licensing? No Extras, no Advanceds. Why go through the trouble of shooting for 20 wpm plus if you can comfortably tag along at 13 plus (or minus!)? Why go through all the "fun" of learning the theory if no tangible rewards ("incentives") are offered? Well, yes, I know. It might have been just as well. The Europeans with their comparatively less complicated licensing structure seem comfortable enough—but, then, they can't take and retake (and retake...) their exams, once failed, every 30 days for free...

Let's face it. All things considered, the patient seems alive and well today. What hasn't killed him has made him stronger. And never mind those diligent island people and their delightful toys. They want to make a living, too, and labor very hard (as I am sure you fully appreciate) so that we can use and enjoy their Sonys, Sanyos, and, yes, your Casio calculator watch. But then, if you insist and *want* to "buy American," what's keeping you, or me, or anyone? Those who want, prefer, and opt for the quality and service American electronic firms have to offer us today can most certainly do so at their discretion. I know I did—and shall continue to do so.

F. Paul Kosbab N4AZN
Hampton VA

BIG E

Thanks for the tip on the Casio C-80. It is a great piece of "gear"! I read your article in the July, 1980, issue of *73*, mentioned the watch to my XYL, and several days later she purchased a C-80 in a local discount department store. It keeps perfect time, all functions work FB, and the price was right.

Thanks, too, for the fine code tapes and study guides. I'm here (Big E) because your team's there.

William J. Switoyus AJ3Z
Shickshinny PA

TAKING EXCEPTION

I must take exception to Wayne's comments in the NSD column on page 4 of the June issue of *73*, wherein he showed a photograph of the Yaesu engineering department and stated, "I suspect there are more development engineers and technicians in this one lab than all of the American ham manufacturers have combined."

Cubic Corporation, who markets ham gear under the Swan label, employs more than 900 engineers with a BS or higher degree, plus more than 350 technicians. This does not include degreed management personnel.

The all-new team at Cubic Communications (ex-Swan) in Oceanside where the Swan gear is produced operates on a free technical interchange with all Cubic divisions and subsidiaries to draw or give technical support and facilities whenever necessary.

I am sure the same is true at Rockwell Collins, and I don't think Drake, Ten-Tec, and others are to be sold short.

American technology does not have to take a back seat to any country in the world and, in fact, it is "borrowed" by every country.

To my way of thinking, the sooner we Americans stop touting and purchasing imported equipment of all types, the sooner the American economy and American way of life will return to some semblance of normalcy.

Sam F. Arn K6TSD
President
Cubic Communications, Inc.
Oceanside CA

HBO

As I am sure you know and I informed WD9IVY, the FCC has authorized cable systems to use a set of "special" channels between 6 and 7. The frequencies of these channels include 144-148 MHz. When I heard about this, I was very skeptical. I have been waiting for this very problem to surface.

What is happening is that the converter attached to the TV is actually receiving at or near the 3m band, so there is little or nothing a ham can do to filter the TV antenna to remove interference (short of also blocking HBO transmissions).

The cable companies have agreed to provide sufficient shielding to prevent pickup of ham (and other) transmissions by their converters operating in these bands. So it is their problem. However, I feel that every ham who has this problem should notify the FCC of it so that they will understand how well(?) this system works. (I feel sorry for any ham running a full gallon on "2" in an HBO area.)

W. D. Rhodes WB2JMX
Webster NY

MDA

Amateur station KA8COI will be operating as a special event station this Labor Day, September 1, 1980 (0330 to 2230 GMT, 7.230 MHz SSB), during the course of the annual Muscular Dystrophy Telethon hosted by Jerry Lewis.

A numbered certificate will be available to all stations making contact with KA8COI during this period. There will be no charge or fee for the certificate, although stations are requested to send an SASE with their QSL. They also should mention their QSO number (which will be given them on the air).

No third-party traffic will be handled on behalf of the Muscular Dystrophy Association and no solicitations for donations will be made over the air. Anyone wishing to donate to the MDA is urged to do so through their local telethon station. The MDA is a nonprofit charity, so donations would be tax-deductible. The Muscular Dystrophy Association has been contacted about this operation and has issued their formal approval. The certificates will bear the signature of Jerry Lewis, National Chairman for the MDA.

QSL information, QSO number, and SASE should be sent to:

Al Graff KA8COI
PO Box 332
South Webster OH 45682

KING OF BOGUS

The article appearing in the July, 1980, issue of your magazine concerning the Dayton Hamvention was quite well done. Too bad the local news media tends to look upon the Hamvention as just another cause of traffic congestion and an increase in the practice of the oldest trade.

However, I must take exception to your remarks about "some nut" dressed in an Arabian sheik's garb.

That "nut" was my good friend and former fellow-employee, Vince Barman. Vince is also Ash-sheik Abu Ibn al Heesshash, Emir of the principality of

Bogus and once Vice Omnipotens to the King of Bogus, Curtis Long.

For those who might not know, Bogus is one of those tiny islands of the mind, not unlike Hay, Abaco, and Espiritu Santo, where the common dreamers go in search of refuge from engineers, politicians, and the ARRL. Most of its inhabitants are former employees of the R. L. Drake company. Some wish they were.

Vince, as he is known to fellow Bogusites, is also N8ASQ. A contact with him is worth 2 points toward the coveted "Worked All Bogus" award. He is intelligent, clean, and not taken to malevolence. He knows four phrases in Arabic. He fixes radios and likes cats. I do not think he is a "nut."

For a nut, you have to look to the other guy in the picture. That's John Wallace WD8OQS. John is the Lord High Sheboygandoski of the Lower Dingus. Now, John is a nut. He plugs S-meters into the 110-ac line.

So maybe next time you can pick on John. He deserves it.

Nils R. Bull Young WB8IJN
Grand Bumpkin
Awards Chairman
Director of International Gizmos
New Carlisle OH

LIGHTEN UP

As a newly-licensed ham and a new subscriber to *73*, I have been disturbed by your occasional potshots at the ARRL and its leadership. Maybe I don't know enough to understand the basis for this, but I do know that I don't like it one bit.

Your editorial in the July issue takes the cake. Now we are asked to believe that the machinations of Mort Kahn and Bill Orr are responsible for the explosive growth of the Japanese electronics industry, to the detriment of American companies.

First of all, I am unconvinced. Secondly, I don't think this sort of thing serves amateur radio very well. Aren't there enough things to write about without sniping at other hams?

The name of your magazine exemplifies the best that amateur radio has to offer as a hobby: the communication of friendship and goodwill from one person to another. How ironic that *73* should occasionally become the vehicle for promulgating divisiveness and negativism. I for one am tired of reading this sort of thing.

Come on, lighten up. Bury the hatchet.

John W. Baker N5BSZ
Houston TX

COMPETITION

I read with interest your editorial in the July issue of *73* and noted the mention of Kahn and Orr and their activities regarding phone band restrictions. This is a subject that arouses my ire rather quickly—and not in favor of their theories. I would like to see the artificial restrictions on our bands put to a vote or poll to see how many of our amateurs today agree with them.

There are several things I would like to see stopped or deregulated; among them, incentive licensing and stipulated phone and CW bands quickly come to mind. I would rather see the bands open for any emission type anywhere with areas marked only by common usage. It seems rather apparent that the present regulations cause much QRM due to crowding and leave some favored few with all the allocations.

If the aims of amateur radio really do include making friends and promoting worldwide understanding among all people, why are these restrictions necessary? No one has ever explained to my satisfaction why we are restricted from certain areas on phone for the benefit of the Canadians and the Mexicans, for example (as mentioned in the letter you published, by George KØWTM).

If we are truly the bastion of freedom in the eyes of the world, why do these restrictions exist? I suspect that if there were another organization, devoted to amateur radio operating parallel with the League, many of these ghosts and skeletons would be examined under a de facto "sunshine" law.

I would like to see such an alternative organization started. I think you could get the ball rolling quite easily with a request in *73* for interested people to contact the magazine.

I don't think the ARRL is all bad, let me clearly state, but as in business, competition is good in order that all may benefit fairly. And, I have an idea that many people would quickly muster to join such an organization if you would provide a starting point. Put my name on the list!

Noell "Dusty" Reed KJ5A
Lafayette LA

Awards

from page 22

Designed specifically for owners of converted Citizens Band equipment, the Ten-Forty Award is probably the roughest worked-all-states award program in existence. Ask those who have tried numerous times and failed!

Available to licensed amateurs the world over, the Ten-Meter 10-40 Award offers a challenge second to none. To be valid, all contacts must be made on the ten-meter band using only "channelized" Citizens Band equipment or similar commercial units. Power is limited to 15 Watts PEP output. External amplifiers are prohibited.

To be eligible, all contacts must have been made on or after October 1, 1978, in the AM, SSB, CW, or FM modes. Mixed-mode contacts are not valid.

To qualify for this award, the applicant must work and confirm at least forty (40) of the 50 US states. An endorsement will be issued if all 50 states are worked.

To apply, make a list of contacts in alphabetical order by US state beginning with Alabama. Include the call of the station worked, the date and time in GMT, the band and mode of operation, and a brief description of the equipment and antenna system utilized.

Do not send QSL cards! Have your list verified by two amateurs, a radio club secretary, or a notary public. Send your application along with the award fee of $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

Though the title may be deceiving, this next award is probably the ultimate in the domestic awards offered by this magazine. A look at the requirements will clearly show the degree of difficulty one will experience in attaining the goals of this award. Luckily, we were sympathetic enough to eliminate any time limitations.

CENTURY CITIES AWARD

The editors of *73 Magazine* designed the Century Cities Award as a dual-Worked-All-USA effort. The applicant who applies for this achievement realizes he has accomplished what is probably the greatest feat available in award programs today.

All contacts must have been made on or after January 1, 1979. To qualify, the applicant must work and confirm a minimum of two cities or towns in each of the fifty (50) US states, for a total of 100 US cities.

To apply, prepare a list of claimed contacts, listing each one in alphabetical order by state. As shown below, include the full callsign of the station worked, the date, the band, and the city. Beginning with Alabama, your list will look something like the following example:

Alabama—W4ZZZ, March 31, 1979, 14 MHz, Decatur; N4XXY, February 1, 1979, 21 MHz, Mobile. Alaska—KL7AB, January 22, 1979, 7 MHz, Anchorage; WL7WW, May 19, 1979, 28 MHz, Fairbanks, etc.

Do not send OSL cards! Have your list of claimed contacts verified by two amateurs, a radio club secretary, or a notary public. Send this list along with an award fee of $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

For applicants for the awards offered by *73 Magazine*, I would like to present some insight on how we process the paperwork. Upon receipt of an application, each award requirement is carefully scrutinized to see that the applicant has met each one to the letter. If approved, a three-

part award worksheet is prepared. The original copy and applicable award fee is mailed to the Peterborough offices for *73* to process. It is there that your award is given a personal touch; from there, it is later mailed to your door. In the meantime, a copy of the award worksheet is mailed to the applicant to acknowledge that the application has been received. Should the applicant feel it necessary to follow up on the application, he or she should write a letter to the Assistant Publisher, *73 Magazine*, Peterborough NH 03458. Writing directly to 73 headquarters will speed your efforts since I no longer retain your paperwork once a request for issuance is mailed.

We hope you enjoy the challenges of the *73* Awards Program and will share its rules with your amateur friends. While we hope you all will pursue the objectives these awards have to offer, we also hope that you will send any information you might have on other award programs which have never appeared between the covers of this magazine. Looking through my files, I see that we have gone many, many months without duplicating a single award. Our files are getting bare, however, and it is the input of our readers that will keep the image of this column original and creative. If your club has an award it sponsors, why not share it with our thousands of readers?

New Products

from page 39

modular addition to the HG-EW winch. This remote control unit allows the operator to conveniently raise and lower the tower from a remote location such as a ham shack. The control displays upper and lower limit positions, up or down operating direction, and also provides a fail-safe sensor and indicator which automatically shuts off the winch should extreme side loads affect tower telescoping. Both the winch and the remote control are available for 110- and 200-volt operations.

For further information, contact *Hy-Gain, Division of Telex Communications, Inc., 8601 Northeast Highway Six, Lincoln NE 68505; (402)-467-5321.* Reader Service number 478.

ARCHER ENGINEER'S NOTEBOOK

Just published by Radio Shack is a new handbook of 415 electronic circuits for electronics hobbyists, experimenters, technicians, and engineers.

The Archer *Engineer's Notebook* contains 128 pages of useful and thought-provoking circuitry in a unique hand-executed style that resembles a master circuit designer's notebook. Applications are included for most of the popular integrated circuits sold by Radio Shack.

Dozens of handy problem-solving circuits ranging from straightforward building blocks to never-before-published novelties, including a generous selection of warbling, flashing, and howling fun circuits, are described. Tips and techniques for beginners are included in the introduction which precedes each section.

Following a brief review of basic electronics, the book is divided into two major sections: digital and linear. The digital section is further subdivided into CMOS and TTL/LS chips. Each chip gets at least a full page, and some get four pages of application circuits.

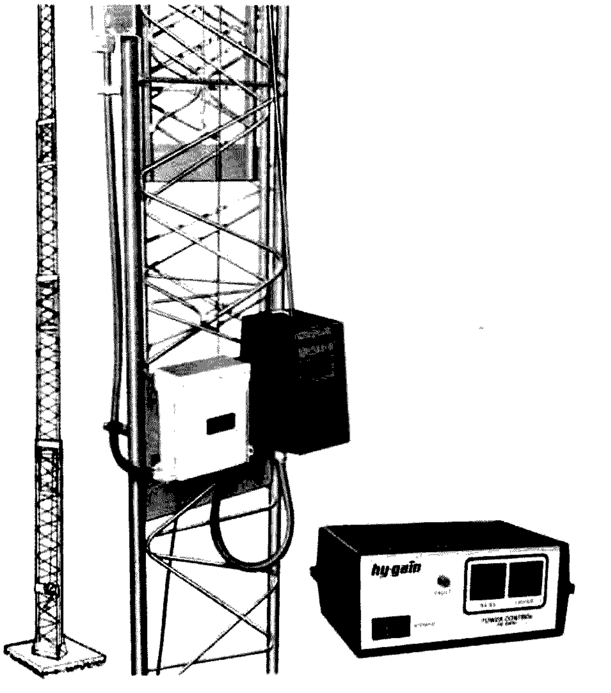
According to Radio Shack, using the book is easy since the chips are organized by function rather than part number. All CMOS gate packages, combinational logic chips, and sequential logic chips are placed in their respective groups.

In a like manner, the linear section includes separate subsections for voltage regulators, operational amplifiers, LED flashers and dot/bar drivers, timers, tone decoders, voltage-to-frequency converters, voltage-controlled oscillators, and audio amplifiers.

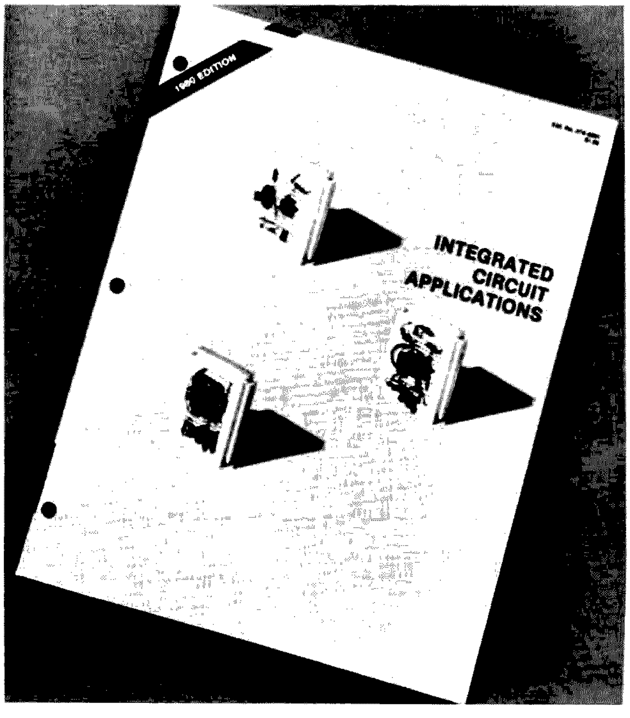
The book was compiled and hand-executed on engineering grid paper by Forrest M. Mims III, an electronics writer who has written hundreds of articles and 36 books covering topics ranging from electronics and lasers to computers and CB radio.

Many of the circuits in *Engineer's Notebook* came from Mims's personal notebooks and his project articles. Others are from manufacturers' data books or were designed by Mims specifically for this book.

Radio Shack, a division of Tandy Corp., 1300 One Tandy Center, Ft. Worth TX 76102. Reader Service number 483.



New products from Telex/Hy-Gain (l to r): HG-70HD, HG-EW, HG-EWRC.



The Archer Engineer's Notebook.

Ham Help

I need a schematic and/or a service manual with power requirements for a Galaxy SSB Comm 1.

H.E. Roby K5JMI
317 Driftwood
San Antonio TX 78239

I need a circuit diagram and/or instruction book for a Simpson #311 VTVM. I will pay for copying and postage.

Nate Bushnell KA0DGN
7175 S. Grant St.
Littleton CO 80122

I am looking for a vfo or a schematic for one with sufficient output to drive a World Radio Labs SB-175 tube-type transmitter. I will pay a reasonable price for the vfo or for the schematic. I will reimburse the cost of copying or return the schematic after copying.

Rex D. Faulkner KA3FTN
3416 Brinkley Rd. #102
Temple Hills MD 20031

I would like to hear from anyone who has successfully tinkered with a CPU 2500 R/K (Yaesu) so as to unlock the PLL in order to be able to listen to lower and higher frequencies. Mine is factory wired for 144 to 148 MHz. Thanks.

Hubert Melin PY1VLY
PO Box 551
20.000 Rio de Janeiro
Brazil

I need to contact individuals who are familiar with permits, regulations, etc., for the marine radio bands—especially VLF, MF, and HF.

Gary Mitchell WA1GXE
Box 1003
Fairfield CT 06430

✓ Reader Service—see page 195

Looking West

from page 10

southern California they utilize 220-kHz input-to-output separation, while other areas have 600, 800, 900, 1 MHz, or any combination thereof. Frankly, none of these has proven truly viable, especially for single-site installations. With a bit more deregulation, though, the answer to developing a solid relay subband is within our grasp. In my opinion, the answer will come from petitioning the Commission to permit FM repeater operation from 51 through 54 MHz and then adopting the now-proven 220-MHz band plan to six meters. This would yield a total of 69 repeater pairs with 1.8-MHz input-to-output separation and a minimum of 20-kHz spacing between repeaters, and would make for easier system construction. To implement it would first take convincing the FCC to open 51 through 54 MHz to repeaters and then convincing the manufacturers of amateur equipment that we meant business this time. One of the reasons that so few 6-meter FM transceivers were ever developed for amateur use is that manufacturers who attempted this, especially with synthesized units, found that without an established national band plan there was little interest in their product. Unless we show good faith by conforming to a national relay band plan, I don't think you will see all that much FM-only equipment coming to the six-meter market. For the manufacturer, the multi-mode transceiver is a better product to market since it covers all bases.

Let's take a closer look at the band plan (Table 1) and then discuss its pros and cons.

On the surface, the concept looks almost too good to be true. The technology has been proven and, from a standpoint of spectral efficiency, the plan makes more sense than anything to date. There are drawbacks, and they must be brought out before we go any further.

First, as Ray points out, there now exists a Pacific DX window from 52.0 to 52.1 MHz. That's because VKs are restricted to operation above 52 MHz, and many, many DX QSOs are made in that slot. While judicious coordination could minimize impact on this window, FM repeaters operating near it, in both proximity and frequency, will have a detrimental effect and cause definite degradation in that spectral parcel. The actual bandwidth of an FM signal is infinite. As noted on page 530 of my own book, the bandwidth (of an FM transmitted carrier) is determined by Carson's Rule as $Bt = 2(f/W + 1)W = 2f + 2W$, where f is the modulating frequency and W is the deviation.

I cannot take credit for discovering the existence of Carson's Rule or its application to amateur FM. In fact, what has just been stated is part of a paper originally prepared by someone far more technically inclined than I, Bob Thornburg WB6JPI. While Bob wrote his original thesis to deal with the problem of 15-kHz tertiary split repeaters, its application is even more important here. Take out your pocket calculators, plug some numbers in for f and W, and see what you get. As you can see, implementation of a band plan for FM relay service such as described herein would spell disaster for the Pacific DX window.

There is yet another problem, one more psychological than technical. Many will ask why FM and FM repeater operation should be given what amounts to the lion's share of the band, even though most of 6 lies unused. This feeling comes from years of established 6-meter tradition, I suspect. The concept is "even though nobody else uses it, it's mine and I like it the way it is!" I can only point to 2 meters, 220 MHz and 450 MHz, and say that I firmly believe that if any mode becomes dominant it will be FM. Look at the number of 2-meter FM radios in the hands of amateurs these days as opposed to the number of radios which operate other modes. Sure, we can go through some more growing pains with which FM relay technology will slowly inch its way into a position of power, or we can start to work together now to protect vested interests. I favor the latter approach. This means getting whatever further deregulation is necessary underway now. Even if we petition the FCC to permit FM repeater operation from 51.0 up and have such deregulation granted, there is no reason why we cannot on a voluntary basis build safeguards into our band plan simply by keeping all FM signals out of a region from 51.9 to 52.2. One of the nice things about Carson's Rule is that while the bandwidth of an FM signal is technically infinite, thankfully levels dissipate in strength very quickly outside the design bandwidth. Nonetheless, a certain amount of degradation will occur in the ambient noise floor of the band. How much? There is no way to know for sure till it happens. It's for this reason and based upon this premise that a good-sized guard band to protect the Pacific DX corridor must be part of any national 6-meter band plan, and even now, with only simplex FM permitted throughout the band, it's wise to keep FM clear of that spectral parcel.

Now that I have punched holes in my own proposal, let's look at the positive side of things. First, and most important, a band plan such as this, if implemented along with regulatory expansion permitting FM relay operation as low as 51 MHz, would make it easy to get a 6-meter repeater into operation. Regardless of the band, one truism holds: The greater the input-to-output separation, the better the system will perform. So, for the sake of argument, let's assume that we can obtain that further deregulation. If we were to adopt the proven national band plan for 220 MHz and apply its technology to 6 meters, we come up with 1.6 MHz between a repeater's input and its output, and a minimum of 20 kHz between systems. This is far better than the 146-148-MHz spectrum where we are dealing with 600-kHz input-to-output separation and 15 kHz between systems. Again, plug some numbers into Carson's Rule if you need any more proof.

Another problem that will be minimized is desensitization. The greater input-to-output separation handles that. Finally, there is the old 6-meter bugaboo, TVI. The reason that the band plan is low-in/high-out is that most of the time repeater transmitters are located in high places removed at least to some degree from humanity. Conversely, repeater users are usually in fairly inhabited areas, and therefore are more prone to causing unwanted twitches on the local one-eyed monster.

Sure, the repeater transmitter will cause TVI. I've yet to run into a 6-meter transmitter that won't. If you're one of those who claims never to have received a TVI complaint when operating 6 meters, then you are either the luckiest person in the world, have the most understanding neighbors, or are surrounded by so many CBers in your neighborhood that your TVI blends in with the rest. I've lived through my share, and it's never been much fun. Since the repeater transmitter will be the immobile object creating the greatest possibility of TVI (but in most cases will be remote from humanity), put it at the high end and keep the user transmitters as far from 54 MHz as possible. Also, don't do what one group I know of did. They rented space at a location shared with a cable TV head end. I guess I don't have to tell you the rest. Rule of thumb: Keep static 6-meter transmitters as far removed from humanity and humanity's visual link to the world as possible.

Thus far we have not mentioned the fact that many model builders have obtained amateur licenses for the sole purpose of flying their model planes or running their model boats in spectra far removed from the 27-MHz CB mess. Obviously, the band plan as outlined would put a crimp in this established operation. However, they need not be displaced from the 6-meter band. In fact, this band plan could hold good vibes for them since provision is made to move them to spectra below 51 MHz and give them a lot more room. Note that 50.6 to 51 MHz is allocated to AM and experimental modes. There is no reason why the remote-control model enthusiast could not relocate within that spectral parcel. In reality, I doubt if AM is going to make a comeback, and the few AMers left could easily live with the remote-control model enthusiasts and vice versa. Keep in mind that most truly wideband, high-utilization-density modes are kept above 51 MHz in this voluntary band plan. That

is the reason for the next part of this discussion, on the special simplex frequency listing.

Let's go there for a moment. There are four reserved simplex channels to meet specific needs. Obviously, if this band plan were to be adopted, it would negate the current national calling frequency. Since amateurs seem to like things to be symmetrical, I suggest that 52.52 MHz, derived from its companion 146.52-MHz counterpart, become the primary national FM simplex calling channel. Likewise, 52.50 could become the 6-meter counterpart to 323.50. That might be called the secondary national calling frequency or, possibly, the regional calling frequency. The same anomaly holds true for 52.46 MHz as a national remote base 6-meter counterpart to the already established 146.46.

This brings us to the last special simplex frequency of 52.56 MHz which is totally dedicated to ASCII RTTY point-to-point communication. If we are going to build a subband for everyone, then the computer-buff ham operator is an important consideration. Another channel could be reserved for conventional RTTY as well, although I suspect that within a few years the traditional green keys may well be a thing of the past.

With ASCII having been approved, with its inherently higher efficiency as opposed to the Baudot we have been utilizing for years, I suspect that by the time a band plan of this sort could be implemented the model 28s would be naught but collectors' items. Prediction: Computers will replace traditional RTTY in a very short time.

ARCH '80 DEPARTMENT

Last month I told you the gruesome details of the flight to St. Louis for the 1980 Amateur Radio Computer Hobbyist convention. I had planned a picture story about ARCH '80 this month, but made one big mistake. In order to travel light, I took along one of those mini 110 pocket cameras. That's the last time I will ever depend on one of those. Out of 20 photos, only four came out. Of those four, none really shows what I want. Therefore, I will have to use the proverbial 1,000 words in lieu of the photos.

ARCH '80 drew about 4,000 attendees to the city of St. Louis for Memorial Day weekend. By all standards, it was a successful outing. Credit for this must be given to an organization known as the Gateway Amateur Radio Association. GARA is a conclave of 17 St. Louis regional clubs which banded together to put on the event. The organization's president is Bob Heil K9EID, and it was Bob who inspired the ARCH convention idea originally. The first one, in 1979, was put together in 90 days and was deemed one of the best of that year. I would give this year's outing at least equal billing.

GARA was able to get just the right mix of everything to hold everyone's interest. It was billed as a family convention, and to that end an outing to a baseball game at Busch Stadium was set up as the opening event and a day at "Six Flags" was the close. In between there was something for everyone. There were seminars galore, covering both amateur radio and computer hobbyist interests, as well as a couple that tied the two together. There were some great bargains to be found at their indoor flea market (which might best be called a mini indoor Dayton). There were some excellent buys in video equipment, as well as the expected amateur radio and computer hardware/software. I make it a practice to leave my checkbook at home when attending these events since I am one of those who will purchase things on the spur of the moment. In fact, I guess I am one of the very few who has attended the 10-acre Dayton flea market and come away dry! After seeing some of the video equipment being offered at almost ridiculously low prices, I wanted to kick myself. Oh well, there's always next year, hopefully.

I spoke with a number of the dealers and distributors, and while most said that business was off a bit this year, the comment was made that this was indicative of almost every show they had attended. I suspect this is also indicative of the overall economy. Just about every one of those I spoke with had high praise for the way that the GARA organization had worked with them on the planning and setup of booths.

In the guest speaker department, there were some big names on hand. Harry Dannals W2HD came in from New York to represent the ARRL. At the last minute, it was announced that the FCC would not be able to send a representative; however, a pretty good FCC/regulatory forum took place with Lou McCoy W1ICP filling in as seminar leader. Personal Communications Foundation President Joe Merdler N6AHU put on an excellent presentation despite the fact that he had only an hour or so's sleep on the flight in from Los Angeles. He drew one of the biggest of the audiences I noted. However, the true highlight of ARCH '80 came at the Saturday night banquet which featured NBC News correspondent Roy Neal K6DUE. Roy spoke on the past, present, and future of both amateur radio and the broadcast industry, doing so from a personal viewpoint that kept the audience literally spellbound. I got so wrapped up in listening to Roy's talk that I almost forgot to turn the cassette over in the machine when side one ran out. I only wish I had room to reprint Roy's entire presentation for you to read—it is a talk that every amateur, old-timer or newcomer, could appreciate.

Above all, ARCH '80 was a fun convention. Not a Dayton Hamvention in size or scope, but rather the kind of intimate get-together of hams that you could really enjoy.

PROPOSED SIX-METER BAND PLAN BASED UPON FUTURE DEREGULATION OF REPEATER OPERATION TO 51.0 MHZ

Frequency (MHz)	Utilization
50.0-50.025	CW beacons
50.025-50.05	Weak-signal CW operations
50.05-50.1	General CW
50.1-50.25	Weak-signal SSB (50.110 calling)
50.25-50.6	Other SSB operations (rag-chew, nets)
50.6-51.0	AM and experimental modes, including radio model remote control
51.0-53.99999	Voluntary FM subband for simplex and repeater operation

VOLUNTARY SUBBAND

The concept for division of the upper three MHz of 6 meters to FM operation is directly based upon the premise of future deregulation to permit FM relay operations on 51 MHz, and is derived directly from the current 220-MHz national band plan. It uses 1.6-MHz input-to-output separation, repeating "UP", i.e., low in, high out. Initial spacing could be 40 kHz between repeater systems, with 20-kHz splits available as the band utilization increased. This would yield 35 initial repeater pairs, with 40-kHz separation and a maximum of 69 repeater pairs with 20-kHz separation (between systems).

Even-numbered pairs would be utilized beginning with 51.02 MHz as the lowest input matched to 52.62 MHz output. The highest channel pair after all 20-kHz splits were implemented would be 52.38 in, 53.98 out.

The current national simplex calling channel would be negated and simplex would be as follows:

52.42
52.44
52.46—Proposed national remote-base intercom
52.48
52.50—Proposed regional FM calling simplex
52.52—Proposed national FM calling simplex
52.54
52.56—Proposed ASCII/RTTY calling and intercom
52.58
52.60

Exceptions

51.9 through 52.2 would be initially reserved and kept clear of FM for use as a Pacific SSB DX corridor.

Table 1.

Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, Attn: Social Events.

ATLANTIC CITY NJ
AUG 30-SEP 8

Station K2BR will be operating from the Miss America Pageant headquarters in Atlantic City from August 30-September 8, 1980. It will be sponsored by Southern Counties Amateur Radio Association on the following approximate frequencies: CW—3560, 7060, 14060, 21060; Novice—3730, 7130, 21130; phone—3935, 7235, 14280, 21380. QSL to K2BR, Box 121, Linwood NJ 08221 with an SASE. Traffic to and from the Miss America contestants will be accepted.

AUGUSTA NJ
SEP 6

The Sussex County Amateur Radio Club will hold its second annual hamfest on Saturday, September 6, 1980, at the Sussex County Farm and Horse Show grounds, Plains Road off Route 206, Augusta NJ. Admission for sellers at the outside flea market is $5.00 at the door and $4.00 in advance. Admission for indoor sellers is $6.00 at the door and $5.00 in advance. Admission for buyers is free and a door prize ticket is $1.00. Talk-in on 147.90/.30 and 146.52. For pre-registration and information, write Sussex County Amateur Radio Club, PO Box 11, Newton NJ 07860, or call Ed Woznicki AC2A at (201)-852-3268.

MENA AR
SEP 6-7

The Queen Wilhelmina Hamfest Association will hold its 11th annual get-together on September 6-7, 1980, at the Queen Wilhelmina State Park Inn, atop Rich Mountain near Mena AR. Registration is $2.50 at the door. Campsites will be available. Features will include a flea market and a banquet. Talk-in on .19/.79 and .52/.52. For details, write Albert C. Petraset AD5J, General Chairman, Rt. 4, Box 612, Mena AR 71953.

GRAYSLAKE IL
SEP 6-7

The Chicago FM Club will hold Radio Expo '80 on September 6-7, 1980, at the Lake County Fairgrounds, Rtes. 45 and 120, Grayslake IL from 9:00 am to 4:00 pm both days. The flea market is open from 6:00 am to 6:00 pm. Tickets, good for both days, are $2.00 each before September 1st and $3.00 at the gate. Indoor flea market space is free with an admission ticket on a first-come basis. Bring your own table and chair. Outside are many acres of available space. Features will include commercial exhibitors in ham radio and computers, ladies' programs, hourly door prizes with a super drawing at 3:00 pm on Sunday with prizes worth thousands of dollars. Food, nearby hotels, free parking, and camping with some hookups will be available. Talk-in on 146.16/.76 or 222.50/224.10 WA9ORC. For advanced tickets, send an SASE to Radio Expo Ticket, PO Box 1532, Evanston IL 60204. For more information, call (312)-BST-EXPO.

MELBOURNE FL
SEP 6-7

The Platinum Coast Amateur Radio Society will hold its 15th annual hamfest and indoor swap-and-shop flea market on September 6-7, 1980, at the Melbourne Civic Auditorium. Admission is $3.00 in advance and $4.00 at the door. Swap tables are $5.00 per day. There will be food and plenty of free parking available, as well as awards, forums, and meetings. Talk-in on .25/.85 and .52/.52. For reservations, tables, and information, write PCARS, PO Box 1004, Melbourne FL 32901.

FINDLAY OH
SEP 7

The Findlay Radio Club will hold its 38th annual Findlay Hamfest on Sunday, September 7, 1980 (*not* September 27, as previously published), at a new location, the Hancock Recreational Center, just east of I-75 exit 161, on the north edge of Findlay, 40 miles south of Toledo. Tickets are $2.00 in advance and $2.50 at the door. Reserved tables are $2.50 per half. There will be forums on Saturday evening and setup Sunday at 5:00 am. Main prizes are a TS-120S with supplies, two TR-2400s, and an AT-120 matcher. For tickets, information, and reservations, send an SASE to PO Box 587, Findlay OH 45840.

PENNSAUKEN NJ
SEP 7

The South Jersey Radio Association will hold its 32nd annual hamfest on Sunday, September 7, 1980, on the grounds of the Pennsauken Senior High School, Hylton Road (1½ miles SE on Rte. 73 from the Tacony Palmyra Bridge), Pennsauken NJ. Admission is $3.00 and tailgate or booth space is $5.00 per seller. Features wil include a flea market, prize drawings, contests, bingo for the ladies, and games for the children. Talk-in on 146.52 or 146.22/.82. For more information, contact Edwin T. Kephart W2SPV, Hamfest Chairman, 4309 Willis Avenue, Pennsauken NJ 08109.

PORT JEFFERSON NY
SEP 7

The Suffolk County Radio Club will hold its third annual Electronic Flea Market on September 7, 1980, with a rain date of September 14, 1980. The site is the Odd Fellows Hall, Jane Boulevard, Port Jefferson LI NY. Walk-ins will be $1.50 and sellers will be $3.00. Gates will open at 7:00 am. Bargains, prizes, food, and friendship will be available. Talk-in on .52, .94, and 223.50. For further information, contact Floyd Davis WA2SDI at (516)-234-9376.

SOUTH DARTMOUTH MA
SEP 7

The South Eastern Massachusetts Amateur Radio Association will hold its annual picnic and flea market on Sunday, September 7, 1980, from 9:00 am until 4:00 pm at the Stackhouse Fairgrounds, Faith Street, South Dartmouth MA. The rain date will be September 14, 1980. Sales space is $6.00 and tables for rent are $4.00. There will be free parking, entertainment, and food and beverages for sale. Talk-in on 147.60/147.00 or CB channel 11. For information, write SEMARA, PO Box P-105, South Dartmouth MA 02748, or phone (617)-997-3674 or (617)-994-4838.

MONTGOMERY AL
SEP 7

The Central Alabama Amateur Radio Association will hold its 3rd annual hamfest on Sunday, September 7, 1980, at the Civic Center, downtown Montgomery AL. There will be free admission, free parking, and 22,000 square feet of air-conditioned activities Including a flea market. Setup will be at 0600, doors will be open from 0800 to 1500, and a prize drawing will be held at 1400 CST. Restaurants and a motel are located nearby and refreshments will be available in the Civic Center. Talk-in on 146.04/.64 or 146.52, rag chew on 146.31/.91, 147.18/.78, or 147.045/.645. For further information or market reservations, write Hamfest Committee, PO Box 3141, Montgomery AL 36109.

BUTLER PA
SEP 7

The Butler County Amateur Radio Association, Inc., will hold its Butler Hamfest on Sunday, September 7, 1980, at the Butler Farm Show Grounds at Roe Airport, Butler PA, from 9:00 am to 4:00 pm. Admission is a $1.00 donation which includes drawings for small prizes. Parking is free. Children under 12 will be admitted free. Overnight campers will be welcome and handicap parking will be available. Featured will be a free outside flea market, an indoor flea market with 8-foot tables for $3.00 each, refreshments, a fly-in to Butler Farm Show Airport (with a fly-in prize awarded), and a mobile check-in on .96/.36 (W3UDX) and .52 (with a mobile prize awarded). The first of 5 main prizes is a Kenwood TS-520SE transceiver. For a special ticket, a 13" portable color TV is first prize. For more details, write Dan Metrick WA3GDS, 130 Rieger Road, Butler PA 16001, or phone 283-1719.

HAMBURG NY
SEP 12-13

The 9th annual Ham-O-Rama '80 hamfest will be held on September 12-13, 1980, at the Erie County Fairgrounds. Ad-

vance tickets are $3.00. There will be exhibits, tech programs, prizes, flea markets, plenty of free parking, and free RV hookups. For more information and tickets, contact Ron Brodowski KC2P, 260 Hilltop Drive, Elma NY 14059, or phone (716)-652-6754.

VALPARAISO IN
SEP 14

The Porter County Amateur Radio Club, Inc., will hold its annual hamfest on September 14, 1980, at the Porter County Fairgrounds, Valparaiso IN. Featured will be a flea market, technical sessions, door prizes, and bingo. Food will be available. Advance tickets are $1.50 and tickets at the gate are $2.00. There will be dealers and commercial exhibitors, as well as free indoor and outdoor space. Gates will open at 6:00 am. Talk-in on 147.96/.36 and 146.52. For tickets and information, write Charles Baker W9SJN, PO Box 251, Portage IN 46368.

WHITESTONE NY
SEP 18

The Tu-Boro ARC will hold its annual auction on September 18, 1980, at the Odd Fellows Hall, 149-14 14th Avenue, Whitestone NY. Doors will open at 6:00 pm for sellers and at 7:00 pm for buyers. Donation is $1.00 per person. Beer and soda will be available. Talk-in on 146.52. For information, call Walt WB2PFO at (212)-539-5732 nights, and Ed WB2IBQ at (212)-746-4082.

PEORIA IL
SEP 20-21

Peoria Superfest '80 will be held on September 20-21, 1980, at Exposition Gardens, W. Northmoor Road, Peoria IL. Advance tickets are $2.00 and at the gate $3.00. Full camping facilities will be available. Featured will be the latest amateur and computer product displays, forums and product demonstrations, a free flea market, ladies' programs, and children's activities. On Saturday evening, there will be an informal get-together at the Heritage House Smorgasbord, 8209 N. Mt. Hawley Road. No reservations are necessary. Talk-in on .16/.76 W9UVI. For tickets and more information, write Superfest '80, 5808 N. Andover Ct., Peoria IL 61615, or phone (309)-692-8763.

GRASS VALLEY CA
SEP 21

The Golden Empire Flying Club, in cooperation with Radio Systems Technology, announces the third annual Fly-In and Avionics Swap Meet on September 21, 1980, at Nevada County Airport, Grass Valley CA. The event is free to dealers and individuals alike and runs from 10:00 am until dusk. Pilots of antiques or homebuilts flying in are invited free of charge to an authentic old-time miner's luncheon. There is no registration or tie-down fee for either the fly-in or the Avionics Swap Meet. Pilots are requested to use the new Unicom frequency, 123.0 MHz. For further information, contact Fran Mitchell, c/o Radio Systems Technology, 10985 Grass Valley Avenue, Grass Valley CA 95945, or phone (916)-272-2203.

ISLIP LI NY
SEP 21

The Long Island Mobile Amateur Radio Club, Inc., will hold its ARRL Hamfair '80 on September 21, 1980, at the Islip Speedway, one block south of Southern State Parkway, Exit 43, Islip LI NY. There will be over 350 exhibitors on hand and food and refreshments will be available at the track. Admission is $2.00 and $3.00 per exhibitor's space. No reservations are necessary. Many awards will be given throughout the day. The heavy rain date is September 28, 1980. For more information, call (nights) Sid Wolin K2LJH at (516)-379-2861, Nick Bellmann KA2CAO at (516)-223-1076, or Hank Wener WB2ALW at (516)-484-4322.

FLINT MI
SEP 21

The Genesee County Radio Club, along with the Bay Area Amateur Radio Club, the Lapeer County Amateur Radio and Repeater Club, the Saginaw Valley Amateur Radio Association, and the Shiawassee Amateur Radio Association, will hold their Five-County Swap-N-Shop on Sunday, September 21, 1980, from 7:30 am to 4:00 pm at Southwestern High School, 1420 W. Twelfth Street (south off 69 on Hammerberg Road, then turn left at 12th Street), Flint MI. Tickets are $2.00 per person in advance and $3.00 at the door, with children under 12 free. There will be food concessions, free parking, and prizes. Talk-in on 146.52. For information, write Bob Ross, PO Box 7671, Flint MI 48507, or call (313)-239-0397.

HARRISBURG PA
SEP 21

The Central Pennsylvania Repeater Association will hold its seventh annual High Rise Hamfest on September 21, 1980, from 8:00 am to 3:00 pm at the Park & Shop Garage, 200 block of Walnut Street, Harrisburg PA. Admission is $3.00 and $1.00 for tailgating. Spouses and children will be admitted free. Door prizes will be awarded, and protected parking will be available for 1100 cars. Talk-in on 144.87/145.47, 146.16/.76, and 146.34/.94. For more information, write CPRA, PO Box 6284, Harrisburg PA.

LOWER BURRELL PA
SEP 21

The Skyview Radio annual swap and shop will be held on September 21, 1980, at Sokol Camp, Lower Burrell PA, from 12:00 noon to 4:00 pm. Registration is $1.00 per ham, and XYLs, YLs, and children are free. There will be plenty of parking and lots of shade. Talk-in on .04 and .64. For more information, send an SASE to Jim Jackson K3VRU, RD 1, Box 7A, Apollo PA 15613.

ROSS OH
SEP 21

The Greater Cincinnati Amateur Radio Association, Inc., will hold its 44th annual Cincinnati Hamfest on Sunday, September 21, 1980, at Stricker's Grove on Ohio State Rte. 128, one mile west of Ross (Venice) OH. Exhibits, prizes, food, and refreshments will be available. Featured will be a flea market with radio-related products only, music and good fellowship, a hidden transmitter hunt, and a sensational air show. Admission and registration are $4.00. For further Information, write Lillian Abbott K8CKI, 1424 Main Street, Cincinnati OH 45210.

ELMIRA NY
SEP 27

The 5th annual Elmira International Hamfest will be held at the Chemung Country Fairgrounds on September 27, 1980. Featured will be an ARRL Forum and talk by Atlantic Division Director Jesse Bieberman W3KT. Also on the agenda is a similar forum and discussion with officials from the Federal Communications Commission's Buffalo NY office. There will be a free outdoor flea market and some indoor space, as well as several electronics dealers from across the northeast. The usual abundance of prizes and good food will be part of this year's event once again. Gates open at 8:00 am. Advance sale tickets are available from John Breese WA2FJM, 340 West Avenue, Horseheads NY 14845 at $2.00 each (save a dollar per ticket off the gate price!). Talk-in on 147.96/.36, 146.10/.70, and .52 simplex.

TYSONS CORNER VA
SEP 27-28

The National Capitol DX Association will sponsor DXPO 80 on Saturday and Sunday, September 27-28, 1980, at the Ramada Inn, junction of Rte. 7 and I-495, Tysons Corner VA. Saturday's half-day session will include Phase I of the DXPO Program, an Attitude Adjustment Party, and a banquet with prizes and surprises. Sunday's session will feature Phase II of the DXPO Program. Unless you have previously attended DXPO, write to Dick Vincent K3AO, Rte. 1, Box 230, Bryantown MD 20617, for more information. If you have any program suggestions, contact John Boyd W4WG, 8424 Reflection Lane, Vienna VA 22180.

BOYSTOWN NE
SEP 27-28

Fremont NE hams will be operating from Father Flanagan's Boys' Home at Boystown NE on amateur bands from 75 meters through 10 meters for a 24-hour period from 1700Z on September 27, 1980, to 1700Z on September 28, 1980. Frequencies used will be plus or minus 5 kHz from 3.905, 7.235, 14.305, 21.405, and 28.605. Special commemorative QSL cards in envelopes postmarked Boystown will be mailed for all contacts upon receipt of an SASE or IRCs. QSL direct to WØRCH, Pioneer Amateur Radio Club, RFD 3, Fremont NE 68025.

ANNISTON AL
SEP 27-28

The Calhoun County Amateur Radio Association will hold its first annual hamfest on September 27-28, 1980, from 9:00 am to

5:00 pm on Saturday and from 9:00 am to 3:00 pm on Sunday at the Municipal Auditorium, 1128 Gurnee Avenue, Anniston AL. Admission is free and there will be daily parking as well as overnight self-contained RV parking. Features will include a large air-conditioned exhibit area, bingo, hourly drawings, and a final drawing on Sunday to award a Ten-Tec Delta Model 580 plus many more prizes. Donations are $1.00 or 6 for $5.00. Tables are $3.00 for one day or $5.00 for both days. Talk-in on .69/.09. For more information, contact Bill Ward W4PCK, c/o CCARA, PO Box 1624, Anniston AL 36202, or phone (205)-820-3619.

GAINESVILLE GA
SEP 28

The Lanierland Amateur Radio Club will hold its seventh annual Hamnic at Lake Lanier Islands on September 28, 1980. There will be a large covered pavilion and a large parking area for the swap shop and exhibits. Food will be available. There will be no entry fee for Hamnic; however, Lanier Islands charges a $2.50 entry fee per car. Picnicking, hiking, and swimming will be available for the kids. Trailer hookups and camping will be available on site. Many prizes will be awarded. Talk-in on .07/.67 (WR4AER). For further information, write Fred Runkle K4KAZ, 25 Stonehedge Drive, Buford GA 30518.

ADRIAN MI
SEPT 28

The Adrian Amateur Radio Club will hold its 8th annual hamfest on Sunday, September 28, 1980, at the Lenawee County Fairgrounds, Adrian MI. Featured will be prizes, games and programs. Tables are available for $5.00 per 8-foot space, $3.00 per 4-foot space, $1.00 per 8-foot trunk space, and $2.00 for an inside space for your table. Talk-in on 146.31/.91 and 146.52. For ticket and table information, write Adrian Amateur Radio Club, Inc., PO Box 26, Adrian MI 49221, or call Bob and Sally Fay of Sword Enterprises at (517)-263-3592.

NEW BERLIN IL
SEP 28

The Sangamon Valley Radio Club will hold its fifth annual hamfest on Sunday, September 28, 1980, at the Sangamon County Fairgrounds, New Berlin (12 miles west of Springfield on Rt. 36) IL. The ticket donation is $1.50 in advance, $2.00 at the hamfest, and 3 for $5.00. First prize is a Kenwood TR-2400 synthesized hand-held. (Club members and families are ineligible to win prizes.) Randy Rowe NØTG will talk on the Navassa DXpedition. There will be a covered pavilion, an indoor display area, and exhibits, as well as food and camping available on the grounds. Talk-in on 146.28/.88 and 146.52. For additional information, contact Joe Suarez WB9RFC, c/o SVRC, 1020 S. 6th Street, Springfield IL 62703.

BOULDER CO
SEP 28

The Boulder Amateur Radio Club will hold Barcfest '80 on September 28, 1980, beginning at 9:00 am at the Boulder National Guard Armory, North Broadway, at the city limits, Boulder CO. There will be an auction and a snack bar. Admission is $2.00 per family and includes a door prize drawing and swap space. Talk-in on 146.10/.70 and .52/.52. For further information, contact Mark Call NØMC, 4297 Redwood Ct., Boulder CO 80301, or phone (303)-442-2616.

ERIE PA
SEP 28

The Radio Association of Erie, Inc., will hold its HAMJAM 1980 on Sunday, September 28, 1980, at the Rainbow Gardens at Waldameer Beach Park, Erie PA. Hours are from 9:00 am to 5:00 pm. The $3.00 admission fee includes a chance for the main prizes, hourly door prizes, and a free cup of coffee. Featured will be commercial displays, huge outdoor flea market ($1.00 per car space), large indoor display area (tables available at $5.00). Food will be available on site. Talk-in on 146.34/.94 (primary) and 146.22/.82 (secondary). For information about overnight parking and other details, write Lee Robinson WA3HJC, HAMJAM Chairman, PO Box 844, Erie PA 16512.

SUTTON NH
SEP 28

The Connecticut Valley FM Association will hold its hamfest on September 28, 1980, from 9:00 am to 5:00 pm at the King Ridge ski area, Exit 11 off I-89, Sutton NH. Admission is $3.00 per person over 16. Festivities include an indoor/outdoor flea market, a floral exhibit, a frisbee toss, a horseshoe competition, dealers' exhibits, food, overnight camping available for self-contained units only, and a consignment room. Door prizes will be awarded, including a grand prize; there will be a raffle at 5:00 pm. Talk-in on .52/.52, .16/.76, and .24/.84. For further information, contact C. A. Breuning, 54 Myrtle Street, Newport NH 03773.

CORNWALL NY
OCT 4

The Orange County Amateur Radio Club will hold its annual auction on Saturday, October 4, 1980, at Munger Cottage, Cornwall NY. Admission is $1.00. The auction begins at 11:00 am. Talk-in on 146.52. For more information, contact William Lazzaro N2CF, 11 Jefferson Street, Highland Mills NY 10930.

BILOXI MS
OCT 4-5

The Mississippi Coast Amateur Radio Association will hold its 4th annual Ham-SwapFest on Saturday and Sunday, October 4-5, 1980, at the International Plaza, Biloxi MS. Admission is free. Features will include a prize drawing Saturday afternoon, an old-time shrimp boil Saturday night, main prize drawings on Saturday afternoon, a flea market, commercial displays, forums, and prizes for YLs, XYLs, and harmonics. Talk-in on 146.13/.73 and .52. For further information, contact Bob Wyatt WB5VCI, Hamfest Chairman, Box 114, Whispering Pines Drive, Waveland MS 39576.

VIRGINIA BEACH VA
OCT 4-5

The ARRL Virginia State Convention and the fifth annual Tidewater Hamfest, Computer Show, and Flea Market will be held on October 4-5, 1980, in the Arts and Conference Center, Virginia Beach VA. Take Highway 64 to Highway 44, which passes right by the door and also into the beach resort area. Featured are ARRL, traffic, DX, and technical forums, as well as free bingo and a lounge for XYLs. Admission is $3.50 and flea market spaces are $3.00 per day. There will be an advance ticket drawing for a Kenwood FM transceiver. For tickets and more information, send an SASE to TRC, PO Box 7101, Portsmouth VA 23707.

WARRINGTON PA
OCT 4-5

The Pack Rats fourth annual Mid-Atlantic States VHF Conference will be held on October 4, 1980, from 9:00 am to 5:00 pm at the Warrington Motor Lodge, Rte. 611, Warrington PA. Registration is $3.00 in advance or $4.00 at the door. The price includes admission to the ninth annual Hamarama flea market on October 5, 1980, from 8:00 am to 4:00 pm, rain or shine, at the Bucks County Drive-In Theatre, also on Rte. 611. The Saturday conference will include a cocktail hour and get-together at 6:30 pm and a buffet dinner, at $9.00 each, at 7:30 pm. The cost for the flea market alone is $2.00 and tailgating is $2.00 per space (bring your own table). Featured will be amateur radio equipment, electronic parts, surplus, and door prizes. Talk-in on 146.52 (W3CCX). For information about both events, write Ron Whitsel WA3AXV, PO Box 353, Southampton PA 18966, or phone (215)-355-5730.

NEW YORK NY
OCT 5

The Kings County Radio Club will hold its Hamfest 1980 on October 5, 1980 (rain date is October 12, 1980), at Manhattan Beach Park Brooklyn NY. Take the Ocean Avenue exit from the belt parkway and follow the signs. Admission for sellers is $3.00, buyers' admission is $1.00, and spouses and children will be admitted free. There will be a large outdoor electronic flea market and plenty of parking. Sellers can bring their own tables or tailgate. Prizes will be awarded and a color TV will be raffled. Talk-in on .52.

BENTON HARBOR MI
OCT 5

The 1980 Blossomland Blast will be held on Sunday, October 5, 1980, from 8:00 am to 3:30 pm EDT at the Lake Michigan College Convention Center, one mile off exit 30 on I-94 near Benton Harbor MI. Prepaid tickets are $2.00 each ($3.00 at the door). XYLs, YLs, and children under the age of 16 are free.

Continued on page 193

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73 MAGAZINE FOR RADIO AMATEURS

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A NOTE

Some years ago, in my pre-Green past, I was employed in a moving and storage warehouse. The owner was something else. If we were booked to capacity, he would book more storage. If we were overbooked, he would book still more. "No" was not in his vocabulary. "But Sir, we have 200,000 pounds more than we can handle right now! How can we take in another 50,000 tonight? Where can we put it?" "I don't *care* where you put it! Put it somewhere, put it *anywhere*, because we've got another 100,000 coming in tomorrow!"

Now, this man was definitely snapped out. Even though I thought he was highly successful, I *knew* he was crazy and figured he had to be at the top of the entrepreneurial heap. Then I met Wayne Green.

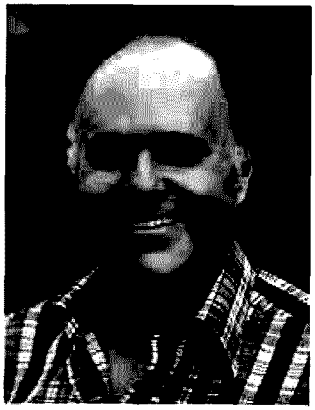
It is not easy working for Wayne. Being subject to a hard taskmaster is difficult enough, but having to deal with one who never sleeps falls under the cruel and unusual clause. He works at least 100 hours a week—*at least*. He produces more editorial material per month (55 magazine pages in July, in four different publications) than possibly any other editor/publisher in the world. He travels, makes guest appearances, gives speeches. He turns out correspondence by the bushel. He reads scores of other publications every month. He monitors the day-to-day operations of a multi-division corporation. And he expects everybody else to keep up with him. Right.

He has his faults. If his pen is mightier than his sword, his tongue is—more often than not—sharper than his pen. "I don't want to *hear* about problems—I want *SOLUTIONS!*" He will listen attentively to a well-reasoned proposal, but don't try to snow him with meaningless drivel. Don't interrupt him when he's typing. Repeat—Don't interrupt him while he's typing! Don't use the color brown. Don't be late for the staff meeting, and did you bring the chart I asked you for? Why is that halftone muddy? Why are there so many quotation marks here? We need to hire ten more people by next Tuesday. Here's an idea for a new magazine—I want the finished product in my hands in a month. Think, think, think. Push, push, push. Never Say Die.

For Wayne Green, no possibility is too remote to be investigated, no idea too wild to be pursued. We of his staff would just like to say thank you to Wayne for the twenty years of NSDing it took to get *73* to this point at which we can all take part in this 20th Anniversary celebration. We know that you're highly successful, but there are those of us who are beginning to think that maybe you might *not* be crazy. So thank you, happy 20th, and, yes, we know that you'd rather have an ad in this space.

J.B.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green



STATUS REPORT

On the event of our twentieth anniversary, and particularly for you readers who have hung in there for much of that time, I thought you might like to know where we are with our many projects at this time...and where we're aiming.

Starting with *73 Magazine*, the backbone of our whole publishing organization, we're in reasonably good shape. We have for years published more articles and even more pages of articles every month than any other ham magazine...often more than all others combined. A recent count put us at about two and a half times as many articles as *QST*.

In case you haven't taken the time to count, *73* also has more pages of paid advertising than any other ham magazine. Our survey earlier this year shows why: *73* readers number slightly over 150,000 and are spending an average of $9,500,000 a *month* on ham gear and accessories. Obviously the ads and articles in *73* are influencing this flow of sales.

With nearly $10 million a month changing hands, it is no wonder that *73* has so many advertisers. This benefits you in several ways...first by making the magazine larger and even more packed with articles. Then it keeps the flow of money going into our industry and thus promotes the development of products to make hamming more fun. it also encourages amateurs to work on new inventions which we will eventually see as articles in *73* and then as commercial products. Everyone gains and amateur radio pays for its space in the spectrum by helping the development and pioneering of new equipment and techniques for everyone.

We really can't forget that it was via amateur radio that FM repeaters became a worldwide phenomenon...that sideband became a practical communications medium...that slow scan television was developed and used. The list is a long and honorable one. But without magazines such as *73*, these developments would not be practical. It takes the cross-fertilization of ideas and the work of many people to make each of these ideas come to fruit.

In the 1980s we'll be pushing hard for amateur radio to pioneer many more breakthroughs in communications. Such ideas as automatic identification, microcomputer-oriented communications, wide-band techniques, synchronous detection of DSB signals, use of commercial satellites for ham communications, new ideas in slow scan which would made it useful to virtually every ham, panoramic reception, a new design technique for transceivers, packet communications with look-up dictionaries on a chip, etc. You, the readers, will be inventing these communications systems and we'll be publishing them and helping you start successful companies using these new ideas.

Another very serious need is for a massive attack on the lack of ham growth. To me this means that every ham club in the country must organize to get new licensees into their classes, preferably from the high schools. Not only do we need more amateurs, and need them desperately, but the country needs the technicians and engineers which will result from this program. If we are ever going to get technical leadership of the world back from Japan, we *have* to out-ham them...and they are about 800% ahead of us on the basis of active hams per capita.

Part of our attack will have to be centered on Washington, with pressures on both the FCC and Congress. We need to get deregulation going again and assert control over our hobby. We have shown that we can do it and we should be allowed to expand this function. It will only be through such deregulation that we will be able to do the experimenting, inventing, and pioneering which must be done during the next few years. The insistence of the FCC that hams only use modes of communications which are over 20 years old (so that their ancient monitoring stations can copy all signals) has put a heavy chill on amateur inventiveness and must be ended.

Another part of our attack should be on a national basis, where we must do everything possible to get our activities into the media...with coverage of important amateur services being reported on television, in newspapers, and via articles in the national magazines. The more we make amateur radio known for its benefits to the country, the easier it will be to recruit new hams into our classes and the easier it will be to get needed legislation through Congress or the FCC.

Then there is the need for promoting amateur radio on a worldwide basis. I've been asking for a $1,000 donation for my hamfest talks toward a fund to work on this situation for the last year and have, surprisingly enough, been able to get this. Recently, the Richland, Washington, hamfest sent a check which has gone into this world development fund. During 1981 I'll be available on a similar basis to help hamfests draw larger crowds (I hope).

The basic plan is to try to get amateur radio into as many of the lesser developed countries (LDC) as possible, using the scheme which worked so well in Jordan. His Majesty, King Hussein, has agreed to help with this project, so with some funding, I should be able to get into gear in time to perhaps help us at the next ITU conference. The African countries are becoming more and more aware of their need for communications and the importance of developing native technicians and engineers, so our sales pitch will be simpler than it might have been a few years ago.

In all, the most exciting years of amateur radio are ahead of us.

COMPUTERS

Well, so much for the hamming end of things. The largest part of our publishing activity today is involved with microcomputers...and this appears to offer us the greatest possibilities or growth.

In 1975, shortly after the invention of the microcomputer, our group of *73* staffers started up *Byte* magazine. Indeed, I don't think there was a person on the *73* staff who was not involved in getting *Byte* going. It was a lot of work and utterly devastating to us when *Byte* suddenly moved out one night. The litigation on that situation will be long and expensive, with several millions of dollars involved, I expect.

Still, the *73* crew has survived even tougher blows in the past, such as an attempt by a previous business manager to put the magazine under so he could start his own magazine. That almost did it to us, but everyone worked around the clock for months and we pulled out of it. Then there was an IRS blitz, from the same source, and that was about as traumatic as anything in my life. By the time the *Byte* thing happened, we could survive just about anything.

It took a year before we were on our feet enough to launch a

second microcomputer magazine, *Kilobaud.* It started off much faster than *Byte*, but playing catch-up is more difficult than covering new ground, so *Byte* is still ahead in circulation. By the end of 1979, *Kilobaud Microcomputing* had passed *73* in advertising pages and was neck and neck and circulation!

In January, 1980, we started a new magazine, *80 Microcomputing,* devoted just to the TRS-80 computer, its accessories and software. This turned out to be one of the most successful new technical magazines in history, passing a hundred pages of paid advertising within nine months of starting publication. The circulation started at 50,000 for the first issue and is expected to pass 100,000 by the end of this year. This magazine is having a significant effect upon the sales of the Radio Shack computer systems and may be the one factor which will help them stay ahead of the coming Japanese invasion of microcomputers.

The microcomputer field, which started in 1975 with sales of about $5 million (mostly by one firm: Mits), has grown at a rate of over 300% per year on the average, with no hint of any slowdown, even in response to the recent recession. Every person in the field can find five jobs or more since there is a desperate need for trained people. Virtually every hobbyist of the early years is now working happily in the industry. . .or has his own firm.

Perceiving the eventual need for massive amounts of software to support the growth of the industry, I started a small group working on evaluating programs submitted by independent authors for mass publication and distribution in the computer stores. This was started in 1978, down in the old potato cellar at *73* in our 250-year-old building on Pine Street. That function has grown to fill most of what used to be a Peterborough motel, a 26-room and restaurant complex. The lab, one of the largest microcomputer labs in the world, is being geared to handle the needs of two local colleges and the high school as well as the work required by Instant Software. Almost a thousand programs are currently either in production or nearly ready for release.

The software programs are supportive of the TRS-80 and a half dozen other popular microcomputer systems. They are being produced in three European languages and several more are scheduled before the end of the year. A production plant is being organized for opening in Ireland to supply the European, African, and Middle East markets.

Plans are also well along for massive support of new microcomputer systems through conversion of existing successful programs for use on the new systems. These are popular with programmers because one order for a single program can provide a royalty on the order of $25,000.

Instant Software is the largest of the microcomputer software publishers. . . and we hope to keep it that way. The biggest problem we face is in getting qualified people to help us grow. . . and in getting office and production space in the Peterborough area. The 40-room house on Pine Street is full. The Instant Software building is full. . . now where?

There is no way to really know how big the software market will be for microcomputers, but estimates by firms in the business of making educated guesses about the future of industries put it at $10 billion within ten years. I think they are low. With microcomputers on every desk in every office, plus in offices at home, on every desk in schools . . . and again at home for home study, plus home computers, we're looking at an incredible computer market. Every one of those computers is going to need programs. . . and a lot of them. These programs will sell or rent for a few dollars up to as high as thousands of dollars per program.

In order to support this growing field, we are planning on starting a business-oriented computer magazine and another in the educational field.

OTHER STUFF

In addition to my few personal interests, such as hamming, fooling around with computers, gourmet cooking, skin diving, skiing, hi-fi, etc., I read about 200 magazines a month to keep up with my state of two arts as well as the state of the world. There are also demands on my time for writing the editorials for four magazines, answering a few hundred letters a month, and keeping up with a couple hundred developing situations, lawsuits and the like.

Some of my time is taken in traveling to visit computer shows and manufacturers, doing consultation, attending an occasional hamfest or club talk, and setting up representatives for Instant Software in as many countries as possible. Add to that some work for the local Chamber of Commerce, where I am the vice president, my membership in the National Industry Advisory Committee for the FCC (NIAC), a few local Mensa meetings, membership in MITA (computer industry group) and ARMA (amateur industry), an occasional newsletter for the *USS Drum* reunions (I served on the submarine during WWII), and there is little time to waste.

My need to watch the television I want on my own terms got me involved with video recorders. . . and that has escalated to video recording. I have in mind making some video shows for ham clubs and computer clubs. If that turns out to be of interest, I'll expand on that. Our camera systems are working well and I'm awaiting a new staffer or two to get this plan into motion. This may be a way to make my travelog of color slides available to many ham clubs, since there are just so many hours in the day for me to work. Videotapes might be the answer.

MY AIM

If I can survive the amount of work needed, I'm aiming for doing all in my power to see that we have one million hams in our country by 1985. I think we need them if we are going to have the technical and pioneering developments we need. We are also going to need them if we ever intend to get the ball back from Japan on technical products design and manufacturing. I'm talking about consumer products such as television sets, video recorders, calculators, integrated circuits, computer developments, ham rigs, etc.

In addition to that, I hope to quickly get the microcomputing industry together to set a standard for electronic mail. This could solve much of the US mail problem for us. . . and also cut down on the cost and time wasted on phone calls. I assume

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LOOKING WEST

Bill Pasternak WA6ITF
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Newhall CA 91321

Have you ever started reading a book and found that you couldn't put it down? That's just what happened to me last night. The book I have just finished is titled *The Magic of Ham Radio*, written by a 60-year veteran of amateur radio named Jerrold Swank W8HXR.

The Magic of Ham Radio is more than just a look into the past. It's a detailed trip through time narrated by someone who has lived the story. It's something you feel rather than just read. It has a rare something that makes you a part of the book—you are not just an outsider looking in on someone else, reading someone else's story. The book is you, me, and everyone else who has ever had any contact with the amateur service. Simply, the book is a true joy, and one that can be understood by anyone—a ham or someone who dwells outside our special world. The book is priced at $4.95 and in my opinion is worth every penny. It's published by *73* and available through direct mail order from *73*, Inc.

FIELD DAY AND THE MEDIA DEPARTMENT

For some reason, the media has discovered Amateur Radio Field Day. I have heard such reports on my own radios and have watched news coverage on my very own Sony TV! For instance, radio station KMPC here in Los Angeles has a new weekend format titled "Weekend L.A." Part of the program revolves around live on-the-spot coverage of events taking place in this town. On Field Day weekend, KMPC sent one of its radio-equipped News Cruisers, a reporter, and a field producer to various Field Day sites to interview the amateurs participating in the event.

Under the watchful eye of producer Kevin Gershan, the reports were interesting, informative, and portrayed the amateur service in a very positive light. Never once was amateur radio confused with CB, even though neither the producer nor air talent was an amateur operator. Obviously they had done their preparatory work well.

The same held true of TV news coverage here in Los Angeles. For instance, Metromedia TV channel 11 had an excellent news feature about Field Day which was recorded at a site in Griffith Park. Here again there was no confusion between amateur radio and CB. The report headlined the emergency communications capability of amateur radio. Others have told me that similar stories were aired by other stations on their news programs. This news coverage was not limited to the Los Angeles area. Norm Brooks K6FO, one of the staff writers for *Worldradio*, telephoned to tell me of his personal experience with the media in regard to Field Day.

Norm's name and call were part of a wire service story about Field Day activities in the Sacramento area. Apparently a network producer for RKO General in New York City read the wire copy and attempted to contact Norm. He was at his club's Field Day site at the time. After receiving the message, he returned the producer's call via a local 2-meter autopatch system right from his club's Field Day location. He was able to give a rather graphic demonstration of exactly how amateur radio functioned, in that the interview was done via the autopatch! Later in the day, it was part of their network news feed and thereby attained national status.

According to Norm, this producer had also done her homework in regard to the differences between the amateur and Citizens Band services. Never once was there any mixup between the two on the part of the interviewer. There are similar stories from amateurs in other parts of the country who were contacted by the local electronic media with the result being some very positive publicity for our service. It didn't take a disaster to bring them to us, as is usually the case. In my mind, this signals a very positive step forward in gaining recognition for our hobby. I doubt if you will ever see a prime-time network special dealing with amateur radio, but then again who knows what some exec might have in mind. Nevertheless, Field Day 1980 was probably the best publicized outing of its type in the history of amateur radio. And . . . Field Day 1981 is only a year away.

SIX METERS CONTINUED

Last month we began to discuss six meters, the deregulation that occurred during the summer, and a possible way in which the band might be developed. Since as this month's column is being written, last month's has not yet reached print, I cannot tell you of any feedback on what I put forth last month. Confusing? Remember, there is a 60-day time lag from when I write until the time you read.

To continue, one question most often asked of me is why the six-meter band is deserted. In many areas, this has been blamed on TVI to television channel 2. In other places, the story is that everyone else is operating on two-meter FM. Both are quite valid reasons, but six meters is to me a very important band regardless of the problems and/or excuses. There is no real excuse for leaving this vital parcel of amateur spectrum unattended. I can give you one very good reason that more of you should consider getting on 6 meters. One of these days it might well get discovered by the 11-meter crowd and be populated by them either legally (as was the case with the establishment of 11 meters) or illegally (as is the case with 10½ meters)!

Not long ago, the FCC acted to deny any further expansion of 11-meter spectrum to CB. Many CB organizations had hoped for the creation of either a new pseudo-amateur-type service or some form of SSB-only CB expansion. The lobbying for this was extensive, and everyone thought it would be a rubber stamp deal. In fact, the decision to deny was a shock to most 10½-meter SSB enthusiasts. (For our purposes, 10½-meters is defined as 27.410 through 27.540 MHz.) The proposal before the FCC was to create 25 new SSB-only channels and permit limited vfo operation as well as skip contacts with other United States and Canadian stations. Also, the five-minute rule on contacts would have been abolished. Though it had the backing of both the Private Radio Bureau and the Office of Chief Scientist, the proposal ran into heavy opposition from the Field Office Bureau.

Field Office Bureau Chief Jim McKinney argued that this approach would not solve the problems of the 11-meter band, and would in effect be rewarding the current illegal inhabitants of 10½ meters with new spectrum. McKinney noted that his monitoring stations had recorded conversations between illegal 10½-meter operators in which it was stated that said operators would "move away from any new expansion so as to maintain their clear channels." Later reports I heard from various sources told of plans by these operators to "take 10 meters" if necessary. Had this occurred, it would have meant an all-out war between the illegals and the amateur radio community.

What does all this have to do with 6 meters, you ask? Simply this. Unlike 10 meters, which is fairly well inhabited by licensed amateurs, these days the six-meter band has an estimated 3000 to 4000 users on various modes scattered nationwide. If 50,000 illegals decided to take the band, how hard to you think it would be for them to accomplish this? "Wait," you say. "These guys are only interested in working skip, and there is little of that on 6 meters." True, many are into pseudo-amateur DXing, but thousands of others are rag-chewers, not unlike you who operate on 2, 220, and 450. All they want is a nice clear parcel of spectrum where they can chew the fat across town without any interference. Is not 6 meters the ideal band to simply take? Could we really protect it from such an invasion? I think not. TVI won't stop them. Many of the 10½-meter illegals operate with very high power levels and already cause severe TVI and RFI problems in their neighborhoods and care little about it. If they're breaking the law anyhow, what's TVI to them?

How then can six meters be protected from such a potential threat? There is only one an-

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DX

Jim Cain K1TN
306 Vernon Avenue
Vernon CT 06066

Dateline: Mid-October, 1974. Seems like only yesterday, as Frederick Lewis Allen would have said. A phone call came in about 2200 UTC from one of the locals who got home from work earlier than we did. "Jim, 15 is wide open to Japan! I can't believe it!" "Skew path over Australia?" we asked. "Nope, direct, just like the real thing, and they're about S7–good, steady signals." It was tough putting in that last half hour at the salt mine, and we pushed the Porsche's pedal to the floor to get home. The 15-meter antenna hadn't been pointed toward Japan for anything other than trying to find our local noisy power pole in at least two years.

Sure enough, we ended up sitting at the radio for a couple of hours, happily exchanging reports with the JA stations, many of them low-power novice operators who had never worked anything in the States east of Seattle; they did their best to pronounce "Connecticut" for the first time and it was easy to sense the thrill in their voices. The openings continued for several evenings, only to Japan and immediately surrounding areas, though. We worked about 500 JA stations in a few weekday evening operating stints, and got about 495 QSL cards through the QSL bureau for the effort. Dinner went uneaten, chores were undone, and sleeping was curtailed during this period, which W1HDQ would later call an unprecedented rise in the solar flux and sunspot activity during a sunspot minimum.

What most of us would call it is a miracle. In the autumn of 1974, conditions had deteriorated for a couple of years, since about 1971, and things were going to get a lot worse before they started getting any better. Ten meters was basically useless, 15 was a joke most of the time, and 20 was no great shakes. Long path? Forgotten. Japan coming in over Europe? Don't be silly. Many of us just kept up a 20-meter beam and concentrated on 40, 80, and 160 for the duration of the vacation the sun had taken from spotting. This writer had over 200 DXCC countries confirmed on 80 meters, with 40-15 long finished for 5-Band DXCC, but 10 looked hopeless. We had rushed home a couple of times that summer to catch multiple-hop Sporadic E openings (or whatever they were) into Europe, attempting to work a hundred on 28 MHz, but the openings were always extremely sharp geographically and never extended into the USSR and seldom into eastern Europe in general. Those, friends, are stinko conditions.

Just five years after the propagation pits of 1974 came the winter of '79-'80, the best in twenty years. Japan was worked from Connecticut on six meters, and hundreds got Alaska and Hawaii on 50 MHz to finish up Worked All States. Ten meters opened to places like 4S7 Sri Lanka at midnight, and Californians worked long path into Africa on 10. Fifteen meters was open many days 'round the clock, with all continents S9 simultaneously. Twenty, of course, was unbelievable, and with 15 and 10 taking some of the load, 20 was often pleasantly uncrowded.

What will this coming operating season be like? The forecasters tell us that the peak of sunspots was reached sometime last winter. . .this time may not see the phenomenal 6-meter propagation, and 10 might be just a hair less terrific, but still this winter will be the best for at least another six or seven years, and no serious radio operator should miss it. While sunspot lulls *do* encourage low band DXing and push us into often-ignored frequency territory, the minimum years are really pretty dismal, and, lest we forget, they will return. So enjoy October, 1980, because the radio won't be this good again soon.

The premier operating event of October (of the whole year, for that matter) is the *CQ* Worldwide Contest phone weekend (CW is in November). Don't miss it. Activities like the *CQ* WW generate the worldwide participation which enables us to discover band openings on paths which are normally unrecognized for mere lack of signals . . . like the old "does a tree falling make any noise if there's no one to hear it?" question. This contest in 1979 produced such feats as several stations who worked all 40 *CQ* zones over the weekend, 150 different DXCC countries, etc. K1RM set a new USA record on 15 meters, an *all*-time mark for a USA single operator on *any* band, and although it might seem that Vince could rest on his laurels for a while, his record could be broken this year, given a DXer at the right station. Maybe K1RM will break his *own* record, which now stands at 1768 contacts, 38 zones, and 129 countries.

DXCC NEWS

What is a *deleted country*? In DXCC terms, it is one which has ceased to count for the award; the last page of the ARRL's DXCC Countries List (CD-216) lists almost fifty such deleted countries. To make the Honor Roll, one must have worked, confirmed, and received DXCC credit for all but nine (or fewer) of the *active* countries on the list. That's why when the Honor Roll listing is published in *QST*,

Continued on page 220

Alvaro Fernandez K operated special callsign 6D2AF during the ARRL 1980 Contest; QSL Apartado A-23, Cuidad Obregon, Sonora Mexico.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CALIFORNIA QSO PARTY
Starts: 1800 GMT October 4
Ends: 2359 GMT October 5

The contest is sponsored by the Northern California Contest Club, with strong efforts being made to have all 58 counties in California on for the contest duration.

Single-operator stations may operate only 24 hours of the contest period; off times must be clearly marked in the log. Multi-operator stations may operate the full 30 hours. Stations may be worked only once per mode per band. All contacts must be simplex. California stations that change counties are considered to be new stations and may be contacted again for points credit.

EXCHANGE:

CA stations send QSO number and county. Others send QSO number and state, province, or ARRL country.

FREQUENCIES:

Novice—3725, 7125, 21125, 28125. CW—1805, 3560, 7060, 14060, 21060, 28060. SSB—1815, 3895, 7230, 14280, 21355, 28560.

SCORING:

Each completed phone contact is worth 2 QSO points. Each completed CW contact is worth 3 QSO points. For multiplier, CA stations use the number of states, VO/VE 1-7, and VY1/VE8 for possible of 58. Others use the number of CA counties worked for a possible total of 58. The final score is the number of QSO points multiplied by the number of multipliers.

AWARDS:

Certificates for highest-scoring station in each CA county, each state/province, and each country. Trophies to the highest-scoring out-of-state single op, highest-scoring CA single op, and highest-scoring DXpedition to a CA county.

ENTRIES:

All logs and summary sheets must be postmarked by November 1st and addressed to: NCCC, c/o Dennis Egan N6QW, 811 Byerley Avenue, San Jose CA 95125. Please include an SASE with your entry.

VK/ZL/OCEANIA DX CONTEST
Phone
Starts: 1000 GMT October 4
Ends: 1000 GMT October 5
CW
Starts 1000 GMT October 11
Ends 1000 GMT October 12

Sponsored by the New Zealand Association of Radio Transmitters, Inc.

EXCHANGE:

Send 5 or 6 digits made up from the RS(T) report plus a three-digit QSO number starting with 001.

SCORING:

Oceania stations (other than VK/ZL) score 2 points for each QSO on a specific band with the rest of the world. For the rest of the world (other than VK/ZL), score 2 points per QSO on a specific band with VK/ZL and 1 point for each QSO on a specific band with Oceania stations other than VK/ZL. The final score is the total QSO points (from all bands used) multiplied by the sum of VK/ZL call areas worked on all bands.

AWARDS:

Attractive certificates will be awarded to each country (each call area in USA, USSR, and Japan) for the top scorer using all bands. Other certificates may be awarded (2nd and 3rd depending on activity and conditions prevailing).

ENTRIES:

Logs must show information in this order: date/time in GMT, callsign of station contacted, band, serial number sent, and serial number received. Underline each new VK/ZL call area contacted and make a separate log for each band used. Include a summary sheet to show: callsign, name and address (please use block letters!), details of equipment used, and, for each band, QSO points for that band and total VK/ZL call areas worked on that band. Include a signed declaration that all rules and regulations have been observed.

All logs should be posted to reach: NZART Contest Manager, ZL2GX, 152 Lytton Road, Gisborne, New Zealand before January 31st. Any logs, even for a small number of contacts, are greatly appreciated!

SWL SECTION:

A VK or a ZL station only must be heard in a QSO and the fol-

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CALENDAR

Oct 4-5	California QSO Party
Oct 4-5	VK/ZL/Oceania DX Contest—Phone
Oct 11-12	ARRL CD Party
Oct 11-12	Montana QSO Party
Oct 18-19	ARRL Simulated Emergency Test
Oct 18-19	VK/ZL/Oceania DX Contest-CW
Oct 18-19	Scouting Jamboree
Oct 18-20	QRP October QSO Party
Oct 25-26	CQ Worldwide DX Contest—Phone
Nov 1-2	ARRL Sweepstakes—CW
Nov 8-9	European DX Contest—RTTY
Nov 8-9	IPA Contest
Nov 9	International OK DX Contest
Nov 15	DARC Corona 10-Meter RTTY Contest
Nov 15-16	ARRL Sweepstakes—Phone
Nov 29-30	CQ Worldwide DX Contest—CW
Dec 6-7	ARRL 160-Meter Contest
Dec 13-14	ARRL 10-Meter Contest
Jan 10-11	Hunting Lions in the Air
Jan 18	FRACAP Worldwide Contest
Mar 7-8	1981 SSTV Contest

RESULTS

RESULTS OF THE 2ND DARC CORONA 10-METER RTTY CONTEST FROM 10 MAY 1980

Call	Score	QSO	Countries	Prefix
Class A				
1. 9G1JX	2703	51	17	36
2. YT2D	1225	35	09	26
3. G3UUP	980	28	11	24
4. I5CBF	930	30	10	21
5. EA3BLQ	780	26	09	21
6. EA3BQQ	744	24	10	21
7. HB9LP	713	23	11	20
8. I2WEG	504	21	08	16
9. G3VXN	437	19	07	16
10. G3HJC	336	16	07	14
Class B				
1. H. BALLENBERGER	368	16	10	13
2. K. WUESTNER	260	13	09	11
3. W. LUDWIG	66	06	05	06

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Okay, now, how many of you out there have heard of iRL? Come on, raise your hands. That's one, two, three... hmmm, not too many. I guess this goes along with what one of the guys from the company told me. You see, they have a new RTTY demodulator, the FSK 1000, and, in his words, "While we haven't expected the FSK 1000 to stun the free world and enrich us overnight, we still can't quite see why people would want to spend almost two hundred bucks more for something else." Well, after looking at the FSK 1000, I don't know what the problem is either.

Over the past few months, we have covered many demodulator designs and considered what makes a good demodulator. A common design point of many of these was the inclusion of a limiter stage in the front end. What the limiter does is boost the signal input to a clipped or limited level so that—in theory—all signals present are processed to the same amplitude. In practice, however, this only works for signals that are in the clear or reasonably noise-free. The ability to work without a limiter, in true limiterless (often called AM) mode, is a distinct advantage on our often crowded ham bands.

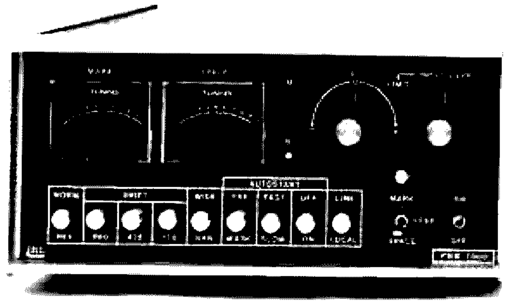
Unfortunately, most of the demodulators marketed to the RTTY amateur have not featured true limiterless operation. While a front-panel switch may be marked "LIMITER ON/OFF" or "AM/FM", there is usually no way to vary the input level to best take advantage of what signal there is. Further, selective fading without adequate logic to allow instantaneous reception on mark or space can be equally disastrous. The FSK 1000 changes all that.

A front-panel input level control and an LED which lights upon clipping, thus exceeding the linear range, make limiterless operation of the FSK 1000 easy. By adjusting the imput so that the LED is just extinguished, maximum capability is ensured. By increasing the input level, any degree of clipping from controlled to hard limiting may be achieved. Clearly, all signals are not alike. Now there is no reason that the demodulator needs to stay the same, either.

Another bugaboo of demodulator design has been the filters. Through the years, filters have ranged, as we have seen, from TV-width coils to toroids to coilless active filters. The problem has always been to maintain adequate selectivity, gain, and bandwidth at reasonable cost vs. performance trade-off. Well, iRL has come through, again, by using modern, sixth-order active filters in the FSK 1000. This permits selectable bandwidth and tunable peaks to cover any shift from 50 to 1000 Hz, with switch selection of 850 Hz, 425 Hz, and 170 Hz. The shift change is accomplished by tuning a multipole bandpass filter of constant bandwidth, rather than using audio frequency mixers in a heterodyning process. Thus, audio image problems, birdies, and spurious frequencies are minimized.

Now, as if the guts were not impressive enough, the boys at iRL have also worked hard to provide a heck of a box. The circuit board is a hefty 3/32-inch glass epoxy number, and the pots and other components are name brands. Full-sized, standard connectors are used on the rear skirt; no scrounging for molex plugs here. The whole thing is enclosed in an anodized aluminum box that unscrews for service but looks like it will support a TD on top of it. (I said "looks like it will"—I have not done it!)

There are even a bunch of options, as if the basic unit weren't enough. You can get a video board mounted inside and make a full terminal. ASCII-to-Baudot conversions go with that one. Some of the standard features are even more impressive, however. A RS-232 keyboard can be hooked into the back to key the loop, and RS-232 outputs are available also. That means the thing will work with our computer terminal, without a 60-mA



The FSK 1000 from iRL.

loop at all. There is a keyboard-activated switch (hitting any key turns on your transmitter) and a CW ID key jack. Tuning meters, scope outputs... I even think it makes a pretty good cup of coffee.

There are a few gripes, however. First off, look at the picture. I seriously considered having a contest to see how many of you could tell which push-button on the front panel was pushed. You see, even in real life, it is hard as the devil to tell what shift you are on, whether autostart is on or off, or whatever. Some form of indicator, LED, or whatever, or changing to toggle switches is needed to clear up that front panel. Speaking of clarity, about midway between the delta-tune and input knobs is a small knob labeled "THRESHOLD." This knob was added to late production runs, and allows you to adjust the autostart threshold (that is, the level at which the autostart will start) from the front panel. Fine, but there is no calibration, scale, or logging on the knob. No way to know where it is set nor return it to a previous setting. Bad news, fellas. And one last note: the autostart. When I first started playing with this thing, about a minute or two into the session, the front lights died and the printer went off. Now, if just the printer and loop had gone off, I would have known the autostart disengaged. But killing the front-panel lights made me think I'd blown a fuse. Only a fortuitous signal brought life to the machine and saved the day. Really, now, why not leave the lights alone? Otherwise, when killing equipment at the end of the day, there is no quick way to know the thing is on.

All in all, however, I have to commend the folks at iRL. They have turned out a solid demodulator that well should stun the free world. The FSK 1000 currently sells for $449.00, and you can see their ads here in *73* or write to iRL, 700 Taylor Road, Columbus, Ohio 43230.

I received a letter recently from Tom Waarvik of Indianapolis, Indiana, who related that he was a beginner, with a Teletype Model KSR-35 and a modem, and that he wanted to be able to receive Morse, Baudot, and ASCII on that setup. He notes that much of the commercial gear is over his budget, and he is looking for cheap ways of code conversion. Well, Tom, this is where the computer in the shack comes in handy. There are reams of published programs for receiving any or all of these modes with just about any of the popular computer chips. You might check back issues of *73* and *Microcomputing* magazines. In September and December, 1979, I listed many of these articles in this columm. See if you can scrounge a copy in your area, or check with *73*'s back issue department. Which computer? Well, I am partial to the 6800 and have written some fairly sophisticated programs to work RTTY on one. But whichever you can get within your budget, 6800, 8080, Z-80, Apple, Pet, or TRS-80, they can be made to work on RTTY and Morse. That is probably the best way to go.

'AWARDS

Bill Gosney WB7BFK
2665 North 1250 East
Whidbey Island
Oak Harbor WA 98277

DX AWARDS FROM POLAND

Our fraternal friend Antoni Kubicki SP5BB, awards manager for Polish Zwiazek Krotkofalowcow (PZK), the national amateur radio society in Poland, was kind enough to provide this editor with the complete details of their fabulous awards program. Allow me to share them with you now.

All Countries 15 Zone

For AC15Z, 23 or more confirmed contacts (or SWL reports) from the following list of countries are required: UP2, UQ2, UR2, UA2, SP (4 districts), OK, OE (2 districts), HA, YU (3 districts), ZA, I, M1 (9A), IT, IS, FC, HV, ZB1 (9H).

Valid contacts and SWL reports are those which took place after December 31, 1954. A QSO with SP is required.

In all cases it is not necessary to send QSL cards to justify your claim. Applicants may submit a list of contacts made giving full details for each. This list may be verified by two amateurs, a local radio club official, or by a notary public.

Submit your application along with your award fee of 10 IRCs to PZK Award Manager, PO Box 320, Warszawa 1, Poland. Allow approximately 60-90 days for your award to arrive.

Worked 21st Meridian

The W21M Award is issued for 16 or more confirmed contacts (or SWL reports) with the following countries: CR6, HA, JW, LA, OH, OHØ, OK, SM, SP, SV (Greece), TL8, TT8, UA2, UP2, UQ2, YO, YU, ZA, ZS, ZS3, ZS9 (A2), 5A, 9Q5.

As with the AC15Z award, all contacts to qualify must be made after December 31, 1954. A QSO with an SP station is necessary. General certification rules apply.

The Polska Award

The newest of awards being offered amateurs by the PZK is that entitled the Polska Award. This very colorful award is available in three levels of operating achievement: Class III requires 20 wojewodztwos (provinces) be contacted in Poland; Class II requires 35 provinces be contacted; and Class I requires all 49 provinces of Poland be contacted.

As with other PZK awards, general certification rules apply. As an alternative, however, should applicants wish to claim contacts made in the SP DX Contest held annually, they may do so without further evidence required as long as the contest was held the same year as application is made. To count, all QSOs must be made on or after June 1, 1975. As with all PZK awards, enclose 10 IRCs as the award fee.

Abbreviations denoting the wojewodztwos (provinces of Poland):

SP1: KO-Koszalin; SL-Slupsk; SZ-Szczecin.

SP2: BY-Bydgoszcz; GD-Gdansk; EL-Elblag; TO-Torun; WL-Wloclawek.

SP3: GO-Gorzow Wlkp; KL-Kalisz; KN-Konin; LE-Leszno; PI-Pila; PO-Poznan; ZG-Zielona Gora.

SP4: BK-Bialystok; LO-Lomza; OL-Olsztyn; SU-Suwalki.

SP5: CI-Ciechanow; OS-Ostroleka; PL-Plock; SE-Siedlce; WA-Warszawa.

SP6: JG-Jelenia Gora; LG-Legnica; OP-Opole; WB-Walbrzych; WR-Wroclaw.

SP7: KI-Kielce; LD-Lodz; PT-Piotrkow Trybunalski; RA-Radom; SI-Sieradz; SK-Skierniewice; TG-Tarnobrzeg.

SP8: BP-Biala Podlaska; CH-Chelm; KS-Krosno; LU-Lublin; PR-Przemysl; RZ-Rzeszow; ZA-Zamosc.

SP9: BB-Bielsko Biala; CZ-Czestochowa; KA-Katowice; KR-Krakow; NS-Nowy Sacz; TA-Tarnow.

The SP-DX Club of the PZK also sponsors a very challenging award for our readers to pursue, the SP-DX Award.

The SP-DX Award

The SP-DX Club of PZK will award an attractive certificate attesting honorary membership into their organization to any licensed amateur or SWL station who can confirm contacts with SPDXC members on or after October 1, 1959: European operators need 15 contacts; all others need 10. General certification rules apply: the award fee is 10 IRCs to be sent with your application to: SP-DX Club, Attention SP9PT, Skr. Poeztowa 131, 44-201 Rybnik, Poland.

The SP-DX Club has forwarded *73 Magazine* this list of the more active members who may be found operating on the bands:

SP1: ADM, ACA, AFU, BHX, HNS, NJ, UZ.

SP2: AEO, AHD, AIB, AJO, AOH, AVE, BA, BBD, BE, BMX, BWO, DPA, DVH, EFU, FAP, FBC, FGO, HL, IU, IW, JS, PI, ZT.

SP3: AGE, AIJ, AMZ, AOT, AUZ, BLG, BQD, CB, CDQ, CTC, DG, DGT, DOI, GEM, HDB, KX, PK, PL.

SP4: AS, AUQ, AWE, BGR, CLX, JF.

SP5: ACN, AD, AEF, AFL, AIM, ARN, ATO, BAK, BB, BSV, BT, CK, CS, DVD, DZI, EWY, GOL, GX, IFU, JB, NE, QP, QU, SIP, WW, XM, YC, YL, HS, YY.

SP6: AAT, AEG, AEW, AKK, ALL, AOL, AQA, AXF, BAA, BFK, BZ, DMJ, DXB, DYD, EGC, FER, GB, SO.

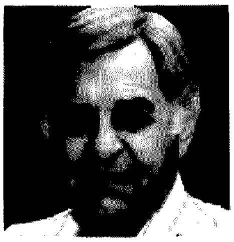
SP8: ABQ, AG, AJJ, AJK, AOV, AQN, ARK, ARU, ARY, ASP, AWL, AWP, BUH, CFZ, CUJ, ECV, EDQ, ENA, FWB, EV, HR, MJ, NR, SR, TQ, YA.

SP7: AGA, AOD, ASZ, ATA, AZ, BEB, BFC, BMF, CDH, CVW, DTP, ENU, GV, HT, HX.

SP9: ABE, ABU, ADU, AHA, AI, AID, AJL, AJM, AJT, ANH, ANT, AOA, AOX, AQY, BDQ, BLF, BNY, BPF, BQF, CDA, CTW, CV, DH, DN, EEE, EFP, EU, FR, JA, KJ, KR, NH, PT, QS, RF, SF, UH, WY, YP, ZD.

Continued on page 223

LEAKY LINES



Dave Mann K2AGZ
3 Daniel Lane
Kinnelon NJ 07405

When I was teaching school, back a few years ago, I was serving in a rather prestigious private school in New York which operated on a trimester basis. During the periods between the trimester divisions, the faculty offered what were known as "mini-courses." These abbreviated sessions, embracing a broad variety of subject matter which was generally unrelated to the general courses of study, were highly popular with our students.

Although I was head of the music department of the high school division of the school and might have been expected to present some musical material such as jazz, folk singing, Calypso, or the like, I did not. Because of my ties with amateur radio, I chose instead to present a condensed ham radio course for the ten-day period, leading to the Novice license. My plan was to get as many students licensed as would be required to get a viable ham radio club going. . .club station and all.

I had no fears concerning the aptitude of the students; our kids were all thoroughly capable in their scholastic abilities. . . excellent in math and science . . .and the only question in my mind was their talent for CW. I needn't have worried. In all the time I held such courses, not one student ever failed to negotiate the code element.

A typical experience: Out of about a dozen boys and girls, nine or ten would succeed in passing the Novice exam. And of those who did, at least fifty percent would upgrade to General, and about ten percent of each original mini-course group would acquire the Amateur Extra ticket in due course, and sometimes surprisingly soon afterward.

As you can understand, my experience with teen-aged kids has been a very rewarding one. But a veritable ocean of negative stuff has been written and spoken about today's young people. Much of it, of course, has been prompted by genuine fears and concerns on the part of the adult population, which has been constantly barraged with TV news stories about juvenile crime in the larger cities. Not that such reports are untrue. But we tend to grow myopic when we are exposed consistently to just one side of a given question. Much of the adult mistrust and apprehensiveness is undeserved. The kids represent what is both good and bad in our society, just as adults do.

Some of our kids came from pretty bad environments; we had a very liberal scholarship program and drew about one-third of our students from inner-city slum areas. Although some of them were never able to overcome their hostilities in order to capitalize on the opportunity to succeed, most fared better. These were among the best kids in the school. Perhaps this was because they realized that unless they tried their best, they would be unlikely to have the opportunity ever again.

I won't pretend that ham radio is the only avenue through which to lead kids into productivity as responsible contributors to society. Nor will I claim that it is the best avenue. But I know that it is an effective one.

We amateurs frequently devote effort toward the recruitment of youth through well-established organizations such as the Boy Scouts, Girl Scouts, Campfire Girls, De Molay, the Shrine, various fraternal and social groups, and the like. This is good, of course, and should be continued, by all means. But I would like to urge hams to investigate the possibility of reaching out into the less-advantaged, easily-ignored sections of the society. The work that can be done is enormously needed, to be sure. And its potential benefit to amateur radio is incalculable.

While we hams are fond of saying that our hobby cuts across all sorts of socio-economic lines, that the amateur radio fraternity is not divided by differences but united by common interests and purposes, this is really a vague generalization and oversimplification. The fact is that although we don't discuss them openly as a general rule, there do happen to be wide disparities, especially economically, and some of us are far more capable of footing the bills which are involved in ham radio. What I am leading up to is that I think that we should have many more club stations in this country than we have. If we did, it is likely that we would have a much greater number of hams, for many young persons who are intimidated at the realization that rigs cost a great deal of money would then seek recruitment into our ranks.

I think that most of us agree that we should seek an increase in our ham population; there are very few who mistakenly advocate a closed group under the illogical theory that this would tend to make us an aristocratic minority. . . better than others. But if we were to confine our efforts to proselytize among the well-to-do exclusively, we would probably be eliminating many of those who, potentially, might make some of the greatest contributions to the hobby.

At this point in time, when the twin monsters of inflation and unemployment have impoverished many families and when this phenomenon cannot help but affect the growth of ham radio, we should be assisting in the development of as many ham club stations as possible.

I personally know persons who could not possibly use all the gear they possess if they lived to be a thousand! The stuff just sits there, unused and forgotten, to be brought out, perhaps, once in a while during some flea market. It is rarely sold, but if it is, it brings in a few paltry bucks.

Let me remind you that the tax laws permit us to make gifts and to declare them as such and take credits based upon their value. There must be enough gear gathering dust and cobwebs to equip tens of thousands of club stations. Why couldn't we organize a campaign among ourselves to try to put such equipment to use so that the club station idea might be stimulated into healthy growth?

The kid who at some future time may sit at an operating table with a headset and a telegraph key, working DX, handling traffic, or rag chewing, won't be hanging around a poolroom, vandalizing someone's house, spraying painted graffiti on subway cars, heisting pocketbooks from old ladies, or shooting dope into his veins!

The Amateur Service has always contributed to the society; our record of public service is our proudest achievement. We can add greatly to that record by making the growth of club stations an urgent priority. And in so doing we will be making a meaningful contribution toward the future of our hobby.

How better could we give back a small portion of all that it has given us?

HAM HELP

Can anyone help me obtain information on the WWII British aircraft receiver type R-1147A. This receiver was possibly used in the Spitfire or other fighter aircraft of this period. Any bit of info you might have would be of value. Schematics and manuals are needed as well (copies would be great). Thanks.

Steven Johnson WD8DAS
823 Irvington NE
Massillon OH 44646

I need a schematic and/or operating manual for a Panoramic Ultrasonic Spectrum Analyzer model SB-7A & PS-8 Power Supply. I also need the same for a TN-337/UPM-72 Frequency Converter (1120-3200 MHz in, 30 MHz out). I will pay for copying or I'll do the copying and return the manuals. Thanks.

Gary McConville WB4SQQ
4144 Rebel Trails Drive
Douglasville GA 30135

LETTERS

HISTORY LESSON

I'm not much given to writing to "ye Ed" except to that of the *SMPTE Journal* for which, in my ancient age, I still review technical papers.

However, the thing that set me off was the letter about "Operation 'Peckerwatch" in the August issue. Speaking for myself, I'm for it. Oh, I'm aware of the ramifications...heck, I spent all of my adult life in communications, the last 27 years as chief engineer of a large TV station. Perhaps the great FCC would eventually get around to twisting the arms of the toothless tiger at State to apply pressure via the World Court at the Hague. By the way, did you not notice that while the WARC was in session, the woodpecker was quiet?

Obviously the ARRL is, as an organization, doing "sweet damn all" about the situation. *QST* should be full of continued exhortations urging the membership to inundate Senators and Congressmen with complaints. What do we have? A totally Casper Milquetoast-ish attitude. When I wrote to Baldwin saying that I had done just that, I heard from one of his minions (apparently he can't be bothered to answer himself...a cardinal requirement for any executive). The reply wanted to know what success I had had!

Re the ARRL: I have no desire to see its destruction, but some major changes have been hanging fire for decades. For the record, I go back to 1930 when I became W3CMY. Came World War Two and other than very, very, brief spurts as W8ENC and W4GPN, I dropped out...as chief engineer of a TV station which designed and built much of its equipment running into several hundreds of units, I had more than enough electronics to keep me busy. But, coming back as KB4GF two years ago, I found that although amateur radio had advanced tremendously, all that I had to do was to scratch the name of "Warner" and substitute "Baldwin." I found the same autocratic attitude which is a autocratic as can be.

I strongly object to the method of electing (?) officers, especially "el presidente"; more on the incumbent later. There was a similar problem with IEEE where the "establishment," the "club," would select a candidate, period. Only this year have we finally gotten a non-establishment person elected to the office. It is about time that something similar occur in the ARRL.

All of which brings me to "el presidente" en situ. This man, as reported in *High Fidelity*, attended an FCC hearing on the subject of RFI. In respect to radio interference to hi-fi gear, he pulled a small capacitor out of a pocket, waved it in the air, and said that this was the solution to all such problems. This character, mind you, is listed in my IEEE directory as an engineer!

Then there is the matter of intellectual integrity, especially as it concerns DXCC. I'm one of the originals and I wouldn't touch the current version with a barge pole. Once upon a time a country was a country. But now apparently any old rock in the ocean will do even if it is totally under water at high tide. Some of the places which have been granted "country" status are incredible. I wonder who are the characters who constitute the DXCC committee and what their qualifications may be as geographers and/or demographers, if any. Apparently their sole interest is a slavering after a continually rising country count. I'm reminded of what I consider a real dandy...Desecheo. I sailed the Mona passage as a very young "Sparks" (only spark and arc in that day). I know the story behind *that*, but having sailed in that area, it seems like a very bad joke.

Autocrat though he may have been, I know that TOM/HPM would have taken the dimmest of views of this. *He* was a man of integrity.

I enjoyed W6CK's article and the "Kilroy" story brought back many memories...New York to Matadi via Norwegian freighter, Leopoldville to Cairo via Qantas Short Brothers flying boat mostly over the desert, Mid East, North Africa, 50 kW transmitter installations, Southern Italy, Rome where I ran Italy's equivalent of RCA's Rocky Point cum AT&T's Lawrenceville plants, Brenner Pass, and no one wanted to accept my orders whereat I said to hell with it, I was going home.

Ah, well, them was the days!

Keep it up. You've got a pretty good rag there, though many of your ideas I find somewhat incomprehensible. But then, variety is the spice of...? I may even re-subscribe.

Hugo A. Bondy KB4GF
Decatur GA

I've read all of Hiram Percy Maxim's books and I'm sorry that he stepped off the world while I was only 14 and just barely getting interested in electricity and radio. I'm sure we would have been great friends...and I know what he would have thought of those who followed him in the ARRL. But that is the same problem every benevolent dictator has...unbenevolent dictators who follow, most of whom get into control by ruthless power plays.—Wayne.

DOUBLE-DECKER

Don Wagner's interesting article on combining Velcro® with a hump floor mount ("The Soft Mount," August, '80) prompts me to describe a variation that I've been using successfully to hold multiple VHF-UHF rigs.

My 1978 Olds Cutlass, like most recent mid-size cars, has inadequate room to mount both a 2-meter KDK and a 220 Midland under the dash without getting in the way of the accelerator and brake pedals.

Looking at the boxes, I discovered that the Midland had air vents on the bottom and sides while the KDK was vented only on the sides. This meant that the 2-meter rig could sit on top of the 220 rig without blocking any of the vents.

The first step was to purchase a metal CB mount with an adjustable tilting top which screws directly to the transmission hump. Once the hump mount was in position, the 220 mounting bracket was permanently attached using bolts, lock washers, and wing nuts. A 1½" strip of black Velcro was glued along each side of the top of the 220 Midland. Since some air circulation was desirable between the top of the 220 and the bottom of the 2 meter rigs, I glued the remaining Velcro to 1½" x ¾" strips of scrap plywood which were, in turn, glued along each side of the bottom of the KDK. The 2-meter rig was placed on top of the 220 and that radio was attached to its mounting bracket which was permanently affixed to the hump mount.

Presto. Both radios were securely in position at a convenient angle and *adequate air circulation* was ensured. A touchtone pad mounted in a chassis box was then Velcroed to the top of the 2-meter transceiver. Since the 2-meter mounting bracket was not used, convenient pre-tapped holes on each side of the KDK were available and mobile microphone brackets were attached using the proper size screws and lock washers. Audio was brought out to surplus Motorola speakers mounted on the rear package shelf of the Olds.

As a result, both radios, touchtone pad, and mikes were conveniently located and the entire assembly can be removed for security or maintenance by merely unsnapping the 220 mounting bracket.

Jon J. Gallo KB6WT
Los Angeles CA

Good, and thanks for telling us about your setup. Also, thanks to you and your wife for dinner back during the NCC show...it was good to get together with you and Joe Merdler for a rag chew.—Wayne.

NO PHONEY

This afternoon, I attempted to check into a certain east coast net in the General portion of the 40-meter band. This net is an informal one, with a fairly large group of amateurs checking in each day.

When the net control station said "This is K2--- for ECA---; are there any check-ins with or without traffic?", I replied by stating my callsign, AF2M. The K2 net control seemed to have a great deal of difficulty with the callsign; he kept on calling me A2FM. I patiently gave him my callsign again, using phonetics

Continued on page 238

OSCAR ORBITS

Courtesy of AMSAT

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR OCTOBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
26889	1	0043:19	84.4
26902	2	0137:33	98.0
26914	3	0036:52	82.9
26927	4	0131:06	96.5
26939	5	0030:24	81.3
26952	6	0124:39	94.5
26964	7	0023:57	79.8
26977	8	0115:12	93.3
26989	9	0017:30	78.2
27002	10	0111:45	91.0
27014	11	0011:03	76.6
27027	12	0105:18	90.2
27039	13	0004:36	75.1
27052	14	0058:50	88.6
27065	15	0153:05	102.2
27077	16	0052:23	87.1
27090	17	0146:38	100.7
27102	18	0045:56	85.5
27115	19	0140:11	99.1
27127	20	0039:29	83.9
27140	21	0133:43	97.5
27152	22	0033:01	82.4
27165	23	0127:16	96.8
27177	24	0026:34	80.8
27190	25	0120:49	94.4
27202	26	0020:07	79.3
27215	27	0114:21	92.8
27227	28	0013:40	77.7
27240	29	0107:54	91.3
27252	30	0007:12	76.1
27265	31	0101:27	89.7

OSCAR 8 ORBITAL INFORMATION FOR OCTOBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
13118	1	0031:28	62.5
13132	2	0036:16	63.8
13146	3	0041:04	65.0
13160	4	0045:51	66.2
13174	5	0050:39	67.4
13188	6	0055:27	68.7
13202	7	0100:15	69.9
13216	8	0105:03	71.1
13230	9	0109:51	72.3
13244	10	0114:38	73.6
13258	11	0119:26	74.8
13272	12	0124:14	76.0
13286	13	0129:01	77.2
13300	14	0133:49	78.4
13314	15	0138:36	79.7
13327	16	0000:12	55.1
13341	17	0004:59	56.3
13355	18	0009:47	57.5
13369	19	0014:34	58.8
13383	20	0019:21	60.0
13397	21	0024:09	61.2
13411	22	0028:56	62.4
13425	23	0033:43	63.7
13439	24	0038:30	64.9
13453	25	0043:18	66.1
13467	26	0048:05	67.3
13481	27	0052:52	68.5
13495	28	0057:39	69.8
13509	29	0102:26	71.0
13523	30	0107:13	72.2
13537	31	0112:00	73.4

OSCAR 7 ORBITAL INFORMATION FOR NOVEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
27277	1	0000:45	74.6
27290	2	0054:59	88.1
27303	3	0149:14	101.7
27315	4	0048:32	86.6
27328	5	0142:47	100.2
27340	6	0042:05	85.2
27353	7	0136:19	96.6
27365	8	0035:37	83.5
27378	9	0129:52	97.0
27390	10	0029:10	81.9
27403	11	0123:25	95.5
27415	12	0022:43	80.3
27428	13	0116:57	93.9
27440	14	0016:15	78.8
27453	15	0110:30	92.3
27465	16	0009:48	77.2
27478	17	0104:02	90.8
27490	18	0003:20	75.6
27503	19	0057:35	89.2
27516	20	0151:49	102.8
27528	21	0051:07	87.6
27541	22	0145:22	101.2
27553	23	0044:40	86.1
27566	24	0138:54	99.7
27578	25	0038:12	84.5
27591	26	0132:27	98.1
27603	27	0031:45	83.0
27616	28	0125:59	96.5
27628	29	0025:17	81.4
27641	30	0119:32	95.0

OSCAR 8 ORBITAL INFORMATION FOR NOVEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
13551	1	0116:47	74.7
13565	2	0121:34	75.9
13579	3	0126:20	77.1
13593	4	0131:07	78.3
13607	5	0135:54	79.5
13621	6	0140:41	80.8
13634	7	0002:15	56.2
13648	8	0007:02	57.4
13662	9	0011:49	58.6
13676	10	0016:35	59.8
13690	11	0021:22	61.1
13704	12	0026:08	62.3
13718	13	0030:55	63.5
13732	14	0035:41	64.7
13746	15	0040:28	65.9
13760	16	0045:14	67.2
13774	17	0050:00	68.4
13788	18	0054:47	69.6
13802	19	0059:33	70.8
13816	20	0104:19	72.0
13830	21	0109:05	73.3
13844	22	0113:51	74.5
13858	23	0118:38	75.7
13872	24	0123:24	76.9
13886	25	0128:10	78.1
13900	26	0132:56	79.4
13914	27	0137:42	80.6
13928	28	0142:28	81.8
13941	29	0004:02	57.2
13955	30	0008:47	58.4

FUN!

John Edwards WB2IBE
78-56 86th Street
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Tests have always played an important role in Amateur Radio. From pre-amateur status until we reach the exalted goal of an Extra-class license, much of our time is spent poring through license manuals and study guides as we scale our way up the ham radio licensing ladder. Yet, no matter how important the FCC's tests may be, let's be honest! From Novice through Extra, they're all about as dull as the finish on an eight-year-old car. You know, pages full of schematics and math problems—not to mention those dreary legal questions—all designed to make us competent radio operators.

Well, since the FCC isn't about to make their theory exams any more fun, and since study guides must accurately reflect the test's subject matter, it looks like studying is going to remain the grim pastime it has always been.

Still, there's no law that says learning has to be painful. Why not add a little fun to all that tedium? That's the goal here. What follows is a test created to teach about amateur radio in a *fun* sort of way. By fun, we mean we've selected interesting questions, devised word games, and transformed some raw radio data into a more digestible form.

Now, if you pass our little exam, you're not going to get a higher-grade license; you won't even receive an award. What you may obtain, however, is a little extra knowledge about our hobby, which may someday help you get that desired ticket or award. And if we accomplish that, while having a little fun in the process, that's just about a perfect combination.

So, sharpen your pencils, prepare your scrap paper (be sure to sign it and return it to the lady at the desk at the end of the test), and let's begin. Answers appear on page 225.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1 W1AW
4 Soviet satellite (abbr.)
6 YL gender (abbr.)
7 420 MHz (abbr.)
9 Above UHF (abbr.)
10 A transceiver
11 Norwegian prefix
12 Morse "from"
13 Tube condition
15 To cease operation
17 Austrian prefix
18 Liberian prefix
19 Wireless
20 Element (abbr.)
21 Antenna tuner
22 Contester's aim
24 _________ beat
27 In the Commission's possession
29 Guianian prefix

Down

1 1,000,000 Hertz
2 Amplitude modulation (abbr.)
3 Highest DX place (abbr.)
5 The "S" in RST (abbr.)
8 What we operate on
9 Simulated Emergency Test (abbr.)
14 What many dials do
16 Ribbon at QSO's end
18 Irish prefix
23 Intermediate frequency
25 Radio frequency (abbr.)
26 Faroe Isl.
28 Polish prefix

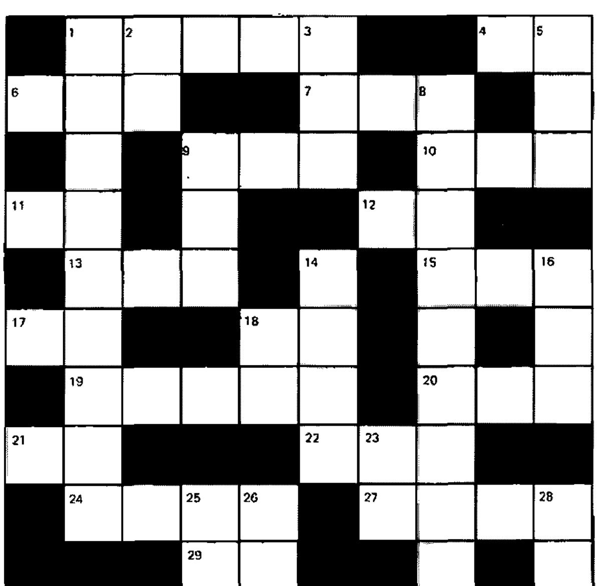

Illustration 1.

ELEMENT 2—SCRAMBLED WORDS

Instructions: Here are some familiar radio terms rendered unfamiliar by jumbling the letters. Your job—unscramble 'em.

EMRAAUT	GYIA	YRTT	UEBT
XCDC	XCAO	DLI	LICO
NENTNAA	SVTS	LOPEID	VTI
SBS	YKEER	CSPEO	OXV
DEDIO	RACOS	DLRESO	VMTV

ELEMENT 3—MULTIPLE CHOICE

Instructions: Same as the FCC's.

1) In addition to being the father of Amateur Radio, Hiram Percy Maxim was the father of a famous piece of weaponry. It was...
1) the cannon.
2) the gun silencer.
3) the "fireless" rifle.
4) the revolver.

2) Your transmitter is set to 7.070 MHz. Can you plunk your CW signal right on top of a broadcast station using that same frequency, even though you'll obviously interfere with him?
1) No, a ham station may not interfere with any other station.
2) Yes, because 40 meters is shared on an equal basis between hams and broadcasters.
3) Yes, since a broadcast station on this frequency would be "out of band."
4) Yes, but only if you run under 250 Watts.

3) One night, while on the 15-meter Novice band, you hear N1XXX transmitting RTTY. Is it within the law to send F1 on a Novice band?
1) No, only CW is permitted on Novice bands, regardless of license class.
2) Yes, with an appropriate license, a ham may operate RTTY on any CW band between 80-10 meters.
3) No, RTTY may only be transmitted between .070-.100 of any band.
4) Yes, RTTY is permissible in any portion of any band.

4) What musical instrument did Sir Charles Wheatstone (inventor of the "Wheatstone Bridge") perfect? This is not a joke.
1) The harmonica.
2) The Wheatophone.
3) The piano.
4) The saxophone.

Continued on page 225

NEW PRODUCTS

ATV DOWNCONVERTER

P. C. Electronics has introduced a new fast-scan ATV downconverter which tunes the entire 420-to-450-MHz band down to your TV's channel 2, 3, or 45-MHz i-f with full bandwidth for color and computer video.

The standard model TVC-4 contains a new microstrip converter with a low-noise MRF901 preamp stage, 12 V dc power supply, BNC antenna input connector, and type F output connector to the TV set. The low-noise figure preamp stage enables seeing sync bars down to as low as .3 microvolts. An ultra-low-noise NE64535 preamp stage is also available as an option to get you down to .2 microvolts in the TVC-4L.

The TVC-4 downconverter comes in an attractive Ten-Tec JW-5 enclosure measuring approximately 5" × 5" × 2¼". Ten-Tec has also specially coated the Cycolac wood grain side panels with a conductive coating for excellent shielding.

For further information, contact *P. C. Electronics, 2522 S. Paxson Lane, Arcadia CA 91006;* (213)-447-4565. Reader Service number 480.

HEATHKIT ALLBAND VERTICAL ANTENNA OFFERS MAXIMUM PERFORMANCE IN LIMITED SPACE

Heath Company has added a new five-band vertical HF antenna to its amateur radio line. The HDP-1473 is a vertically-polarized, omnidirectional antenna designed to give complete CW and SSB coverage of the 80- through 10-meter amateur bands.

The antenna employs specially-designed high-Q traps to optimize operating bandwidth, and the swr is 1.5:1 or less at resonance on each band. The HDP-1473 may be used with any transmitter or transceiver employing nominal 50-Ohm input. A built-in coax connector takes the PL-259 on the operator's feedline. Measuring 28 feet, four inches, the HDP-1473 is designed to accept maximum legal power.

For more information on the HDP-1473, contact *Heath Company, Dept. 350-310, Benton Harbor MI 49022.* Reader Service number 479.

THE AZDEN PCS-2800 10-METER FM TRANSCEIVER

Last summer, Japan Piezo Company came out with their first product aimed at the US amateur, the Azden PCS-2000 2-meter FM radio. Now they are marketing a 10-meter FM transceiver using the same microcomputer design. If you have been holding back on 10-meter FM because you don't want to convert a CB radio or design your own unit, cheer up! The PCS-2800 is specifically designed for this group of amateurs. It should help popularize this interesting band just as recent commercially-made equipment has revolutionized 160 meters.

For those not familiar with 10-meter FM, the band is structured as follows. The national simplex frequency is 29.60 MHz. There is also a simplex channel at 29.50 MHz that is helping to thin out the congestion at 29.60. There are four repeater channels: 29.52/.62, .54/.64, .56/.66, and .58/.68. (The input frequencies are 100 kHz below the output frequencies.) Thus there are six channels at present, with 29.60 MHz functioning as a "priority" channel. The PCS-2800 scans these six channels for either a busy or vacant spot.

The transmitter has two selectable levels of output power: 1 Watt and 10 Watts. The FM deviation is ±5 kHz, the same as on 2 meters. The receiver is designed for FM only, although it covers the entire band plus a bit extra (28.00 MHz to 29.99 MHz). Tuning increments are 10 kHz.

Keyboard

The 12-button keyboard on the PCS-2800 performs all frequency control and scanning operations. In this respect, it resembles its 2-meter brother. But there are a few differences.

Four keys, 100K UP, 100K DOWN, 10K UP, and 10K DOWN, advance the frequency by the indicated amounts within either of two ranges, 28.00-28.99 MHz or 29.00-29.99 MHz. The MHz range is chosen by the MHz UP key.

By holding down the 10K UP or 10K DOWN key, the MHz range can be "swept" in an upward or downward direction at a rapid rate. This gives the feeling of vfo tuning. As the desired frequency is approached, the key is released and then actuated once or twice as necessary to get the radio on frequency.

Either MHz range can be scanned in 10-kHz steps by pressing the **AUTO SCAN** key. The SCAN MODE switch, in the upper right-hand corner of the front panel, selects "busy," "vacant," or "free" scan. In free scan, the range is scanned continously regardless of channel status. A quick check for band openings might be one use for this scanning mode; signals will briefly open the squelch and cause a burst of noise.

There are six programmable memory channels. Channel 1 is immediately accessible by pressing the **M1** CALL key. This key may be found in two places: on the keyboard and on the microphone. The national simplex frequency, 29.60 MHz, might be a good choice for memory channel 1.

Memory programming, recall, and scanning are carried out by means of the four keys M ADRS, M SCAN, M CALL, AND M WRITE. The memory is reprogrammable at will, and is backed up by three small cells so that memory will not be lost when the unit is off or in storage.

Other Controls

The SCAN MODE switch has a second function: simplex/off-

P.C. Electronics' TVC-4 ATV downconverter.

set selection. When this switch is set to the left of center, the transmitting frequency is 100 kHz lower than the receiving frequency, facilitating repeater operation. When the SCAN MODE switch is to the right of center, the radio operates simplex. The three scan modes (free, busy, and vacant) are provided on either side of center; there are thus six switch positions.

High power (10 Watts output) or low power (1 Watt output) may be selected by means of a lock button. Another lock button transfers volume and squelch control from the front panel to the microphone.

The PCM-2000 microphone is the same microphone that is used with the Azden 2-meter radio. Volume, squelch, and memory channel 1 recall can be controlled from the microphone; the 10K UP and 10K DOWN buttons are also duplicated there. This makes operating "on the road" convenient and enjoyable.

Remote Head

The PCS-2800, like its 2-meter brother, can be pulled apart into two pieces. The microcomputer is housed in the smaller, front-panel piece, which is called the "head." The transmitting and receiving rf circuits are in the rear section. If there isn't enough room in your car to conveniently install the entire unit, the head can be mounted under the dash and the rear section placed under a seat or in the trunk. Azden manufactures a heavy-duty, 15-foot interconnecting cable (optional) for remote-head operation.

Operation

The 10-meter FM band is quite a bit different from either 10-meter CW/SSB or 2-meter FM. The 28-MHz band is of course subject to worldwide ionospheric propagation, especially at the present sunspot maximum. Any time you have ionospheric propagation, you'll encounter fading. Fading affects FM in an interesting and peculiar manner. This is especially true for selective fading. CW and SSB have relatively narrow bandwidths and are not affected much by this type of fading, but FM has a deviation of ±5 kHz, and the modulation itself is accomplished by frequency variations. Selective fading will sometimes produce a whining or buzzing sound on FM signals. Nevertheless, it is not uncommon to hear full-quieting signals from thousands of miles away.

FM has some definite advantages over other modes. Most important is its relative immunity to noise, both man-made and atmospheric. FM communication may be possible in a noisy location where SSB or even CW would be unreadable at the same frequency and power level. Also, FM is less likely to be demodulated by home stereo hi-fi equipment. This could be important to some hams whose neighbors are less than totally rational and compassionate!

Hickok's new LX 304 DVOM.

With the PCS-2800 connected to a whip about 8 feet long (I didn't even measure it) fed with 100 feet of RG-58/U, I was able to make contacts from as far away as Vermont. I didn't try hard to work any DX, but stations were heard from all four corners of the continental United States within a 1-hour period. All this took place on the national simplex frequency, 29.60 MHz.

Conclusion

The Azden PCS-2800 comes with power cord (+12 V dc) and fuse, microphone, and mobile mounting hardware. An optional 15-foot connecting cable is available for remote-head operation. A base-loaded mobile antenna with "mag" mount is also available; it comes with 10 feet of RG-58/U and connector, ready to use. A 12-volt dc power supply is also available.

The PCS-2800 and accessories are distributed by *Amateur-Wholesale Electronics, 8817 SW 129 Terrace, Miami FL 33176; (305)-233-3631.* Reader Service number 482.

Stan Gibilisco W1GV
Cocoa Beach FL

NEW DVOM FROM HICKOK

New from the Hickok Electrical Instrument Company is the latest in their LX series of hand-held DVOMs. The new LX 304 features an easy-to-read, ½-inch-high, 3½-digit LCD display; automatic polarity, zero, and overrange indication; ½-year battery life in typical use; simplified one-hand operation; and ultra-rugged construction with excellent overload characteristics for long-term reliability.

Other features include an automatic decimal point, a built-in low battery indicator, diode and transistor testing capability, and 0.5% accuracy on V dc ranges.

Engineered and manufactured in the US, Hickok LX series multimeters are self-contained, with test leads that store in the removable, protective thermoplastic cover. They will withstand a four-foot drop without loss of accuracy.

For further information, contact *The Hickok Electrical Instrument Company, 10514 Dupont Avenue, Cleveland OH 44108; (216)-541-8060.* Reader Service number 476.

RADIO SHACK'S SAFE HOUSE RF FIELD DISTURBANCE ALARM

Computers are penetrating every part of our modern lives, so it should come as no surprise that Radio Shack now offers a computerized motion-detector security system. Now you can protect your home or business with an rf field as well as with optional window and door switches.

Radio Shack's Safe House should not be confused with lower-priced ultrasonic systems. The Safe House uses a low-level microwave signal at approximately 10 GHz. When the microwave field is disturbed, the transmitter source is affected and triggers the alarm. The motion-sensing unit is combined with a single-chip computer which provides the necessary delays and a sophisticated on-off switching scheme.

The Safe House is simple to use. For basic protection, set it in a location where its field will create space traps in and around doorways. When triggered, the unit will drive a speaker with a piercing siren-like sound. Once the speaker is in place, all that is needed is a 110 V ac outlet into which to plug the system.

A potentiometer allows the user to tailor the field size to a particular location. If the level is too high, the unit might be triggered by false reflections. Arming and clearing the unit is accomplished by punching a four-digit code on the front panel. No keys or hidden switches are needed. There are approximately 25 seconds during which the alarm will not be activated. This delay gives you time to enter or leave the room after the alarm has been armed without activating the siren.

For use in a recreational vehicle or boat, the Safe House can be hooked directly to a 12-volt battery. A built-in gel cell battery will automatically be switched in to power the unit for up to four hours if the conventional source fails.

Continued on page 242

Escape from Mt. St. Helens!

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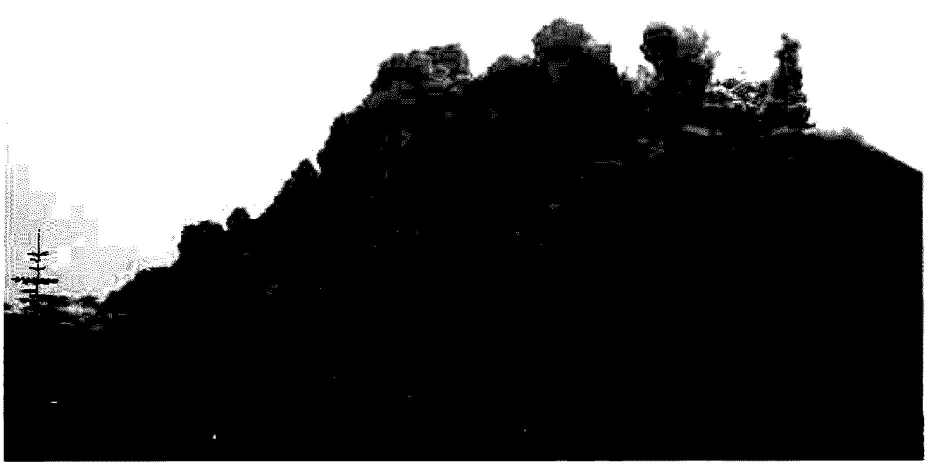
"Mt. St. Helens has erupted!" Dorman W7ZDR excitedly reported as we listened intently for news from home at the shack of Ralph ZL2PI in New Zealand. (It was March 28th there, but the 27th back home in Vancouver, Washington.) The first intimation of this sensational event had reached us on ten meters at the station of Dennis ZL2AQA, over which we learned that earthquakes had been shaking the mountain since March 20th. The volcano had been dormant for 123 years.

Ten days after our return from New Zealand, we left our home (forty-five miles southwest of the mountain) for the foothills of 9671′ Mt. St. Helens, a major Cascade peak, as volcano watchers. At that time, geologists were apprehensive of a bulge of rock and ice on the northwest side which was then growing at the alarming rate of five feet a day. We had volunteered for a one-week mission with the Washington State Department of Emergency Services and had been signed up for public service by Al K7KNZ. From the 4240′ high point of a logging road, we would observe the high slopes and report steam vents, mud slides, and avalanches, with special attention to the South Fork of the Toutle River Canyon, critical because of flood potential. We'd be perched just outside the red (restricted access) zone and eight miles due west of the summit.

Arriving at the end of the pavement in the fog on May 13th, we threaded our way up a maze of roads using the directions that Chuck N7ALB, a volcanology student and former observer, had given us. After locating the best view spot, we were soon in business, running one Watt of power with an Icom 210 (borrowed from our club, W7AIA). Working under RACES, we reported to Reade N7AGG, Washington State RACES Officer in Olympia.

With nearly zero visibility, the first few days allowed us only fleeting glimpses of the snow-



Mt. St. Helens at 8:32 am May 18th. View is looking east with the summit 8 miles distant. The South Fork of the Toutle River is at left. Our escape road went 1½ miles toward the mountain on the right before we were able to turn south.

crowned summit, making us feel uneasy with no knowledge of the volcano's activity. On one of those foggy days, Ty W7WFP climbed on a stump with his hand-held Icom 215 and called Russ K7SUX, RACES Radio Officer for Clark County. (He was checking our low-power half-Watt communications of a standby rig.) Meanwhile, I walked among the logging slash admiring the fragile avalanche lilies blooming in the harsh winds and sleet and snow that occasionally whitened the log jumbles and low fir trees.

On Friday, May 16th, Channel Six TV parked their van next to ours, doing a story on loggers in the Toutle. That afternoon we watched large helicopters urgently ferrying equipment from various camps in the doomed South Fork of the Toutle River Canyon.

Saturday, May 17th, dawned in a blaze of scarlet, burning away the last shred of fog and providing excellent visibility. The once dazzling white mountain had been dulled by purple-grey ash flows, giving it a surprisingly barren appearance. On the northwest side, the bulge appeared menacingly as a large warp on the left skyline. Otherwise the peak retained its nearly symmetrical shape. It was easy to retrace my old climbing route of many years ago with everything so seemingly quiet and bright and every feature showing on the west face.

That day the seismic report came in late but seemed routine. Originating from the University of Washington, it had been relayed daily by Dorothy WB7OBB in Seattle. (Only harmonic tremors over 4 were reported, which was usually about ten a day.) For awhile, a helicopter carrying geologists perched on the crater rim itself. Al K7KNZ called asking about avalanches in the Toutle, but all we saw were a few bright steam plumes high up.

By late afternoon, another volcano-watcher, Gerald (Jerry) Martin W6TQF, drove his motorhome to a location near Coldwater Peak, seven miles north-northwest of the mountain and ten and one-half miles north-northeast of us. That evening Bob K7UPT and friends came up with supplies, staying for a potluck dinner. (Bob had checked out the 5700 Road along the South Fork of the Toutle River as a possible escape route for us.) It was a perfect evening and we laughed at Bob's shoveling up a load of ash-covered snow to take home. Later, over two meters, we had a limited chance to get acquainted with Jerry before the fateful day arrived. The day closed with the peak looming high into a star-sprinkled sky, apparently at peace.

A light overcast replaced the flawless skies of Saturday, but the dawn was colorful with Mt. Rainier in full view. Jerry's cheery "Good morning!" had greeted us this calm Sunday, May 18th. It was peaceful and windless with the temperature at 47 degrees F. Jerry and Ty discussed two steam vents high up on the north-northwest skyline just under the crater rim. Two of the plumes were white and had been seen Saturday, but a new one appeared tan or dust-covered and drifted across the Wishbone Glacier. From his viewpoint, Jerry could pinpoint its location. He was just commenting on this when Ty felt the earthquake that unbalanced the delicate equilibrium in the area of the bulge. Jerry felt it also. Outside our van I was sitting in a folding chair sketching the mountain; I did not feel

Ty W7WFP and Marianna W7WFO with their Dodge "Van Co."

it. (Later reports confirmed the quake at magnitude 5.0, the strongest since the mountain came alive on March 27th.)

Less than one minute after the jolt, the volcano sent up its first black clouds. It was 8:32 am. I stood up watching the black billows boil up out of the summit and the north side simultaneously, thinking, "What an interesting show!" Scarcely had the thought surfaced when the entire summit area was enveloped in rolling, velvet-black billows that growled like muffled thunder, expanding at an incredible rate. One fantastic cloud exploded huge rocks and ice. Ty saw a part of the Goat Rocks formation slide away, the toe of a mammoth landslide. We imagined Jerry, terrified, witnessing the entire north side of the mountain sliding toward him. With the black explosion cloud racing northward in a horizontal blast at 120 miles per hour, Jerry had only minutes for his last transmission: "I've got to try to back out of here!"

Ty ran for his camera and took seven pictures as the blast rolled out toward Mt. Rainier. He noted that the enormous black cascade, indescribably complex and banded with steam, was fanning out toward the South Fork of the Toutle, the last protection for our exposed ridge. "Let's get out of here!" Ty yelled as I walked toward our car, stunned.

Jumping in the van, we sped eastward down the road (toward the mountain) for one and one-half miles before turning south. "Which way are you going?" Bob K7UPT's voice pierced the static, and I screamed, "South!" I also remember shouting, "The cloud is going toward Coldwater Peak and Jerry!"

Our fourteen-mile ride down over the rough forest roads seemed as unreal as a nightmare. I found myself on my knees clutching the radio, being showered by falling objects from an open cupboard. Out our van windows, the death cloud virtually filled the visible sky in its immensity. It was dirty grey and suffocating as a tomb with darker columns slowly rising to a billowing mushroom top.

It was almost beyond conception—an unimaginable evil abstracting bizarre patterns of twisting, undulating smoke and hot gases ascending to the roof of hell. In a race against time, our frail vehicle paralleled that horrendous cloud, flashing with bolt lightning and only one mile away. It

dwarfed everything by its magnitude; the spindly alder trees loomed like matchsticks that swayed slightly before the churning terrible greyness. Against the deep gloom, the pale sickening grey of the cauliflower column of the main eruption writhed upwards, carrying its load of ash and pumice and superheated poisonous gases. For a short while a blue car hurtled down behind us, as terrified as we were, and then it turned off.

The last thing I remember before we reached the relative safety of Lake Merrill (below the exposed ridge) was a swelling deep grey cloud dramatically rimmed in sunlit silver and edging the sky's soft blueness. At last we dared to stop. We breathed silent prayers of thanks. We switched the 210 to high power and picked up Marv W7RPT in Vancouver, who relayed to Olympia that we were OK and returning home. We could now see the cloud's edge, steam-whitened and rising fountainlike above us to a scalloped saucer-shaped disk, swirling with graceful effects.

At the junction of the forest road with the highway, we passed a roadblock and then bordered Yale Lake where people were driving *toward* the mountain to sightsee. Soon we were in green country and on paved roads again. Never have green and growing things looked so beautiful! Though churchbells were ringing in a country chapel, people were outside watching the towering inferno of a volcano that had unleashed an explosion as powerful as the hydrogen bomb.[1] Into the hazy blue sky the decapitated mountain[2] was pouring multiple columns of ash and steam twelve miles high and eventually around the world. (No eruptions of Mt. St. Helens had been this big for nearly 3000 years.)

We turned away from the black horror of a sunny Sunday in May and drove home, experiencing a strong sense of unreality. We knew that people like Jerry Martin W6TQF, Reid Blackburn KA7AMF, and Dave Johnston[3] had died in the terrible blast of our once serene Mount St. Helens. We had been allowed to live.[4] We felt humble. ■

Author's Notes

1. The blast, fanning out twelve to fifteen miles in a northwest, north, and northeast direction, devastated 156 square miles, felled trees like matchsticks, and rained ash to a depth of four feet in the area where Jerry Martin, Reid Blackburn, and Dave Johnston were working. It destroyed 2 billion board feet of timber and left a "moonscape" of unrecognizable land forms around the Spirit Lake area.

2. The explosion lowered the mountain by 1300 feet. It opened a new huge crater on the north side measuring about 2½ miles long by 1½ miles wide.

3. Reid Blackburn KA7AMF, a newspaper photographer, was doing voluntary work for USGS and National Geographic. He was in the same general area as Dave Johnston, working for USGS, and Jerry. Though Jerry Martin is presumed dead, he is listed among the missing. He spent about a month on volcano watch at a different location before coming to the viewing spot near Coldwater Peak.

4. Though the devastation stopped at the South Fork of the Toutle Canyon uncomfortably close (within a mile) to our location, it did not reach our camp, except for some light ash. One gas can we'd left in our hurry was picked up later that day and said to be very warm.

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Sheila Ran!

—a sightless sprinter's triumph is one of ham radio's finest hours

Got to run faster. . . faster, Sheila thought to herself as she ran down the track. . . *where is that 50-meter mark?*

"50 now," she heard and put on some extra effort. "75 looks good!" was the next she heard; then, "Left, keep going, looks real good —THERE'S THE END! You did real good!"

At that moment, Sheila's friend Jennie grabbed her, and she knew for sure the race was over. Now came

Photo A. Sheila during a practice session.

Photo B. Ed Mulvin WB0IFF and Sheila, with the Motorola MT 500 transceiver.

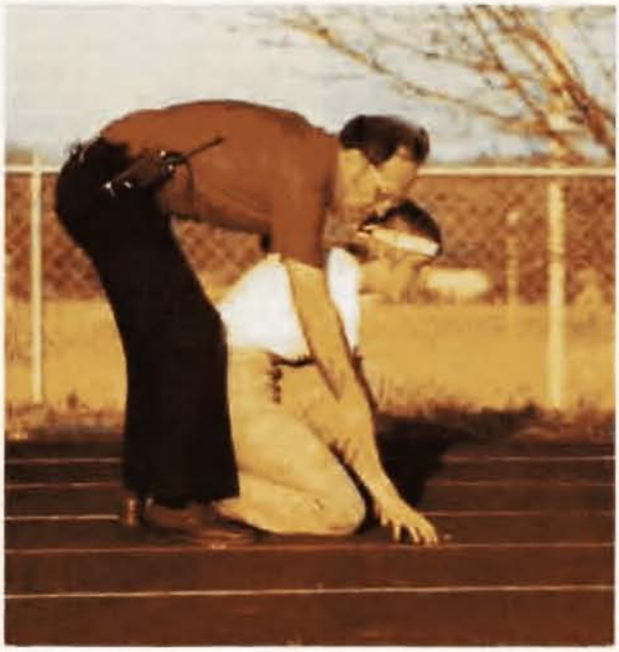

Photo C. WB∅IFF positions Sheila's hands so that she can "see" the lane markers.

Photo D. Sheila talks with the ABC news crew, May 15, 1979.

that wait for the official time and placement.

From the starting position, I carefully put the Motorola transceiver into the belt holster and ran toward the track officials to find out quickly where Sheila placed. This was one of many trips I had made over the last four years. This also was the last year that I would be doing this because Sheila was now a senior in high school and would be finished with high-school track. My special logbook soon would record the last of some 220 hours of training and track meets with Sheila.

The preceding scenario represents the culmination of a four-year experiment in human engineering utilizing the facilities of amateur radio. You may have read my earlier 73 article, "Run, Sheila, Run!" (December, 1977). At that time, I described an innovative use of ham radio which could enable a young girl who is totally blind (she wears glass eyes for cosmetic purposes) to compete in high-school track. Originally, with the assistance of Ron Kinton WB∅MBZ, a retired, tired, 6-meter model airplane radio-control receiver was modified and equipped to receive an AM signal. I dragged along an old Gonset 6-meter transceiver—and a car battery for power—to every practice and track meet and was able to direct Sheila down the track with an amazing amount of success. Sheila was an excellent and willing candidate for this type of experiment. She ran in the cold, the heat, the rain, the snow—in anything—with never a complaint.

After the first track season was completed, Ron Kinton and I put a smaller transmitter together. It, too, was basically a Heathkit radio-control transmitter strip with an AM audio input added, along with a rechargeable nicad battery pack. Life became easier for me after that.

Sheila and I trained intermittently that summer. When track season started in March, 1978, there was too much snow on the track and we were forced to run in the halls at her school. *That* was a really hairy experience because the halls at Dowling High School are sort of short for a blind kid, and there was a post in the middle of the end of one hall! All of these things really scared me, but Sheila trusted and ran! The other runners (sighted) could run around the corners and up and down the stairs, but this was a little too much for Sheila.

Whenever we could get outdoors, we would, but the temperatures were frequently below freezing with lots of wind. We ran on the road in front of her house, and if I could guide her around the curve, we could get a good 100 meters. Sometimes she would get into a snow bank, but that didn't hurt. We also would go over to a large parking lot at the church across the street. It was quite mind-boggling to see this young girl race across the lot in her sweat suit, the hood up over her head with the draw strings pulled so tight that her eyes were completely covered! Sometimes I would let Sheila get into the snow banks, as she couldn't get hurt. I would be rewarded with a round of snowballs—she had good aim! Finally, the snow melted and we could work out on the track. Life got easier for both of us.

During track meets the first two years, Sheila would run her heat by herself with no one else running on the track with her. April 8, 1978, was a cold, drizzly day and a track meet was scheduled. This was the first anniversary of the very first time Sheila had ever tried the radio, and *this was the first track meet she would win!* Her time for 100 yards (it was changed to meters the next year) was 13.4 seconds. You must remember that Sheila had a distinct advantage: the cold drizzle got into the eyes of the other girls and slowed them down, but it didn't affect Sheila.

Later on during this season, we discovered that

Photo E. The ABC "That's Incredible" crew prepares Sheila's segment of the May 12, 1980 show.

heavy crosswinds would affect her course. This could be dangerous because now the track officials were wanting her to run with other competitors on the track. We were able to get them to allow us to have the lanes vacant on either side of her and this was some comfort, but the first track meet with other competitors on the track brought a lot of stress. This was only the second time she had run this way, the first time being on the day before in practice.

At this meet, Sheila came out of the starting blocks on a diagonal! I lost my cool and shouted too loud into the mike, overmodulating the transmitter and distorting the signal in her receiver; Sheila kept running. When she came to the grass at the left side of the track she turned and ran until she hit the grass on the right side, then turned again, got to the end of the track, and finished a respectable third. She was disqualified, and the officials asked the other girls if they wanted to run the meet over. They declined, with one of them asking, "What good would it do? I couldn't get near her anyhow!"

It's a good thing Sheila couldn't see during that particular run, as I'm sure she would have been scared pea green. I was! She missed kids, hurdles, and track officials. Later, I learned to keep cool and control my voice, and this served me very well when one time she was within two inches of a curb and I was able to get her away from it very slowly and avert possible injury.

The third year (1979) we really had a lot of problems. It was practice in the afternoons and sit up every evening repairing the receiver—it was aging and had lost its sensitivity. Components were deteriorating rapidly. I made a trip to Ron's, and the decision was to work the receiver over completely and put an AM receiver chip into it. This meant more stripping of the existing components and changing the battery voltage to 9 volts. This worked for a few weeks, but the main problem was in the first mixer stage and the coils were not available.

We were at the early start of the official practice season. Along with the miserable cold and snow, the radio wasn't working the way we needed it to work. The original design required a long trailing antenna in free space. We stuffed a pair of three-foot pieces of wires down her shirt—one in front and one in back. Being in such close proximity to her body affected the receiver very adversely. This, coupled with the age of the receiver and the reduced power of the transmitter, made for some overwhelming problems. Ron was on the verge of stripping out an old Motorola pager and putting it on two meters FM, but during a quick conversation with Dick Bugler of the Des Moines Motorola sales office, I told him of our dilemma. Dick was able to loan me the necessary commercial gear to keep Sheila running for the rest of the 1979 track season.

The commercial gear was on 155.58 MHz and, with the exception of an occasional bit of commercial traffic, we didn't have any QRM problems. Whenever something did come through we just waited. Fortunately, there wasn't any interference during a meet. We had ear molds made for her and these, along with the commercial gear, proved to be an unbeatable combination! This was the year she would be first in her heat and her time would go from 14.06 to 13.8 for the 100-meter dash. This was still junior varsity track, and she turned in some very good performances. She still had not gained the ability to remain completely in her lane, but there were no serious problems.

The local news media gave us excellent coverage. The local ABC affiliate, WOI, Channel 5, televised a meet which interested the network enough to send a news crew out from Chicago on May 15, 1979. This appeared on ABC news May 17 and was picked up by David Hartman on "Good Morning, America" the next morning.

Now things were happening fast and furious because after "Good Morning, America," Motorola had taken a very active interest in Sheila. Motorola sent a film crew and a public relations man to make some film of our project. They became very excited and decided to take Sheila and her family to Fort Lauderdale, Florida, where they presented her with a pair of the newest MT 500 handie-talkies along with a Pageboy II receiver. Wow, did we have the gear! (The gear was placed in the amateur band for us and we operated on 147.99 MHz.) Sheila received a letter in track for her efforts that year, and that, along with all the coverage we received and the support of Motorola, really

Photo F. Ron Kinton WBØMBZ works on the module.

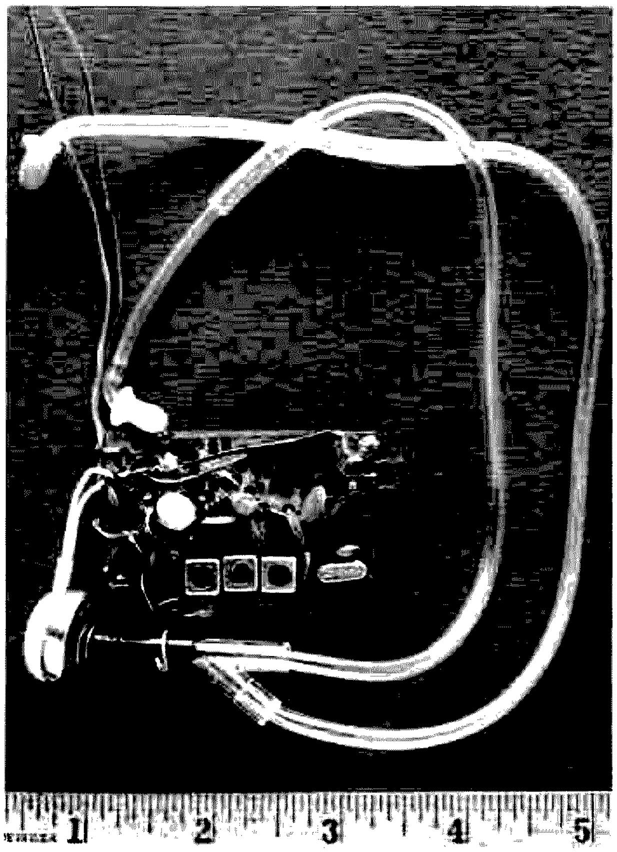

Photo G. The original module.

made all the efforts worthwhile.

The fourth and final year (1980) started just like the rest except that we didn't have the extreme cold. A lack of snow cover made the practice sessions go very well, and we had a radio that worked! Sheila had to run varsity, however, and this put a lot of pressure on her. The first meet gave her a time not as good as the previous year, but she was still very competitive and her course down the track was as good as anyone's. I was elated—she had never run so true as now.

Then the weather turned cold, the pressure became almost unbearable, and her ability to hold a true course deteriorated. There was still nothing seriously wrong, however, and she kept on running. I was able to interest the television program "That's Incredible," and they arrived in Des Moines for a video taping session with us. This added to the pressures that were building up, and Sheila turned in the worst time she had yet had for the season. She finished last. The cameraman did worse—he lost the finish of the race. What luck! When Sheila realized where she finished and realized that this was the next to the last meet she could run (the next meet would be a qualifying heat for another meet), she decided to quit.

Sheila may have stopped running now, but she proved that the blind can be very serious competitors. She is the only person that we know of who has ever tried to run this way. The ability of a human being to make such a complete transition to hearing from sight while actively competing has been proved by Sheila Holzworth in Des Moines, Iowa! It all was made possible by the privileges we have with amateur radio. ■

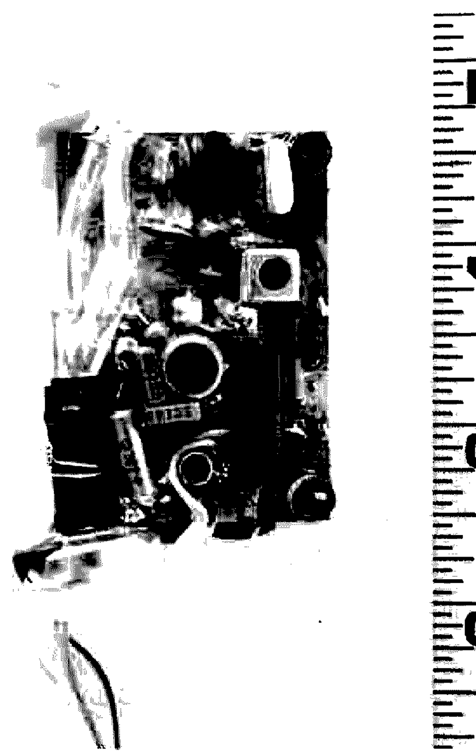

Photo H. The module after Ron worked it over.

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The First Man in Space Was a Ham

—UA1LO remembered

Back on February 13, 1962, I happened to be in the right place at the right time and had a chance meeting with a very distinguished radio amateur, UA1LO, Yuri A. Gagarin, the first cosmonaut to orbit the Earth—a trip of 1 hour and 48 minutes. Although I had never worked him, I followed space research and travel closely as Sputnik went up and successive manned flights took their turn—theirs and ours.

There have been many articles and much speculation about an amateur in space or in government—will he use 2 meters?—and so forth. I saved such articles and even have a front cover of *73*—"A Ham in the White House—K7UGA"!

Yuri Gagarin UA1LO.

I spent a few months in Italy, and a cable directed me to Athens to demonstrate a police X-band radar to the Greek Ministry of Transport, Physical Society, and all the high brass of the constabulary. As I landed in Athens, I saw a red carpet and a rose-covered open Cadillac at the terminal building which seemingly was lined with all the police of the city.

"This is nice," I said to my distributor. "This is for me?"

"Well, no," he said. "You can walk on the carpet, but the car is for Yuri Gagarin, the Russian cosmonaut. Look, here comes his plane now."

We cleared the suitcase radar through customs and headed for the city. Major Yuri Gagarin, 28, was the Air Force hero being welcomed by the City of Athens. I had a selling job to do and demonstrated the radar successfully that afternoon.

That evening, UA1LO was being feted at a banquet in his honor. Anyone and everyone in physics, astronomy, and electronics was there, and I was at a side table as a guest of the chief of police. There were speeches in Greek and Russian, toasts, and hurrahs.

The next day I had the day off and went to the Acropolis to see the Parthenon. I had two color-loaded cameras, 120 format and 35mm, plus the old 8mm movie format with color film. I stood on top of the hill—and then the open Cadillac came up to the threshold of the Acropolis and Yuri Gagarin and entourage made the climb to the top.

I had a good vantage point and used all three cameras. Yuri was given an olive branch and stood by the Parthenon. I took a

prize picture and then went up to shake his hand. I wore my W1QMS lapel pin and he spied it and said, "Ya, UA1LO. I am UA1LO active on CW. You, too?"

I said, "Mostly 10-meter AM phone."

Newsreels ground away—the Greeks led him away to the Museum. I had the privilege of translating between him and an English reporter who asked if Yuri saw the Parthenon from orbit. He said, "Nyet—too small,"—but said that he saw the zigzag Great Wall of China as a distinguished Earth landmark! (His highest point above Earth was 203 miles, and his average speed was 17,000 mph.)

That ended a very brief encounter with UA1LO. If I had not worn my lapel pin, this never could have happened.

The Greek newspapers put Yuri on page 1 for several days, and my radar work was on page 8. Such is life!

My photos were slightly over-exposed, but useful. While at an exposition in Moscow in 1974, to demonstrate photo-interpretation gear, I hung an 8×10 enlargement of Yuri on the wall of the booth. Russians from every walk of life looked at the picture in awe, and the women, with deep reverence, said a little prayer.

The head of the USSR space program came by, followed by Premier Kosygin, and I requested that the picture be presented to Yuri's widow.

One never knows who the fellow next to you might be.

Yuri Gagarin, regretfully, became an untimely silent key a few years later. He was killed in an airplane crash, and the amateur radio fraternity prematurely lost UA1LO. ■

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NASA Satellites You Can Use

—with permission, of course

Illustrations courtesy of NASA

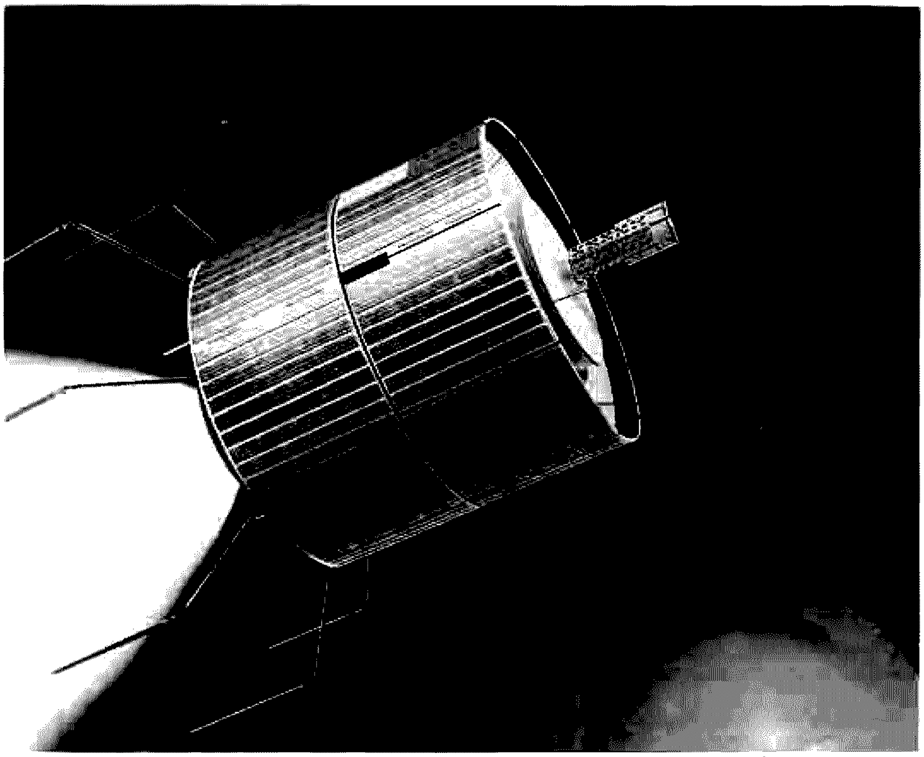
The older of a certain pair of aging satellites celebrated its thirteenth anniversary last December.* The original communications experiments for the two have long since been concluded. NASA experts have given up predicting the date of their demise.

*ATS-1 was launched on December 7, 1966. ATS-3 was launched on November 5, 1967. ATS-2 and 4 failed to achieve orbit. ATS-5 lost sync and is presently uncontrollable at 70° west longitude. ATS-6 was removed from orbit in August, 1979, after five years in service.

They are the Applications Technology Satellites, ATS-1 and ATS-3, and they are up and running every day providing dependable communications to remote areas of the world and to ships on the high seas.

The amateur radio fraternity should be particularly interested in these satellites for a number of reasons. The most attractive is their operating frequency. Both employ the same 100-kHz-wide transponder frequency plan with the center uplink at 149.22 MHz and the downlink center at 135.6 MHz, tantalizingly close to the two-meter band. The fact is that ham gear is used presently by some ATS ground stations with satisfactory results.

Another fascinating aspect of the ATS spacecraft is that they reside in geosynchronous orbit at 149 degrees west and 105 degrees west longitude, respectively. As is the case with all geosynchronous satellites, they revolve around the Earth's axis over the same equatorial subpoint once a day at an altitude of 22,282 miles (that's roughly 5½ times the Earth's radius). Both satellites have flies in their orbital ointments, however, and I'll get back to this later.



The National Aeronautics and Space Administration (NASA) has proven technical feasibility with regards to the use of VHF transponders aboard geosynchronous satellites, and experiments along these lines are no longer conducted or entertained. However, proposed projects concerning imaginative communications applications are constantly being reviewed by the ATS experiments managers at NASA Headquarters in Washington. If a project shows merit, a time slot, usually an hour a day, is provided to the user for the experiment to be conducted. For example, certain hospital emergency rooms and ambulances in Mississippi and Alabama have recently been outfitted

with ATS equipment after it was suggested that satellite communications be used when conventional terrestrial links fail.

The transponder occupancy rates during satellite daytime hours are presently approaching 100 percent. The day usually begins for ATS-3 when personnel at Palmer and Siple stations in the Antarctic talk with their respective university sponsors in the United States. Promptly at 1300 UTC, research vessels from both the Atlantic and Pacific begin communicating with their bases, passing such traffic as position reports, equipment requests, and project status.

Occasionally, RTTY and FAX are used on the network. Tests of all sorts are conducted throughout the day from points as remote as rescue sites in Panama to NASA stations in Hawaii. The research vessels return for an hour slot at 1600 UTC, and, usually, after a final Palmer and Siple station schedule, the quiet hours on ATS-3 begin. ATS-3 is not silent because its batteries need charging. ATS-3 stands mute because nobody wants to conduct experiments at night.

To the radio amateur, this is downright ludicrous. For a period of over fourteen hours a day, this spacecraft sits perched high above the United States (and the entire Western Hemisphere, for that matter) anxiously awaiting the proper stimulus to carry out its mission. If you or your group can devise a nighttime program acceptable to NASA, you can provide the stimulus needed to awaken a sleeping giant.

Meanwhile, ATS-1 hangs conveniently over the equator at a point serving the continental United States, Alaska, Australia, and, of course, everything in between. (See Fig. 1.) Its primary use is as a governmental, medical, and educational party line for the Pacific region. Late night and early morning hours (satellite sun time) find ATS-1 dormant. Once again, this down time offers tremendous opportunity for those of you with a unique communications idea.

NASA has arbitrarily designated five channels within the 100-kHz transponders, listed in Table 1. These channel assignments are intended to be used by radio equipment with 5-kHz peak deviation frequency modulation. Sound familiar?

ATS-1 users normally operate on channel three, while ATS-3 users operate on channels two and four. There is a good reason for this procedure. Due to certain antenna side-lobe characteristics, ground-station uplinks occasionally access both satellites at once.

You may have noted that the downlink transponders fall within the VHF aircraft band. One of the first experiments NASA conducted was communications tests with aircraft in flight. Depending upon your location, you may be plagued by AM interference from high-flying aircraft. For example, the Washington DC area is within range of such interference on channel three (135.6 MHz) when aircraft work the Cleveland Air Traffic Control Center.

Other types of interference are emitted from the spacecraft themselves. The US Air Force operates security police networks in the uplink passband and this traffic can be received on the corresponding downlink frequencies. A Canadian paging service, CHC-343, is a regular on 135.640 MHz.

Although it is unlikely, NASA has the ability to select other orbital subpoints for ATS-1. Gas thrusters enable it to be driven anywhere along the geosynchronous highway. The fuel supply aboard ATS-3, however, was exhausted shortly after it was parked at its eternal resting place of 105 degrees west. Gravitational imperfections and oblateness of the Earth have created this spacecraft graveyard. (Another one is located at about 79 degrees east.) Once their fuel supplies are depleted, all geosynchronous satellites swing over one of these two stable points like a pendulum. ATS-1 has a tendency to slip eastward, requiring a velocity change of 155 feet per second per year to keep it at 149° west.

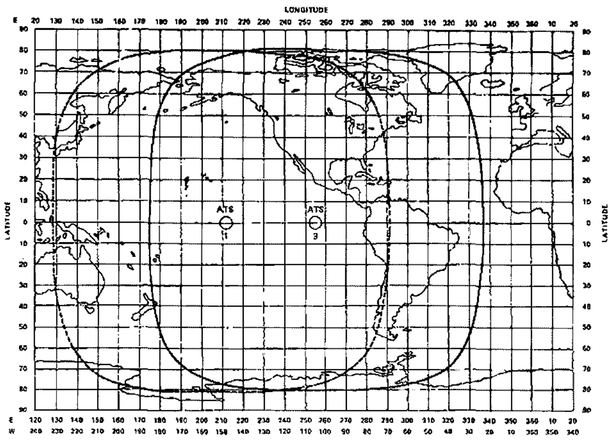


Fig. 1. Earth coverage of ATS-1 (at 149° west longitude) and ATS-3 (at 105° west longitude).

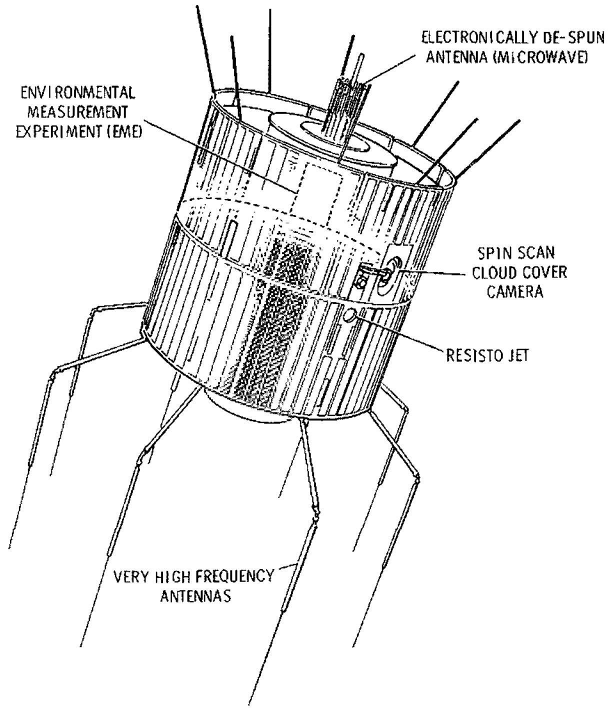


Fig. 2. ATS exterior experiments.

Channel Number	Uplink Frequency	Downlink Frequency
1	149.175	135.555
2	149.195	135.575
3	149.220	135.600
4	149.245	135.625
5	149.265	135.645

Table 1. Transponder channels.

Antenna azimuth for ATS-3 from Washington DC:

$X = 27.8$ degrees

$Y = 38.5$ degrees

$$\text{Azimuth} = \tan^{-1}\frac{\tan X}{\sin Y}$$

Substituting:

$$\text{Azimuth} = \tan^{-1}\frac{\tan 27.8}{\sin 38.5} = \tan^{-1}\frac{.527}{.623} = \tan^{-1} .846 = 40.23 \text{ degrees}$$

Since Washington is east of the spacecraft, we add the result to 180°. Therefore, the azimuth is 220.23 degrees.

Antenna elevation for ATS-3 from Washington DC:

$$\text{Elevation} = \tan^{-1}\frac{\cos X \cos Y - .151}{\sqrt{1 - (\cos X \cos Y)^2}}$$

Substituting:

$$\text{Elevation} = \tan^{-1}\frac{\cos 27.8 \cos 38.5 - .151}{\sqrt{1 - (\cos 27.8 \cos 38.5)^2}}$$

$$= \tan^{-1}\frac{.692 - .151}{\sqrt{1 - .479}} = \tan^{-1}\frac{.541}{.722} = \tan^{-1} .749 = 36.8 \text{ degrees}$$

Geosynchronous satellite range in miles may be found by the formula:

$$\text{Range} = 26210\sqrt{1.023 - .302(\cos X \cos Y)}$$

Once more, from Washington, the range in miles to ATS-3 can be computed as follows:

$$\text{Range} = 26210\sqrt{1.023 - .302(\cos 27.8 \cos 38.5)} = 26210\sqrt{1.023 - .302(.692)} = 26210(.902) = 23641 \text{ miles}$$

In order for their axis synchronizations to be maintained—that is, the spacecraft's angle in relation to Earth—the satellites are spin-stabilized. The spin rate is about 96 rpm and provides a noticeable amplitude-modulated pulsation, particularly from weak signals.

As I mentioned earlier, there are anomalies in both ATS orbits. ATS-1 is presently experiencing a north-south inclination of about 10 degrees, while ATS-3 suffers from a similar inclination of 8.5 degrees. These disorders are uncontrollable from Earth and will continue to increase at a rate of .86 degrees per year. Beamwidths of most ground station antennas are in the range of 30-40 degrees, so the necessity for tracking does not yet exist. Siple station (64° south latitude) now must meet ATS-3 orbital schedules since the spacecraft is over the horizon during its north inclination.

Let's now address ourselves to an ATS receiving system. For one reason or another, NASA has excluded channels one and five from operation, so we are concerned only with three receiving frequencies: 135.575 MHz, 135.600 MHz, and 135.625 MHz. Some ground stations own mammoth General Dynamics diversity-telemetry receivers, but for most of us this kind of equipment comes straight from fantasyland and is certainly not necessary. The University of Miami purchased some inexpensive crystal-controlled VHF scanners a while back, and they continue to perform satisfactorily.

AM aircraft receivers will not work. (The spin-stabilized carriers are sometimes recognizable on these receivers.) Old tunable VHF monitor receivers will not work very well due in part to their poor sensitivity and unnecessarily wide i-f bandwidth. Surplus General Electric and Motorola receiver strips are great and fill the bill perfectly. Since I already owned a Bearcat 210 synthesized scanner (which does not tune to 135 MHz), I decided to go the converter route. My converter is designed so that its i-f is exactly 100 MHz below the input frequency, allowing me, for example, to punch up 35.6 MHz to receive channel three.

With regard to antennas, a simple 88-inch loop fed with 75-Ohm coax will work adequately. But remember, there's a 168-dB path loss between the satellite and your station, so you should give your receiver all the help it can get. If your coax run is long, an inexpensive rf preamplifier will help tremendously. (The serious listener should purchase a preamp anyway. Janel Labs has them in stock for $21.95. Ask for Model 137PB.)

My antenna, which is best described as a four-element quagi, cost $4.80 and consists of three pieces of wood and some aluminum clothesline. This antenna is linearly polarized and is mounted at my QTH in the horizontal plane. The antennas on the ATS satellites likewise are linearly polarized, but this arrangement is of little consequence. Radio signals in the VHF range are severely affected by a phenomenon known as Faraday Rotation, causing ultimate receive polarizations to be unpredictable. It is rare that I encounter no signal at all, and then this situation lasts only a minute or so. Most ATS ground stations transmit and receive on circularly-polarized antennas, of both the helix- and cross-yagi variety. Although this solves the Faraday Rotation problem, an immediate loss of 3 dB is realized over an antenna in the same plane.

Your next objective is to point the antenna in the right direction. You should be able to use the guess method if your antenna is a loop or small yagi. However, here are the geosynchronous aiming formulas for those of you with super arrays—as well as for the mildly curious.

Where X = the difference between satellite longitude and site longitude in degrees, and Y = the site latitude in degrees:

Azimuth = $\tan^{-1}$ ($\tan X/\sin Y$), and—

Elevation = $\tan^{-1}$ $\cos X \cos Y - .151$ divided by $\sqrt{1 - (\cos X \cos Y)^2}$.

Note: If you are in the Northern Hemisphere and west of the spacecraft, subtract your answer from 180°. If you are east of the spacecraft, add your answer to 180°.

For examples, see the box.

If you are in Washington, or about 23,641 miles from ATS-3, and are communicating with a friend whose station is likewise that distance from the spacecraft, you can expect a signal delay of approximately one fourth of a second: 2 × 23,641 = 47,282

path miles; divided by 186,000 miles per second, it means a .2542-second path time.

ATS ground station transmitters vary in power from 50-500 Watts depending upon communications reliability, geographical location, antenna gain, and other considerations. The Antarctic stations operate with 500-Watt transmitters, while many research vessels do well with 80 Watts into an eight-turn helix.

Once the satellite transponders have been saturated, additional uplink power is wasted. The entire downlink transponder power aboard each spacecraft is about 40 Watts. Satellite output power is a function of the input. ATS-3 is designed so that two or more uplink signals will produce the corresponding output ratios. For example, if uplink signal A on channel two is twice as strong as uplink signal B on channel four, the downlink power will exhibit this same two-to-one power ratio. ATS-1 compresses the weaker signals and the downlink is not a linear function of the uplink.

It is time now for you to formulate an operational plan. Your first step is to obtain the "ATS VHF Experiments' Guide." This can be procured by writing: ATS Experiments Manager, Office of Applications, Code ECS, NASA, Washington DC 20546.

Finally, ATS usage proposals must be well thought out, thoroughly described, and unique in approach. If your proposal is rejected and you still believe you've come up with a great idea, contact your Congressman—he may have a sympathetic ear and place a call to NASA on your behalf. In any event, good luck! ■

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Undertones

—a fractional frequency oscillator

Last time I wrote a ham magazine article, Wayne Green and company misspelled my name (April, 1957, CQ) so I've been hesitant about trying again. Oh well, after 22 years he deserves another chance.

Now, all of you have heard of crystal oscillators. Almost all of you have heard of overtone oscillators, where the circuit oscillates on an approximate whole integer, odd harmonic of the crystal fundamental frequency. But how many have heard of the "Undertone Oscillator"? (My name; gotta call it something!) This one oscillates on some fraction of the crystal fundamental such as ½, ⅓, ¼ . . . 1/100, etc. Well, read on, my friend, it is very simple.

This circuit is a by-product of work on a crystal-controlled vfo with a 1000-kHz range. (Works very well, thank you.) Fig. 1 shows the very simple circuit. U1c is an optional buffer to isolate the oscillator from load capacitances. U1 is any TTL NAND gate, 7400, etc. If the NAND gate has more than two inputs, e.g., a 7410, tie all unused inputs to +5 V dc. 74Sxx ICs have been tried but aren't quite as stable and draw too much current. 74LSxx ICs might work well. CMOS NAND gates, e.g., 4011, might work OK at lower frequencies. The circuit has been tested from fundamental oscillations through 1/350th of fundamental. Almost any crystal will work except some very low frequency rocks such as a 200-kHz one that I tried.

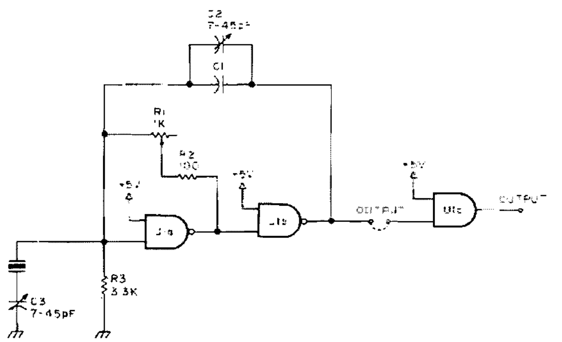

Fig. 1.

The oscillation frequency is set by C1 and R1/R2. C3 is optional for trimming the oscillator to an exact frequency. C2 is optional for help in locking the frequency to a function of the crystal frequency. R1/R2 and R3 bias U1a into its linear region. The output is a TTL-compatible square wave. Larger division factors (lower frequencies) are limited because it is too difficult to select the desired division factor. 1/100 is about the maximum I have found practical.

R1 gives a wide range, as Table 1 shows. Different undertones can be selected by small R1 changes, so a 10-turn trimmer pot helps in picking the desired one. At small division factors (higher frequencies), R1 adjustment is not so critical, so R1/R2 and C1 can be fixed components selected experimentally. Also, at small division factors, better operation is obtained with C1 selected so that R1 is near the higher end of its range (1000 Ohms) for the desired frequency. At higher frequencies, the load capacitance affects the setup of the circuit. Therefore, it is better to have the circuit connected to the next stage or load when adjusting. If the 7400 IC is used and the other two gates are uncommitted, one of them used as a buffer (unused input to +5 V dc) eliminates this problem.

The table shows some ranges for different values of C1 obtained from a 11.000-MHz crystal. A frequency counter or a general coverage receiver are helpful for establishing the oscillation frequency. The circuit will oscillate even without a crystal. Between selected division factors, it oscillates on random, unstable frequencies.

A strange thing is that some division factors lock in better than others. For instance, with a given crystal and C1 value, 1/15, 1/16, 1/17 and 1/18 might lock in

C1	50pF	300pF	[illegible]	[illegible]	.002 µF	.0047 µF	[illegible]	[illegible]
DIVISION FACTORS	[illegible]–÷3	÷2–÷6	[illegible]	[illegible]	÷8–÷40	÷9–÷94	[illegible] 32	[illegible]

Table 1.

nicely. Then 1/19 might not lock, but 1/20, 1/21, etc., might lock well. Some factors lock with poor stability. If the factor you want doesn't lock well, try a slightly different value of C1. Division factors greater than about 1/30 become fairly critical to set and aren't very practical. One-half through 1/10 are easy, and very stable operation can be obtained. After a division factor has been selected, remove the power, wait a few seconds, then turn it back on. Readjust R1 until it always starts oscillation on the desired frequency. This is more critical at larger division factors (lower frequencies). There is a little drift in the first 30 seconds the oscillator is on. (This is minimal at small division factors such as 1/10.)

What can this circuit be used for? Use your imagination. Let's say you want a 1000-kHz reference, and in your junk box is an old 40-meter, 7-MHz rock. Set up the circuit with C1 at 1000 pF and set R1 for divide-by-7, and presto, there is a 1000-kHz crystal oscillator. The 11-MHz crystal is set up to divide by 110 (C1 at 6700 pF) and makes a nice 100-kHz reference rich in harmonics.

I would be interested to hear of applications that others might find for this circuit, and of any new developments in the circuit. Also, if anyone knows where this type of oscillator is covered in any literature, I would appreciate hearing about it.

A note: Be careful; sometimes the circuit can be made to lock on unusual division factors such as 1/3.5! Operation in this case is unreliable. Although it will work, this is not a particularly good circuit for fundamental frequency oscillation. ■

The Arcane Art of ATV

—the transverter approach to fast-scan television

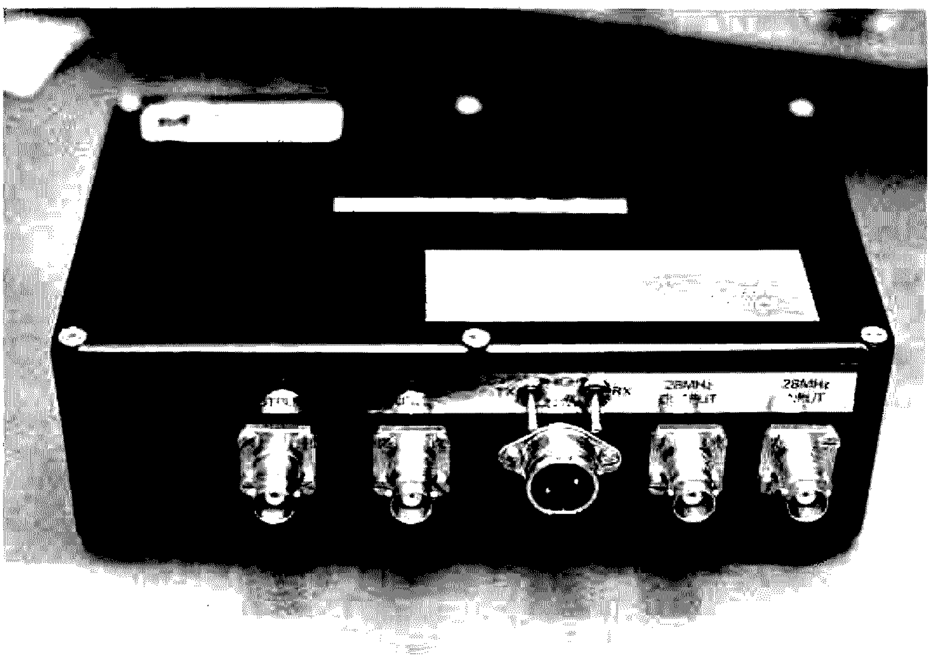

Photo A. The standard MMT 432/28 transverter, manufactured by Microwave Modules of Great Britain. All inputs and outputs are available along one side of the rugged cast-aluminum enclosure. The 432-MHz output is on the left, followed by the 432 input port. This is normally not connected, but you can jumper the receive-converter input to the connector when using an external linear. The DIN power and control socket is in the middle, followed by the receive-converter output with the transmitting-converter input on the far right. This particular unit is a dual-LO unit with control switches for the two crystals above the DIN socket. The dual-LO units are useful in working repeaters and can be used to make an ATV or all-mode repeater, as noted in the text.

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Back in the "good old days" of amateur television (ATV), in the 50s and 60s, one constructed a 420 transmitter, modulator, and converter, teamed the latter up with the station communications receiver, and fired up on the air. Today, almost no one uses that approach for 432 work. The ready availability of highly effective HF sideband transceivers has resulted in a wholesale switch to transverters for point-to-point and satellite communications. Quite remarkably, considering the state of the art in compact solid-state transverters for 432, little attention has been paid to the use of transverters for ATV operations. The only exception I know of was an old QST article (Campbell, 1962) that described a tube-type transmitting converter for ATV. This novel approach

involved amplifying the video-modulated rf output from a standard TV camera and heterodyning the signal up to the 420-450-MHz band. It was a very interesting concept, although somewhat cumbersome to implement with the state of the art at that time.

One of the most popular transverters for 432 MHz now in use is the MMT 432/28, manufactured by Microwave Modules of Great Britain. This company is well known for its quality line of VHF and UHF equipment. One of the major US outlets for the line is Spectrum International of Concord, Massachusetts. John Beanland of SI has always been very cooperative when it comes to making interesting modifications of Microwave Modules gear for specialized applications, and the two of us spent considerable time working up a modification of their standard 432 converter for use on ATV.

In the course of one of our many phone conversations on that subject, we got on to the notion of using the MMT 432/28 in ATV service. Unable to resist the urge to tinker with a new idea, I had John make me up a modified version of the transverter. The modifications included realignment of the LO system to provide for converter output on channel 3 with channel 3 rf drive to actuate the transmitting converter. John delivered the unit at the Dayton Hamvention two years ago, and I put it through its paces as soon as I got it home.

With an internal jumper in the driver input circuit, the transverter will develop its rated 10 Watts peak output with only 5 mW of drive, and I thought it might be possible to drive it with the rf output of a standard camera, à la Campell. The receive section worked just as expected and the transmitter strip would develop full output with a few milliwatts of drive, but the direct approach to transverting did not work out since no available camera had sufficient rf output to more than tickle the transmitting converter. The project was temporarily shelved due to time pressures and the unit was loaned out to a series of new ATV operators in our area for use as a receiving converter.

Eventually, however, I got around to thinking about upgrading the ATV station, only to come face-to-face with the ravages of inflation. It was then that memories of the $$ I had spent on the transverter surfaced, and I suddenly developed the time to reexamine the basic concept! The transverter was snatched back from the last borrower and was put to work in an amazingly short time. The project went so easily and worked so well that I think the transverter idea deserves careful consideration by anyone planning to set up an ATV station.

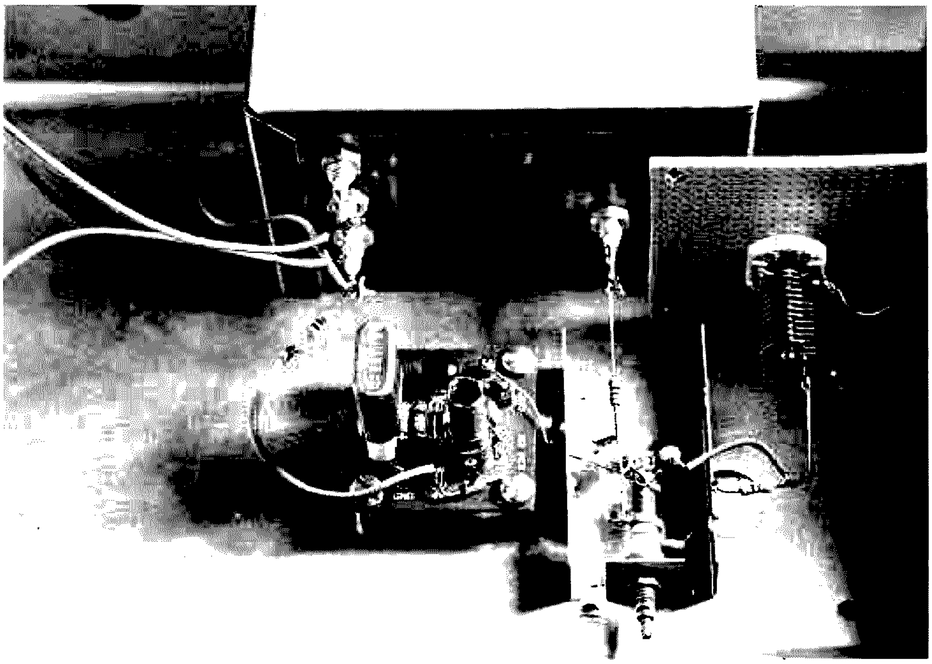

Photo B. Rock-crusher driver for channel 3. The power capabilities and complexity of the driver are clearly evident! The little OX oscillator board, complete with EX crystal, is in the center. The final output stage is in a small brass channel assembly to provide shielding. I don't know if the shielding is required, but I used it anyway. The half-box contains the final output transistor coil and collector bypass cap. The output-coupling capacitor comes out to the right and taps into the 47-Ohm load resistor with the ground side of the resistor soldered to the brass wall. The variable-output drive capacitor should be mounted so as to insulate the shaft from ground. The modulator is in the small box to the rear. This shielding and the feedthrough caps were a holdover from using the modulator with the 432 transmitter strip and power module. In this application, you could simply wire it on perfboard.

System Components

Only four black boxes are required for a basic 10-Watt ATV station. The first and most important box is the transverter itself. Photo A shows one variation of a standard MMT 432/28 transverter. Modified versions for ATV are available from Spectrum International for $259.00. You need to provide two items of information when ordering. The first is your local ATV frequency. In the Lansing, Michigan, area, we use 437.25 MHz 439.25 MHz is perhaps the most widely used frequency nationwide, but you should check for the standards in use in your area. If your area has a repeater, check the information at the end of this article.

The second item is the VHF channel you want as your i-f output—either channel 2 or 3 is suggested, depending upon your local VHF TV-channel allocations. We use channel 2, which is vacant in central Michigan, but my original transverter was set up for channel 3 because we planned to try the unit out in Dayton and that was the clear channel in that area. We do get a moderately strong broadcast signal on channel 3 in our area which creates some weak signal

Photo C. The author, delivering a penetrating stare to the Lansing ATV crowd while snapping his own picture. The camera was photographing the 437.25-MHz output signal on the station TV while running about 60 Watts peak output. The system delivers a perfectly stable signal with gray scale and resolution capabilities limited only by your TV camera and lighting. A Sanyo CCTV camera is used at my station along with bounce lighting. If you have a color camera, the modulator and driver will handle the signal with no problem.

problems, so choose a vacant channel for your i-f.

You also will need a TV set. Almost any set of modern vintage will do, although a transformer-operated set is preferred due to the ease of converting such a set to serve double duty as a video monitor. You also will need a TV camera. New cameras of quite good quality can be obtained for as little as $250, and at larger hamfests such as Dayton, you can do even better. Used cameras usually can be obtained for $50-$100, but these may need a new vidicon.

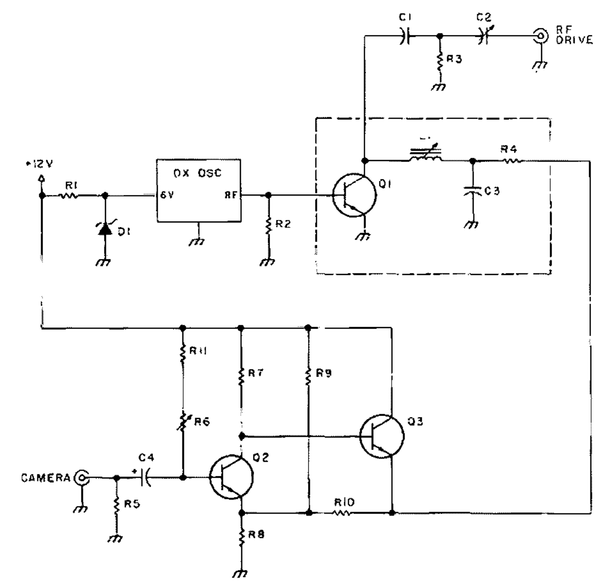

Fig. 1. Schematic diagram of the VHF TV driver circuit. See Table 1 for component values.

Finally, you will require a source of video-modulated rf on channel 2 or 3. This is the only construction part of the project and presents no problem, as we shall see. The transverter draws 2.1 Amps peak, so an inexpensive 2.5-Amp, 12-14-V supply (see your local Radio Shack) will handle the power-supply needs.

The system has a number of advantages that place it a cut above your usual ATV system:

1. Since the transverter incorporates a state-of-the-art, crystal-controlled converter, you really can't do any better, and no add-on preamps are required. The fine-tuning range of the TV will handle a several-MHz spread between stations, so mixing 437.25 and 439.25 operations is no problem (we do it all the time).

2. Drive requirements are limited to an extremely low-powered VHF unit which is easy and inexpensive to build and easy to modulate.

3. Transmitter modulation adjustment is easily made while watching the VHF signal on the TV set.

4. On-the-air monitoring is quite simple and effective since while you transmit, you are watching the low-powered VHF driver, which will not overload the set regardless of your power output on UHF.

Construction

As noted earlier, the only part of the system you have to build is the milliwatt VHF driver. Fig. 1 shows a circuit diagram for this unit. The heart of the driver is one of the little OX oscillator kits from International Crystal. This oscillator, teamed up with an inexpensive EX crystal for channel 2 (55.25 MHz) or channel 3 (61.25 MHz), provides our basic frequency reference. Actually, the OX oscillator has more than enough output to drive the transverter to full output, and the first evening's operation involved video modulation of the OX oscillator. Although the resulting signal was as good as many you see on ATV, you really can't get the best possible video signal with this approach. Instead, a simple final amplifier stage was added. You don't really need the power—we will throw most of it away—but video modulation of the final will produce all the video quality your camera is capable of delivering.

The 2N2219 transistor specified was used because I had it on hand for use in switching applications. It works very well at this frequency. You may be tempt-

ed to try a hotter transistor (such as the 2N3866), but if you do you may have oscillation problems. At 5/$1.00 from James, the 2N2219 does just fine!

The output transistor and coil were isolated in a small half-box of brass to provide shielding. A small hole in one wall passes the base lead which was insulated with a small piece of spaghetti stripped from hookup wire. The base resistor is grounded to the outside wall, and a short wire connects to the rf output of the OX oscillator. Since the final has far more output than needed (it draws 200 mW, as shown), the output is capacitively coupled to a 47-Ohm load resistor. The top of the resistor is connected to the driver output via a variable capacitor which serves as a drive level control.

Photo D. Mike WB8JXF, one of the original "dynamic duo" in Lansing ATV. The path is about 8 miles, and he was loafing his amplifier along at about 100 Watts peak output when the picture was taken.

The modulator is a circuit designed by WB8JXF. The only modification involves an adaptation for use with ac-coupled cameras—far more common than the more expensive dc-coupled cameras with which the original circuit was used. Modulator layout is non-critical. The shielded enclosure and feedthrough capacitors shown in Photo B were a holdover from earlier use of the modulator with various 432 transmitter strips, and such elaborate packaging is not required here.

Tune-up is quite simple, but a few regulatory cautions are in order. The essential point is that we are not authorized to broadcast TV signals on channel 2 or 3, even if the channel is not in use locally. The little driver doesn't put out much rf compared to the transmitter strip, but if you connect it to a wire or antenna, it will radiate and that could be an invitation to trouble. If the unit is built in a shielded box and coax is used to make the interconnections, you will be hard pressed to pick up the VHF signal on the TV in the shack and you will not be radiating the signal.

A grid-dip meter makes for easy tune-up, although it is not essential. If one is available, switch the dipper to the wavemeter mode (assuming the proper coil is in place) and couple the coil to the OX oscillator coil. Tuning around the proper frequency should show an rf peak. Tune to the peak and you will be on frequency regardless of the usually poor calibration of most dippers (the one I used turned out to be off by 10 MHz). Now switch to the dip mode and couple to the final output coil. With the lead from the modulator disconnected, tune the coil for a dip. At this point you can connect the modulator lead and you should be on frequency. If you switch the dipper to the wavemeter mode, you should see a very substantial rf peak from the final.

If no dipper is available, you can proceed as follows. Temporarily remove the connection between the fixed output capacitor and the 47-Ohm load resistor. Solder the free lead of the capacitor to the base of a #49 lamp and ground the shell. Disconnect the modulator lead and connect the 100-Ohm resistor to 12 V dc and tune the output coil for maximum brilliance on the lamp. Reconnect the capacitor to the load resistor and connect the 100-Ohm resistor back to the modulator output.

Use a piece of coax to connect the output of the driver to the input of your TV and tune the latter to the i-f channel. Set the drive capacitor to minimum (plates completely unmeshed) and turn the driver on. The TV screen should go blank with a strong signal. Connect a properly-adjusted camera to the video input and run the camera input pot through its range. At one extreme, white areas will begin to smear, eventually spreading to cover and obscure any video display. This is called "whiting out." At the other end of the range, the contrast will increase and you will begin to lose sync. The proper setting is

R1—100 Ohms
R2—1000 Ohms
R3—47 Ohms
R4—100 Ohms
R5—100 Ohms
R6—10k linear-taper, panel-mounting pot
R7—47 Ohms, 2 Watts
R8—10 Ohms, 2 Watts
R9—560 Ohms
R10—100 Ohms
R11—2200 Ohms
C1—.001-uF ceramic disc
C2—5-30-pF variable (DRIVE)—value not critical
C3—.001-uF ceramic disc
C4—100-uF, 16-V aluminum electrolytic
D1—9-V, 1-Watt zener
Q1—2N2219
Q2—1306 (CB driver)
Q3—1307 (CB final)
L1—15 turns of #28 enamel on a ¼ inch slug-tuned form

Table 1. Component values for Fig. 1. All resistors are 1/4 Watt unless otherwise noted.

Photo E. Jeff WB8RJY, about 5 miles from my QTH. Jeff is running the VHF Engineering 1-Watt exciter, Motorola power module, and a 2C39 cavity final with about 20 Watts average output when the picture was taken. He is not nearly as gnome-like as he looks—really, he is suffering from the very common "wattmeter syndrome"! The 1-Watt modulated exciter is driving the power module beyond its quasi-linear input range, resulting in some sync instability and excessive contrast. A little more padding between the exciter and the module, and he now runs the same output power with no problems. You can run into similar problems, as noted in the text, if you overdrive the transverter. TV is not a mode that makes the best of any amplifier, and you will always have to trade off some power to get video quality.

achieved by starting at the white-out end of the range and advancing the control until any evidence of whiting out is absent from bright areas of the picture. Camera adjustments can be touched up at this point if desired. What you should see on the screen is a faithful reproduction of the camera output.

System Interconnections

We are ready now to tie the system together and put it on the air. Fig. 2 shows the system interconnections for a basic 10-Watt peak output station using the barefoot transverter, while Fig. 3 shows how to handle an external power amplifier. Let's look briefly at each option.

10 Watts. If we are using just the transverter, we need make no provisions for T-R switching of that unit. The MMT 432/28 incorporates PIN diode switching, activated by an rf-sensing circuit at the driver input. Thus, our manual T-R switch need only key the driver in transmit. The tune-up with this version is most easily accomplished with a power output indicator such as a Bird meter or the new Heathkit 1-GHz inline wattmeter.

Start with the drive capacitor at minimum and key the driver. Slowly advance the drive control to the point where power output no longer increases. Note the peak output reading and back off the drive until you hit about 2/3 of the previous peak reading. If the drive control is set too low, you will not only hurt picture quality, but also you will not be getting all of the power the transverter can deliver. If the drive is set too high, you will begin to get picture pulling and other signs of sync instability.

You can check the drive setting on the air by having the other station look at the stability of your picture. This is best adjusted with a signal level that just introduces some snow into the picture. You can swing either the transmitting or receiving antenna (or both) to cut the signal level down for this test. If the picture is unstable (pulling, "hooking" at the top of the picture, rolling, etc.), back off the drive until the pic-

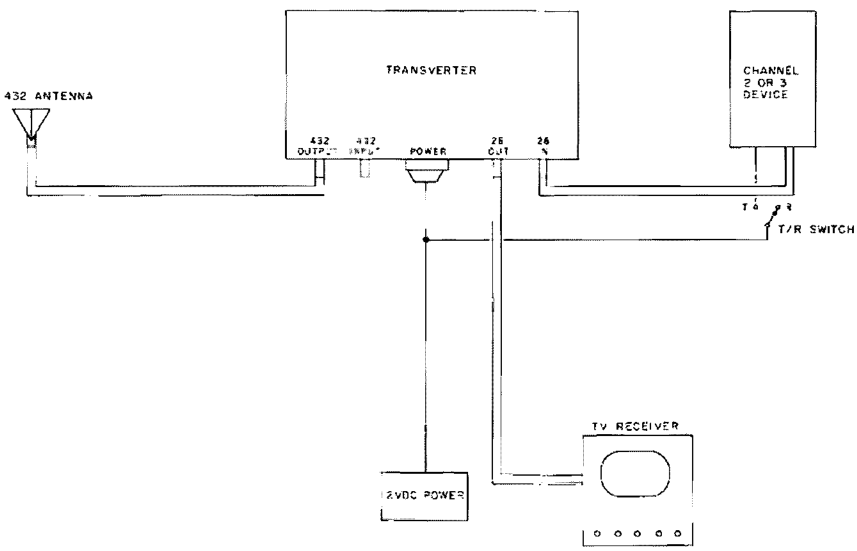

Fig. 2. System interconnections for using the transverter barefoot, providing a basic 10-Watt peak output ATV station.

ture stabilizes. If the display is solid, you can try advancing the drive slightly until instability is noted. You then can back it off slightly.

All tests on the air should be conducted with a station which will provide an honest video report. Some fellows are so enthused by seeing a TV signal they will give rave reviews even if they have to roll their eyes to keep up with the picture. Avoid such a station! You are now in business at the 10-Watt level. Note that in transmit you will get a nice clear picture on your i-f channel—very nice for use as a viewfinder!

High Power. At 10 Watts peak output, the MMT 432/28 transverter will drive a variety of linear amplifiers to quite respectable power outputs. A number of different amplifiers are in use with our ATV group. WB8JXF and I run 4CX250s in *VHF Handbook* cavities. With a 2-kV plate supply, the transverter will drive such an amplifier to close to 500 Watts peak input—provided you supply plenty of air! My own cavity is run with only 800 V on the plate and loafs along at about 160 Watts peak input.

Several other stations are using 2C39 cavities from commercial FM equipment (Motorola and GE), running them in AB1 with excellent results. In grounded grid service, these amplifiers will supply 25-30 Watts of average power output when operated off an old transceiver power supply. The K2RIW and some of the newer 432 power amplifiers should do equally well. One approach which has not been used in our area involves using one of the linearized solid-state power amplifiers. The cost of such amplifiers and their high current supplies makes a tube-type power amplifier far more appealing. Dollar for dollar, you probably can do far better with a tube-type circuit.

Photo F. Jim WB8YSC, running about 10 Watts average power output using a 2C39 cavity final. Most of our ATV group (six operators as of the last net) are located east and south of Lansing, but Jim is in Grand Ledge, Michigan, off to the west of Lansing. This is about a 10-mile path to my QTH, and despite the fact that both of our antennas are just mounted at rooftop height, the use of sensitive crystal-controlled converters at the receiving end provides a perfectly usable picture. Jim does his share with careful transmitter setup and good lighting—both factors which make a big difference over an extended path.

Fig. 3 can be used as a guide in hooking up such an amplifier. Several differences from the low-power system exist that are worth comment. First, you will have to provide a separate receive input for the transverter. The BNC

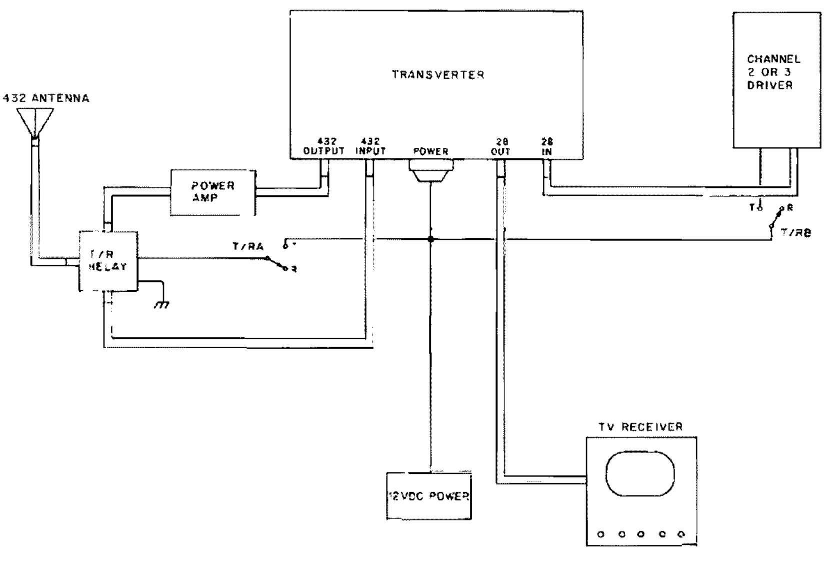

Fig. 3. System interconnections when using the transverter with an external power amplifier. In addition to the amplifier, you will need an antenna change-over relay and an additional set of contacts on the T-R switch to control the relay. You also will have to connect the receive-converter input to the 432 input jack as noted in the text and your transverter manual. Depending upon your amplifier and power supply, you can run 500 Watts or more peak input with such a system.

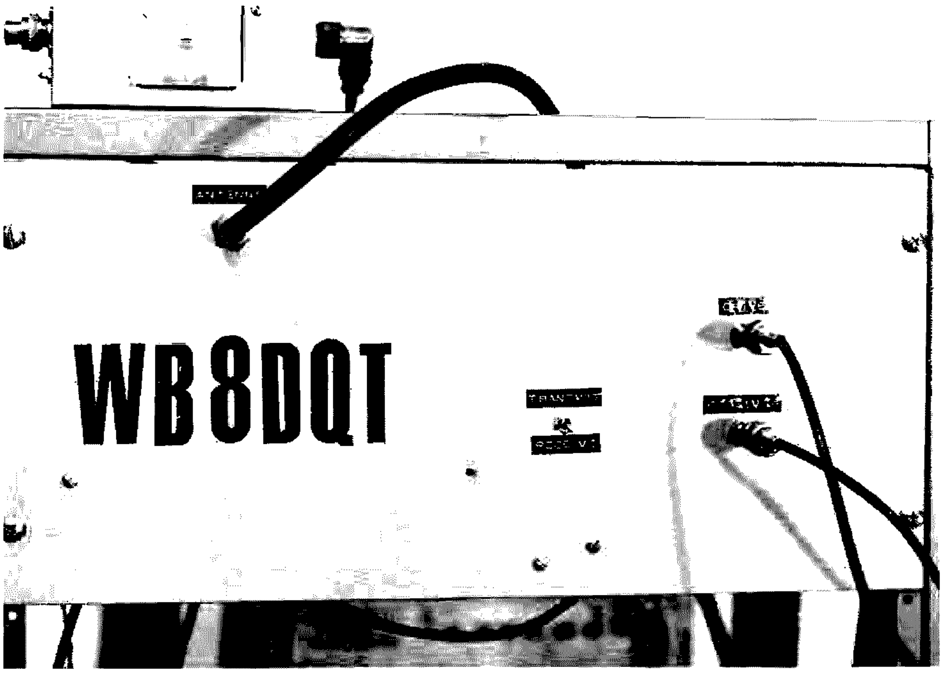

Photo G. Rack-mount installation of the transverter at my station. An old rack panel from another project was salvaged to house the transverter installation. The transverter mounts behind the panel, as does the shielded driver unit. In the 10-Watt mode, only three interface cables are required—the antenna transmission line (above the call letters), the camera output, and the receiver output to the TV—the latter two coming in on the right end of the panel. The power output meter can be seen on top of the desk-top rack. The 4CX250 linear sits on the base of the rack with extension cables running down the back to the amplifier inputs and output. The vacant center area in the rack is now occupied by the voice transmitter which uses the old 1-Watt exciter and the 10-Watt power module. This way, nothing was wasted and I ended up with a high-quality sound system.

connector for this purpose is mounted on the unit and you should follow the instructions in your manual for making the one new connection required. Second, although the transverter does not require a relay for switching, the external amplifier does mean that we will need an antenna change-over relay. A check with a local two-way service shop handling Motorola or GE mobile equipment will reveal a variety of 12-V dc relays designed for UHF service that can be purchased for moderate cost.

A DPDT T-R switch will be needed, with one set of contacts actuating the driver and another switching the antenna relay. It has been our experience that the linear can be left drawing resting plate current during receive with no problems, so bias or other switching is rarely required. If you do want to cut the amplifier off during receive, it is easier to switch the relatively low voltage of the bias supply rather than trying to switch the HV line.

Setup follows the pattern outlined for the 10-Watt power level. Your limiting factor will be the drive level to the transverter and usually not the drive from the transverter to the external amplifier. If the 10-Watt transverter can overdrive the linear, you probably are using an amplifier that is hardly worth hanging onto the system. If you are going to fuss with an amplifier, it should be one that will deliver useful power gain.

Sound

Sound transmission, in the early stages of system development, is probably best handled on 2-meter FM. Most people have or can get 2-meter FM gear, and, in theory at least, the sound commentary should attract some additional converts. Sound transmission up on 420 usually is handled in one of three ways. One method, used in some areas, is to FM the video carrier. With this system, the various stations use an auxiliary UHF-FM receiver tuned to the carrier frequency. Although the FM modulation has no real effect on the TV transmission, this system has disadvantages. First, you must provide the separate sound receiver. Second, unless the TV signal is quite strong, it is difficult to limit out the AM-TV modulation, resulting in considerable sync buzz on the signal.

The second approach is to use a 4.5-MHz FM subcarrier system. With this technique, you FM modulate a 4.5-MHz oscillator and then mix this signal with the camera video prior to feeding it to the video modulator. The FM signal then appears on the transmitted signal, 4.5 MHz above and below the video carrier. The FM signal above the carrier frequency then provides audio through the TV set.

This system has the advantage of simplicity, and only one antenna is required. Your amplifiers, however, must be wide enough to pass both the video and audio subcarrier. This is no problem with the transverter and you may wish to give it a try. This approach is used on a number of commercially-made ATV rigs, two of which are in use in our area. In our experience, this approach provides marginal results. Neither of the two stations routinely uses its 4.5-MHz sound system, because each of them has excessive sync buzz coupled with relatively low audio level. Since each operator has gear from a different manufacturer, one does tend to wonder about the effectiveness of the system.

The latest trend in our area is to crystal up an FM strip 4.5 MHz above the video carrier and operate that as a separate sound system. Results with this approach are excellent, providing full quieting in the TV sound system and very good audio levels. Ideally, you would use a transmitter power level and sound transmitter antenna gain that would provide an erp for the sound that would run about 1/5 of that which you attain on the video transmission.

In practice, many operators locally will get by with 10-30 Watts of sound output into an omnidirectional antenna system.

Commercial surplus strips, the VHF Engineering transmitter strip and Motorola power module, or one of the newer 440-FM transceivers now on the market, will all do for sound transmission. While this approach is more complex than the subcarrier system, the results are well worth it.

Results

The transverter approach has proved to be completely trouble-free in day-to-day operations and produces a signal whose quality is limited only by the camera or other video source used. Photo C shows a sample of the 437.25-MHz output of my system when an inexpensive Sanyo CCTV camera is used. Photos D, E, and F show typical results on received signals. My only reservation is that it took me so long to get around to trying the system out!

Future Developments

Other VHF Drivers. Several other options exist for the VHF driver stage for those interested in experimenting. If your camera has modulated rf output, you may want to experiment with transverting that signal. The rf output level of cameras and other video sources is limited by FCC regulations and is far too low to drive the system directly. About 30-40 dB gain would probably be needed with most rf sources. Since you are starting at a reasonable signal level, an amplifier designed like a multi-stage, 6-meter front end would probably do the job and you wouldn't have to worry about noise figure. One approach that I am working on currently involves the little rf interface module kit marketed by Radio Shack. This module will provide both video and sound output on channel 3 or 4, and if the quality proves acceptable, it is a real possibility. The unit puts out about 1.75 mV across 75 Ohms, so a multi-stage amplifier will be required to develop sufficient drive as noted above.

If you really want to go first class, consider the use of one of the VHF modulator circuits that cable TV companies use to put a signal on your local CATV system. Such units should be able to drive the transverter directly, and they have capability for high quality video and sound. They are expensive if purchased new, but that should not deter the true amateur scrounger!

Repeaters. Linear transverters like the MMT 432/28 have several applications in the repeater area. The Microwave Modules unit is available in a dual-LO version for the OSCAR operators who also want standard SSB capabilities on 432. If your area has an ATV repeater, the output is probably on 439.25 or thereabouts with an input down near 427. In such a case, you could order the dual-frequency transverter with one LO hard-wired to provide transmitter output at the repeater input.

Such a dual-LO unit also can be used directly as a repeater in several modes. One that I am looking at seriously is really quite simple in concept. One LO chain would operate the receiver at the low end input frequency. The second would run the transmitter at the output frequency. The converter output would loop out at channel 2 or 3, be amplified, and then be fed back to the driver input. The normal rf-sensing circuit would be disabled and a TV would be hung on the converter output for control. A 15-kHz PLL tone decoder connected to the sync detector of the TV would trigger the manual T-R pin of the MMT 432/28 transverter. With this system, any TV signal at the input frequency would be retransmitted at the output, but non-TV signals would not be repeated. Of course, this function could be bypassed if you want a multi-function repeater.

The advantage of such a transverter-repeater is that it would operate with any mode—CW, SSB, AM, TV, you name it! Hang an amplifier in the system and your repeater can operate at any desired transmitting level. ATV growth in the Lansing, Michigan, area has now reached the point where it becomes tedious to swing the antenna around to the different stations, leaving some stations looking at a snowy picture while you work the fellow across town. A central repeater, with all antennas in the area pointed at it, is beginning to look appealing!

Summary

Well, there is little more to be said. It's simple, clean, and works extremely well. The method is extremely versatile, leaving lots of room for experimentation and development. If you would like to try something like this, contact John at Spectrum International. Unlike dealers who sell black boxes made in Japan, John just loves to work with someone with a new application or idea! As for you fellows in northern Ohio, Indiana, and Illinois, the central Michigan ATV net meets on Monday evenings. Swing the antennas north for a change, and if the band is in decent shape, we would love to work you! ■

Author's Note:
The modified transverters are available from Spectrum International, PO Box 1084, Concord MA 01742; telephone: (617)-263-2145. Contact them regarding options and current pricing. International Crystal, the source for the OX oscillator boards and EX crystals, is at 10 N. Lee St., Oklahoma City OK.

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How to Make a Good Scanner Better

—a bevy of useful mods

All programmable scanners are not the same. At this writing, Radio Shack (PRO 2001, 2008), Electra (Bearcat 160, 210, 211, 220, 250, and 300), and Regency (Touch, K100, K500, Digital Flight Scan, and M100) are the only direct-frequency-entry scanners on the market. The Regency receivers are shown in Photos A through D. Early contenders like those from Tennelec and JIL (SX-100) have gone by the wayside.

Photo A. The K100 is an improved version of the original Touch.

Among those in the present field of scanners, the Regency series is well suited for field modifications. Why modify a good scanner? Because there are certain flexibilities which are desirable but have not yet been incorporated into the programmables. Extended frequency range is one; selectable AM detection is another. With programmability extendable down below 30 MHz, AM detection would be an asset. In this article, we shall examine both modifications.

Which Regency to convert? Naturally, the more recent scanners are an im-

provement over the original Touch (ACT-T-16K), but many of those originals are still in the field.

The Touch

The ACT-T-16K was Regency's entry into the direct-entry programmable field; as a first-generation scanner, there were many shortcomings which were corrected in subsequent models. For those owners of the original Touch, we offer the following modification notes.

As factory issued, the Touch may be programmed out-of-range by sequentially pressing MA, 9, and CL before entering the desired frequency. The algorithm ranges which may be displayed are: 10.00-71.255, 110.74-192.655, and 311.00-515.5875 MHz. Unfortunately, the receiver rf tracking will not accommodate this great a range, even with retuning.

Without realignment, most ACT-T-16Ks *can* receive the following frequency excursions when given the out-of-band command (individual units will vary slightly): 21.4-57.5, 142.825-178.9, and 406.95-515.425 MHz. But by some judicious realignment, the tuning flexibility of the Touch can be programmed to receive far more useful ranges: 15.375-49.785 MHz (adding shortwave, WWV, CB, and 10 meters), 136.74-171.17 MHz (adding weather satellites and military base communications), and 388.8375-492.1 MHz (adding some military aeronautical, plus the UHF government band).

While it would be delightful if we could control each of the three ranges separately, unfortunately we can't. All ranges are set by a master voltage-controlled oscillator. Let's compromise on an optimum frequency range which allows the flexibility of the scanner to cover those frequencies which are most active: 18-53, 141-174, and 401-501 MHz. Not all Touchs will wind up with these identical ranges, but most should come close. You will need standard alignment tools and a signal generator for these adjustments.

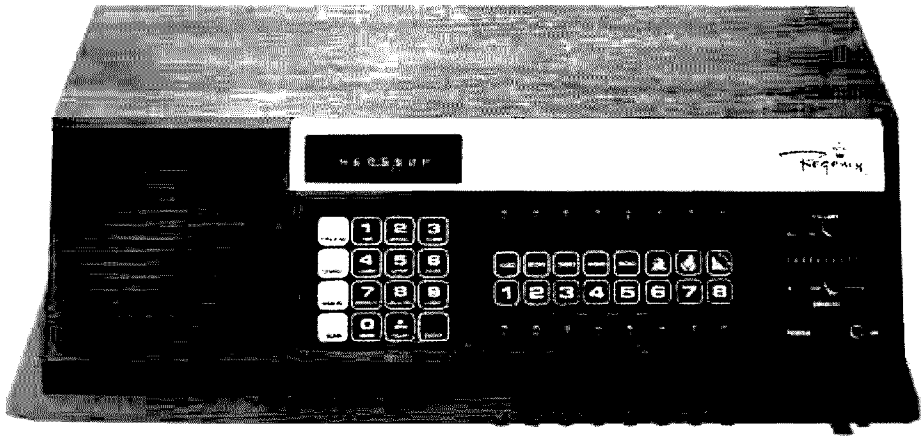

Photo B. The K500 is loaded with microprocessor-controlled features.

Part A: Vco Board Frequency Range Set

- Check receiver on all functions for normal operation.
- Remove antenna.
- Remove 4 screws from bottom of cabinet; slide chassis out.
- Remove 6 hex-head screws from top lid of vco compartment; remove screw from top of shield. Carefully pry up top lid and remove.
- Locate R407 (56k) from Fig. 1. Solder a 120k resistor across it.
- Turn radio on.
- Check regulated B+ at standoff terminal adjacent to voltage regulator IC501. Adjust R534 if necessary to read between 9.50 and 9.55 volts dc.
- Locate coil L401 (yellow) as shown in Fig. 1. Carefully screw slug outward until it is flush with coil form. Advance squelch knob fully clockwise; volume should be at one-third.
- Press in sequence: MA, 9, CL.
- Enter 141 MHz into channel 1. Press MA.
- Screw L401 slug slowly in until squelch breaks (background noise will be heard). This setting will adjust band-edge limits on all three ranges.

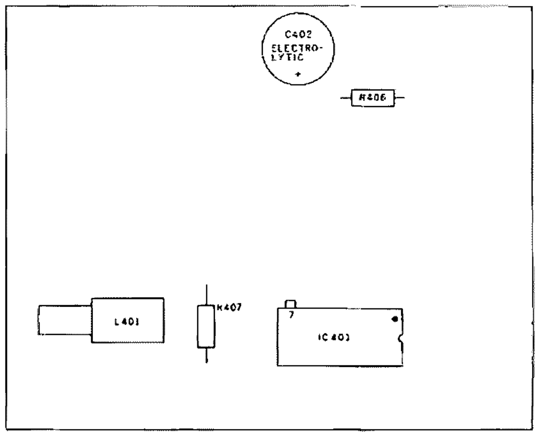

Fig. 1. The vco board, showing parts locations.

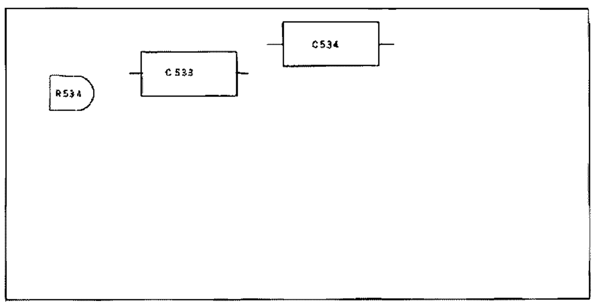

Fig. 2. Trimpot R534 is on the mixer board and adjusted in Touch conversion.

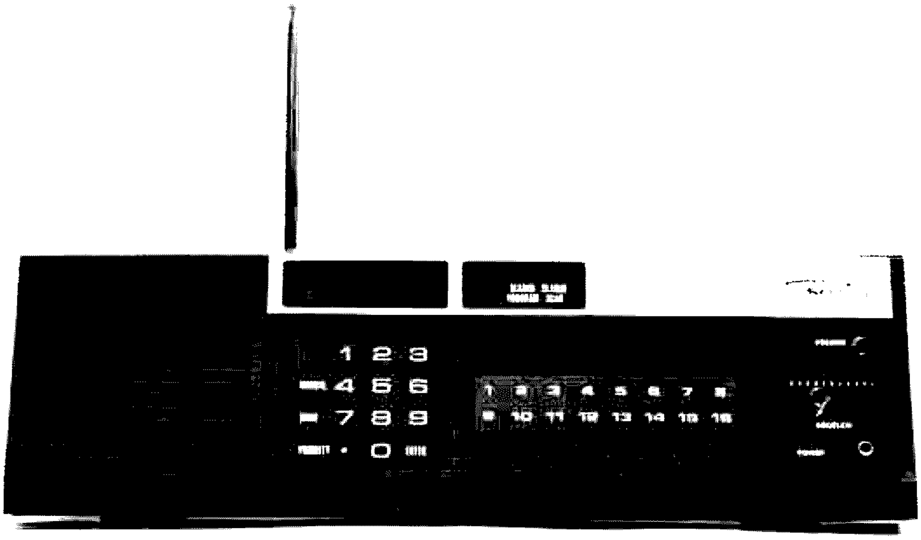

Photo C. The Digital Flight Scan is a programmable 108-to-136-MHz AM scanner for aircraft buffs.

● Replace cover on vco compartment. Do not replace screws until you are certain that the desired frequency ranges are covered by the new vco setting. (Also see part F.)

Part B: Low-Band Rf and I-f Alignment

● Enter 41.1 MHz into channel 1. Press MA.

● Set signal generator exactly on 41.1 MHz so heard *weakly* by scanner.

● Adjust L303 and L302 for best quieting. The locations of these coils are shown in Fig. 3.

● Enter weather channel (or other local steady signal) and adjust L314 (discriminator) for greatest audio output.

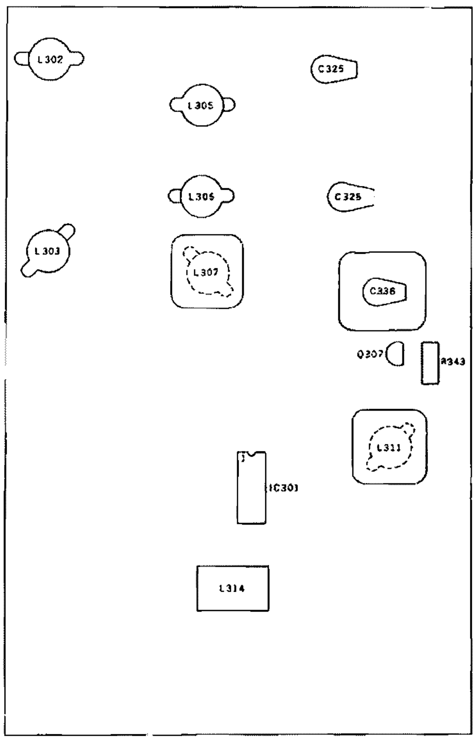

Fig. 3. Locations of rf and i-f components for Touch alignment procedures.

Part C: High Vco Buffer (UHF Tracking)

● Turn receiver off.

● Locate L311; solder 3.9-pF capacitor (NPO or silver mica) from bottom terminal to adjacent ground foil.

● Turn receiver back on.

● Enter 406.1 MHz into channel 1; enter 470.1 MHz into channel 2.

● Carefully connect a dc voltmeter between emitter of Q307 and ground foil. Attachment to emitter lead may be made at adjacent resistor R343 lead closest to back of radio.

● Press channel 1 and channel 2 alternately, adjusting L311 for equal readings (approximately 3.8 volts).

Part D: VHF High-Band Rf Alignment

● Enter 157.1 MHz into channel 1; enter 139.1 MHz into channel 2; enter 174.0 MHz into channel 3.

● Press channel 1 and MA.

● Adjust rf signal generator accurately to be received weakly on 157.1 MHz.

● Adjust L305, L306, and L307 for best quieting.

Part E: UHF Rf Alignment

● Enter 445.1 MHz into channel 1; press MA.

● Set signal generator for weak signal to be heard on 445.1 MHz (channel 1).

● Peak trimmers C325, C328, and C338 for best quieting.

These steps will complete the rf and i-f alignment procedures for the ACT-T-16K.

Early models of the Touch had a characteristic search whine which was quite distracting; some reduction may be experienced by the following addition of a resistor. Try it in place before soldering permanently. If it helps, fine; if not, forget it.

Part F: Search Whine Reduction

● Remove vco compartment lid.

● Locate resistor R406 (6.8k next to large electrolytic).

● Solder a 470-Ohm resistor to lead closest to electrolytic capacitor; wrap the other resistor under loosened mounting screw and tighten. Replace vco cover.

● Check operation on search to see whether whine interference has been reduced. If not, remove 470-Ohm resistor and disregard Part F modification.

Part G: AM Detection for CB and Shortwave

Notes: Audio recovery will be ragged and of a low volume, but more readable than with straight FM detection. We are reducing the signal level below hard limiting, thus permitting some amplitude modulation to sneak through to the

detector. Be sure receiver is switched off before beginning this modification! Part G is not recommended unless AM detection is of paramount importance. I assume no responsibility for damage resulting from this modification!

- Mount an SPST switch conveniently for use.
- Connect one lead from the switch to chassis ground.
- Connect other switch lead through a 10-Ohm resistor to pin 9 of IC301. Make *certain* that you have correctly identified pin 9. Measure voltage with a VOM to double-check that there is no significant voltage present which could damage the IC by grounding the pin. Be extremely careful while soldering; the IC paths are very close together, and the IC is easily destroyed by accidental voltages on the wrong pins. I know from sad experience!

Photo D. The M100, newest in the Regency line, features straightforward, compact design.

The K100

The K100 offers considerable improvement over the earlier Touch. Most of the shortcomings of its predecessor have been corrected, and the general alignment recommendations listed below apply equally well to its bigger brother, the K500. No tests were performed on the new M100, but it may be assumed that the procedure would be similar. To program the K100 beyond its advertised frequency ranges, press the decimal key before entering the desired frequency. Algorithm ranges displayed are approximately 10.19-92.10, 131.1-213.015, and 372.737-576.875 MHz. By careful realignment, the following ranges were actually receivable in our test unit (vco slug inserted): 15.2-53.8, 136.1-174.7, and 387.0-502.5 MHz; (vco slug removed): 20.65-66.14, 141.56-187.0, and 403.2-539.6 MHz. The vco coil is located under the top shielded compartment, toward the front of the cabinet.

After setting the vco slug so that the squelch breaks at the desired upper and lower limits on each band, proceed with the rf alignment.

Rf Alignment

- Monitoring a weak signal from a signal generator set to approximately 45 MHz, peak the two coils located under the fuse for best quieting (maximum signal strength).
- Monitor a signal near 165 MHz and peak the three coils in a line located near the antenna jack. Peak adjacent trimpot near 150 MHz. Alternatively, the trimpot may be peaked near 147 MHz for best 2-meter reception. (Note: High-band tracking is only about 6 MHz wide, factory set for 155-163 MHz, approximately.)
- Locate the two trimmer capacitors adjacent to the open 1-turn coils. These are the UHF trimmers. Tune in a weak signal near either 470 or 492 MHz (whichever is more active in your location). Peak the two trimmer capacitors for best quieting. Locate the shielded trimmer capacitor and peak it for best signal near the *minimum* capacitance setting. Peak the adjacent trimpot near 420 MHz. The alignment steps should be repeated until no improvement is noted.

AM Detection for the K100

Again, as pointed out with the Touch AM modification, this feature is only moderately successful, but if selectable AM is vital, it will work in a pinch.

Connect an SPST switch in series with any convenient capacitance of from .01 to 1 microfarad between pins 3 and 5 of IC301, the i-f chip. When the switch is closed, AM will be detected.

The K500

As received from the factory, one sample K500 showed the following algorithm readouts: 19.600-60.555, 135.100-176.055, and 371.6875-576.475 MHz. The actual extended ranges which would break squelch as factory adjusted were: 19.600-57.0, 137.60-176.055, and 388.1875-513.025 MHz. These ranges may be improved by the same type of alignment procedure as outlined for the K100.

Conclusion

It must be pointed out that these are experimental modifications only and worked with the particular samples of Regency scanners available at the time the improvements were attempted. I can assume no responsibility for the projects of readers nor for damage which may result to circuitry!

It would be a good idea to obtain a factory service manual to verify the procedures outlined above, and for ideas regarding additional modifications later.

The experimental procedures suggested in this article will allow a listener slightly more reception flexibility than originally possible with the factory issued scanners. If any readers come up with additional field modifications (such as an S-meter circuit operated from the audio squelch bus), I would like to hear about them! ■

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Win Friends for Your Club

—PR is the name of the game

Editor's note: If you plan to write a news item or story for *73*, do as we do and not as this article says! Ask us for a copy of our one page "How To Write for *73*."

While we have *edited* this article according to *our* rules of style, the author's recommendations on style are not changed to conform with ours since he writes about styles for most newspapers and radio and TV news desks. Follow his advice and you can't go far wrong.

A two-year public relations plan of a South Texas amateur radio club led to a free place for club meetings and a tower built by college welding students without charge from material donated by an oil field supply company.

The tower was erected with manpower and equipment loaned by a television cable company and the US Navy. Its site was provided by Bee County College.

The Beeville Amateur Radio Club (BARC) pays no electric utility bill or rental at its repeater location.

BARC members have been featured in more than 20 newspaper stories, were cited in a popular column distributed to more than 30 newspapers, and have appeared on three talk-show telecasts on a Corpus Christi television station. They also were subjects of a TV news film feature during a field day, and different television studio photos appeared in the December, 1979, issues of *73* and *QST*.

BARCers have been heard over 10 AM and FM commercial radio stations, have given public demonstrations, and have shown amateur radio films to Rotary and Lions Clubs. This summer they staged their fourth amateur radio class in cooperation with the college and have had public service spots run on radio and television—all without charge. In a city of less than 15,000, they have seen the area's ham population grow to more than 30.

Other clubs likewise can provide needed exposure for amateur radio through a carefully executed public information program which reaps rewards.

BARC's success has been simple: It has applied basic journalistic rules to public information news releases to provide quality news and features about ham radio to electronic and print media. This, coupled with a club aimed toward community service, has led to high visibility of amateur radio with subsequent rewards.

Articles in ham publications over the past several years have accurately stressed the need for enhanced public relations, but few provide step-by-step prescriptions for success.

Since the foundation for solid public relations begins with news and feature stories ("releases") of high quality which will be accepted by any newsroom or city desk with little or no editing, this article will:

- help your club understand the word "news" and give pointers to help clubs recognize what is a genuine *news* story and what is *feature* material;
- provide a few rules of accepted journalistic style;
- show examples of acceptable and incorrect styles; and
- pave a path through the process of writing and preparing the story.

News Is Like Bananas

News is as perishable as bananas. Today's White House statement will be tomorrow's bird-cage bottom. Feature stories, on the other hand, usually have "shelf life" and fit Sunday's feature page or September's supplement. Your first move, and that of fellow club members, is to recognize what is news. You should understand how to tailor that news to the requirements of the publications you send it to.

A club publicity officer should be chosen. He should develop the ability to prepare material harmonious in style with the *Associated Press Stylebook*,[1] considered by most journalists to be the bible of the newspaper profession.

Your local newspaper is the best teaching tool at hand. It can be an excellent "journalism professor," especially if it is a major daily. Grab a copy of it and examine page one. (Using the paper serving your immediate area is important because what is news in "Midtown" is not necessarily news in Manhattan.) With that front page, analyze the stories. Tear them apart and scrutinize individual ingre-

dients. Components will include newness, immediacy, prominence, proximity, suspense, consequence, emotions, and/or oddity.

Get a copy of any Sunday newspaper and examine the features section. You will find stories about hobbies, unusual and unique interests, and personalities. Others may be yarns that include everything from fire prevention to hurricane protection and diet.

Pick a few of the "straight" or "hard" news stories from page one and clip them. Select a feature or two from the Sunday paper, and save both types of stories as patterns for yours.

Recognize that what you do at the club meeting Saturday can be news. Play it all the way with an advance "what's gonna happen Saturday" story and a follow-up "what did happen" piece. An advance story explaining that the local repeater bunch, for instance, will install autopatch rather than have a formal meeting is marketable "hard" news *and* feature material. That club members, for example, are building the autopatch in Joe's garage employing 30 key-thumpers from all walks of life could give the story the "feature" or "human interest" angle needed to unload your yarn at the city desk.

Nobody but a ham gives a hoot in hell about ICs, capacitors, and other miscellanea of the autopatch, but readers do need to know what a repeater means to them and how the autopatch serves in emergencies. They will be amazed that a walkie-talkie can call a telephone 15 miles away when their $350 CB won't reach a "good buddy" down at the pool hall.

This gathering in Joe's garage may also be worth a high quality photograph—in black and white, precisely focused, accurately exposed, well-planned, artistically composed, and expertly printed. A picture of the whole mob, beer cans and all, staring at a nervously-held Instamatic is not news. A penetrating closeup of a 13-year-old ham feeding solder to the gun tip mastered by the retired physician can be featured on the front page.

Good news or feature photography tells much of the story without words, although news and feature shots are supported by written captions under them, called "cutlines." The *best* photojournalism, however, could stand alone.

In addition to ensuring that the photograph is technically tops, remember that newspapers have limited space. Their incomes are from advertising and every word or picture is "worked around" the dollar, which is valuable space. A group picture of the beer-belly bunch consumes at least three columns of costly space to get every grinning, yawning, shut-eyed mug. The suggested "tight" closeup, preferably shot vertically, ideally will be a two-column shot, but might even fit in one. Sure, it would be great to have three or four columns, but one top-grade photo will find its way to publication when a dozen "handshaking, certificate-passing" shots won't stand a chance.

A wide angle 24mm or 28mm lens on a 35mm single-lens reflex and a perspective approach can help. Outstanding examples of ageless photojournalism of the highest quality can be seen in any old copy of *Life*. Good photographers crawl in holes, bear blizzards, scale towers, and wallow in leech-infested swamps, if necessary, for that different, unusual angle. Look for the view that snatches reader attention. Don't underestimate the impact of a fine photo to "sell" your story.

Thirty bucks or so out of the club treasury for a professional photographer is worthwhile if your group can't tap a member or friend with a high-quality camera and a trained eye. Newspaper photogs don't earn much money, and most will freelance. Not only will you get a quality shot from them, but newspapers like to run their own stuff.

Snappy 8 × 10 glossy prints are preferred by most papers, and that size grabs the green-eyeshade gang's attention much quicker than your local drugstore snapshot that looks as though it were developed along with your teenager's socks in Monday's laundry.

A photo isn't always called for, and there are many other opportunities for news or feature releases even if your club isn't meeting in Joe's garage. Story suggestions include the following:

- Advance story on election of officers; post-meeting story on who was elected.
- Advance stories on all club meetings—where they will be held, when, and why.
- Advance stories on all fund-raising activities and what the income will be used for; follow-up on how much was raised and how it will be used.
- Features or "brites" on unusual contacts: A chat with VR6TC, citing his relationship to the *HMS Bounty*, ties in history and adds color to your hobby. A conversation with any "rare" or famous station is good for at least a few lines (and maybe a photo) in Sunday's paper.
- Every field day should be covered photographically and in writing. This calls for

an advance piece and after-the-fact article.

● A transmitter hunt should be shark bait to the TV crews—fine feature material on film and for the newspaper.

● Swapfests will bring in droves of camera crews if details of the event are given advance notice through releases.

● Any public service activity or adventure should be given top publicity.

● How the club is prepared for emergencies is both "hard" news and feature material.

● Personalties of club members, age differences, and husband and wife teams are usually good human interest material. Don't overlook the possibility that a prominent banker, politician, police chief, or preacher may be in your midst. A feature highlighting "prominence" will "sell."

● The fact that you sold a piece to *73* is worth a photo for most hometown papers. For the photo, stick the magazine way out in front—at arm's length—and the photographer, using an ultrawide lens, will make the magazine look six feet long and your grin three feet across.

● Ham radio lends itself to public demonstrations at fairs, school career days, and conventions. Give it everything—pictures, stories, and mailed invitations.

● Handicapped persons often overcome significant odds to get on the air. If they are willing, a yarn about their FCC test preparation and subsequent operation is photo and feature meat.

● RACES, MARS, or other such operations warrant stories and photos. While "Midtown" is sweating in a 100-degree heat wave, tantalize the TV crew through an icy chat with the Navy's "Operation Deep Freeze" hams.

● Don't ever skip the "kiddie angle." Newspapers love shots and stories with curtain climbers, whether it's the elementary school science demonstration or 6-year-old Tammy getting her ticket.

● Have you built any unusual gear, like a device to help the sightless ham tune his rig? Maybe you've built a radio-controlled combination bird-feeder, dog-walker, and can-opener. Anything unusual will stimulate the city editor to peer seriously over his half-frame specs.

● If you've scheduled a talk for a civic club, give the news media advance notice. TV crews or a newspaper reporter might even show up and cover the story for you.

● Plenty of publicity can be generated for and as a result of ham radio classes. This is one of your better opportunities for spreading the word. Interested? Call the community education department at your nearby educational institution. They'll likely help you get the thing kicked off and give support with lesson plans, equipment, classroom space, and publicity.

Recognize Elements of News

Let's inspect the autopatch project in Joe's garage and see how this is news *and* feature material.

Immediacy or "nowness" is present in that a ham radio meeting Saturday is focused on building and installing a new device, called an autopatch, which can benefit the community. Because hometowners can relate to disasters such as earthquakes, floods, hurricanes, or tornadoes, this brings the value of emergency repeater power and autopatch "home." That's the proximity of the news—how it affects readers.

The element of "oddity" or the unusual quality of your information is exemplified by the youngster and the senior citizen bound in friendship through a common thread—their hobby.

Additional elements may combine to form the basics of your release. Perhaps the club president is mayor, city manager, police chief, bank president, or brain surgeon. The fact that it's the mayor who is calling Moscow makes news. That's "prominence."

"Consequence," sometimes allied with "proximity," is readers seeing results of reliable repeater operation during a disaster. Examples should be cited to drive home that point in your autopatch feature.

If you've ever climbed a tower, there also can be "suspense" for the news. It takes imagination, but a tower-climber's tale could be done suspensefully. If your club joins a search effort or pitches in during a rescue, there's clearly the element of suspense, and also emotion, to amplify in your story.

Use Accepted Style

This aspect of producing your news release is vital to success. Editors have neither the time nor the patience to rewrite your submission. If it isn't up to acceptable standards, it probably will wind up in the circular file (or even worse, may be assigned to the library reporter, Miss Elmira Furd, who will get all the facts screwed around, calling your club the local CB REACT team transmitting VHFs around impressionable children).

After you've grasped the basics of news elements, it's time to organize that news in an acceptable journalistic format, in step with the *Stylebook*.

There are three pieces of gear any successful newswriter should have: a good dictionary, a clean-printing typewriter, and a stylebook. Although stylebooks are necessary for serious writers, the club publicity officer—if he is slightly sharper than a wet Kleenex—can put that "old professor," the newspaper, to work for the same effect.

Unlike writing for English grades when in high school or college, newswriting requires that you write for others. Gobbledygook and ham radio jargon are synonymous to the average reader. He doesn't give a diddly-damn about QRZs, QRXs, beams, baluns, and bands. What he is concerned about is himself, his health, his well-being, and the happiness of his family and friends. He can comprehend the importance of emergency power making communication possible in the aftermath of Camille, Carla, Beulah, Dandy-Don, or whatever the last big storm was called.

When a repeater is compared in operation with that of police radio, the reader understands how important that tool is to his family during trouble. Because it operates at VHF frequencies, narrowband FM, into a Ringo Ranger at 500 feet using Phelps-Dodge duplexers feeding one and seven-eighths-inch Heliax, concerns him no more than the emotional impact of the price fluctuation of cotton on sharecroppers in southern Alabama during Christmas, 1891.

With a newspaper as a guide, examine those stories on the front page—car wrecks, city council meetings, international news, and political news. Interwoven throughout each are answers to the inescapable five "Ws" and the "H."

Who? What? Where? When? Why? and How?

Those must be answered fast in a "straight" news story. It's called the "in-

verted pyramid," and it means "Hit 'em with the big facts first and follow down the story, bang, bang, bang, in a descending order of importance."

Put yourself in the reader's place and sift through your notes for what will be most important to *him*. That goes in your first or "lead" paragraph. It's not like writing a novel. It's not like writing for *73*, and it sure as hell isn't *Penthouse*. An acceptable six paragraphs for a "straight" or "hard" news approach to the weekend autopatch story follow:

> Members of the Midtown Amateur Radio Club Saturday will install a communication device which can save lives if another hurricane strikes.
>
> John J. Jones, city police chief and amateur radio operator, explained that his club "will build a gizmo called an autopatch that will allow hams in an emergency to call any telephone from walkie-talkies."
>
> "The beautiful thing about it," Jones added, "is that the whole repeater and autopatch system is totally independent of electrical power from the utility company and can operate at least three days on storage batteries."
>
> Jones explained: "The autopatch hooks the repeater automatically to telephone lines, but telephone lines are not needed for basic repeater operation. It's an added extra. We can call telephones or other hams on radios with the system."
>
> Midtown's police chief also pointed out that the "repeater system is a relay transmitter and receiver that extends the range of small hand-held or mobile radios."
>
> Jones said hams will be the only Midtowners with the capability to either call telephones from walkie-talkies or talk to highway patrol headquarters if power fails.

The typical story would continue, building on a few more details, explaining that the equipment was built by club members, their possible affiliation with RACES, and other details of interest to readers. The final paragraph might list club officers and tell where and when the organization meets and whether or not the public is welcome.

That "straight" news beginning would be the "before the fact" story submitted to electronic and print media. If no reporters or camera crews show up at Joe's garage, then the publicity officer's next move is to prepare a feature story about the event. An example of the first few paragraphs of such a feature follow:

> A 13-year-old from Crockett Junior High

Bill W. Smith
Public Information Officer
Midtown Amateur Radio Club
P.O. Box 9282
Midtown, TX 70260

(EVENT IS SATURDAY, MAY 10, 1980)

(FOR IMMEDIATE RELEASE)

Members of the Midtown Amateur Radio Club will elect officers Saturday and afterward will tour computer facilities of a company with world-wide operations.

John J. Jones, club president, stressed: "All members should attend. We will serve coffee and doughnuts and following our election, we will drive to Media, Inc., for a demonstration of their Hewlett-Packard 3000 computer."

Media, Inc., an industrial microfilming organization, maintains its computer at 30 East Harbor St.

Jones, city police chief and a ham radio operator, said the club's 60-member organization operates two different radio repeater stations in Midtown, giving hams communication coverage throughout the county.

Jones explained that repeaters, which are relay devices, extend range of low-powered mobile and walkie-talkie radios "making amateur radio operators tremendously valuable to Midtown during an emergency."

The local group meets the second Saturday every month beginning at 10 a.m. in the police commissioner's conference room at City Hall, 3322 Washington St.

Club meetings are open to the public, Jones said.

####

5/5/80

(FOR FURTHER INFORMATION: CALL BILL SMITH AT 664-2981)

A press release prepared like this will likely see print. Every club working for enhanced public relations can ensure that amateur radio frequencies remain dedicated to public service and not commercial interests.

School and retired surgeon Dr. Nicholas Barnhardt joined forces Saturday in a neighbor's garage where their 60-year age difference dissolved in a plan to save lives.

Barnhardt's "scalpel" was a soldering iron and his "assistant," Jody Merriman, put wrinkles in his freckled seventh-grade face as he helped the doctor design and build an "autopatch."

This "patch" won't splint a bone or suture a cut, but it will help heal broken lines of commercial communication during hurricane season.

Barnhardt, who retired from surgical practice last year, and Merriman, son of Mr. and Mrs. Frank J. Merriman, 620 Los Altos, share a common bond —a tie they have with a king, a senator, a Florida blonde, a Texas farmer, and nearly a million others worldwide.

Now that you have had a dose of precisely what makes hard news and how features differ in approach, let's examine some rules:

- Avoid personal pronouns. I, me, my, your, and our are not used at all in newswriting and seldom in feature stories except in direct quotes. [*And, also, except in 73!—Ed.*]
- Omit needless words. Keep sentences and paragraphs short. Write simply, clearly, concisely.
- Avoid ham radio jargon. If it must be used, explain it in simple terms.
- Avoid unnecessary capitals. Capitalize titles before names. Lowercase titles are used alone or when set off from a name by commas. Examples:

John J. Jones, president of the Midtown Amateur Radio Club, said, "Jody's assistance was invaluable in the system's design."

Midtown Police Chief John Jones today explained the benefits of amateur radio.

Midtown's police chief said today, "Ham radio classes start Monday at 7 p.m. at the college."

The words "ham radio" and "amateur radio" are lowercase except when preceded by a proper club name or used in FCC terminology: "Hams operate under rules and regulations of the FCC's Amateur Radio Service."

- President Carter "stated." Nearly everybody else "said," "explained," "pointed out," "asked," "added," "complained," "stressed," or "emphasized." Use them naturally. "Said the senator" is *Time Magazine's* own style and it isn't seen in most newspapers. Rather, use: "Jones said," "Jones emphasized," "Jones stressed," "he said," "the chief explained."
- Avoid use of "Mr." before names. John J. Jones, *not* Mr. John J. Jones. It is, however, correct to write: Mr. and Mrs. John Jones or John and Evelyn Jones. If both husband and wife are later cited, he becomes "Jones" and she is either Mrs. Jones or Ms. Jones, if she prefers. Tantalizing teenager Tammy Jones becomes Miss Jones or Ms. Jones, and brat Jimmy is just another "Jones."
- Avoid use of first names after initial introduction. John J. Jones becomes "Jones," not "John."
- MDs, DOs, ODs, DVMs, PhDs, EdDs, DDs, DDSs, and other doctorally-titled men and women are granted that title only once in a news story. Use it with their names only in first reference. They then become "Jones" or "Smith" like everyone else. They may be called "the physician," "the surgeon," "the dentist," "the optometrist," or, in limited cases, "the doctor," but not "Dr. Jones" after first use and never "Doctor Jones."
- Do not use qualifiers unless directly quoted. Qualifiers include very, pretty, good, bad, best, worst, finest, sharpest, rather, sort of, kind of. Certain usages in features are excepted, but avoid them for news.
- *Do not editorialize!* Opinion is left to the editorial page. Opinion in news should be only in the form of a direct quotation. Don't even *think* about using opinion when writing a news story. Anything even vaguely approaching the writer's opinion must be fully substantiated by quotations taken from the subject. Following are some opinions that give editors ulcers:

Ham radio is the only way to fly.
Ham radio is a fun hobby.
Ham radio is a blast.
A good time was had by all.
A cordial invitation is extended.
Come one, come all.
We all had a ball.
It is the best group of guys and gals in town.
Try it; you'll like it.

However, it would be acceptable to quote someone on such opinion. Examples:

In comparing CB to ham radio, Jones said: "It's like trying to compare a kite to a Boeing 747. The jet will get you there, but the kite only flops in the breeze. Ham radio is the only way to fly."

Jones, inviting the public to the next meeting, said, "We have a ball. Come one, come all, and meet the best group of guys and gals in town."

- Use of numbers: Spell out numbers under 10 except when used with dates, times, addresses, or telephone numbers. Numbers over nine are written in figures except at the beginning of a sentence. Consult your stylebook for further exceptions.
- Use of dates: Abbreviate Jan., Feb., Aug., Sept., Oct., Nov., and Dec. when used as dates. Spell them out when used as words. If the event occurs within the week, use day of the week and *not* the month. Don't abbreviate days of the week. If the event is more than seven days distant, use the date but not the year. Examples: "Nov. 8 is the deadline for application," "Midtown hams will stage their annual talent show in November," "The club meets Saturday."
- Avoid clichés.
- Leave ornamental decoration and glitter on the Christmas tree. Remember, your writing is not to impress anyone with verbosity or intellect, but to promote amateur radio. Mushy writing isn't good news.
- Memorize news deadlines at your newspaper and radio and television stations and observe them. If you expect a camera crew from the television station, they must have plenty of advance notice through your release. Call them a few hours before the event as a *gentle* reminder, but in no case should you lead them to believe that you expect or demand their appearance. Don't think your feature on Joe's garage dropped off at the newspaper's city desk late Saturday afternoon will make the Sunday feature page. It won't. Whatever media deadlines are, respect them as you would a wet bobcat found in your VW glovebox.

● NEVER tell a television news director, reporter, or newspaper editor how to run his business. *Never.* Don't tell the editor where or when you believe the story should appear. Leave your item, thank him, and get out of the way. Never walk in complaining "Why didn't my piece about plate dissipation on 811s get in Sunday?" However, when a story is run—and it won't be about 811s—call the editor or news director with sincere thanks.

● To stretch truth with news media personnel will end up stretching the club's collective neck. If any club members are yearning for lobotomies by running about the countryside shooting up garbage cans, wagging shotguns, slashing tires, planting jamming devices, and sending psychotic notes of threats to other repeater groups, help investigative reporters and law-enforcement officials uncover the slime. That earns respect and flushes sewage. If the club is ever guilty of a cover-up or information manipulation, move. Tomorrow. To Adak.

● Do establish friendly relations with CB radio clubs and try not to blast them in your stories. The comparison of a Boeing 747 and the kite that I made earlier is a bit harsh for public consumption. Explain clearly the differences in the two modes of communication and downplay negative aspects. Work with the REACT team and you will gain new hams. Invite them to your meetings and show, through example, "how to fly."

● Do include radio news directors in your distribution of releases. Electronic media writing styles are slightly different, but they will use your release to prepare their copy.

● Meet management at the local radio and television stations and make plans for public service spots. What hams do for public service is gravy for those responsible for meeting the federal requirements that stations provide a certain amount of public service programming. Tag the photographer for some brilliant slides. With management, explain the relationship of your hobby to their mission of public service. That means free publicity for ham radio classes and other benefits. (The ARRL has available without charge some 16mm color film spots, in sound, and taped radio announcements.)

After understanding the basic rules, plop down at your typewriter and hack away. A final draft of your release should be double-spaced, grammatically precise, error-free, and immaculately typed. See the box for an example.

If all this seems like too much trouble, think about that free space at 500 feet on your local TV station tower, and maybe some free "slave" labor headed by the station engineer to rig it. Or, maybe your club needs a rent-free place for meetings or help with electric bills for the repeater and club station. Perhaps your organization would benefit by county- or city-paid telephone bills, or first choice in sifting through surplus at the next sale.

Or, of course, you can forget about it all and let 10m, 15m, 20m, 40m, 75m, 160m, or 220 go to commercial interests.

Don't say it'll never happen. Eleven meters once was a ham hangout. Remember? ■

Reference

1. *The Associated Press Stylebook* (New York: The Associated Press, 1977).

73 Magazine Staff

Field Strength for Free

— a home-brew conversion

Probably many amateurs have old VOMs that have outlived their usefulness or have been replaced by better test equipment. In our case, a ten-year-old Japanese VOM was starting to develop all sorts of problems—a switch that was activated when the pin tip from a test lead was inserted in the Ohms jack made erratic contact, resulting in false resistance readings, jacks on various other functions were worn out, and two current ranges were burned out. The VOM had a good meter movement and case, however, so rather than simply discard it, we turned it into a very handy and sensitive field-strength meter.

Undoubtedly, the same can be done with many other VOMs at minimum or no cost using junk-box parts. One can end up with quite an attractive looking instrument, as good as the one shown in the photograph of the front of the converted VOM.

In the case of this VOM, there was a series of pin jacks running vertically on both sides and along the bottom of the space below the meter. These were covered up with a piece of Lexan (the black, wrinkle-finish material seen in the photograph) and the pin jack holes used with 6-32 hardware to hold the material in place. Of course, any sort of attractive plastic or metal can be used as a covering plate. The miniature on/off switch for the amplifier circuit incorporated in the field-strength meter is shown in the center of the plate. You can also just discern (on the right side) the knob for a sensitivity control.

The instrument's meter originally had the usual VOM scales. However, the scales were on a plate which could be unscrewed and turned around to reveal a black surface. This surface was painted gray and the numbers shown were placed on it using a rub-on lettering/numbering transfer sheet. The method of dressing up an old VOM will vary with the instrument involved, but with a bit of imagination one usually can find a method that will result in a new-looking instrument rather than one which is a reminder of a discarded VOM.

The VOM had a 250-μA movement, so it was al-

Photo A. The front of the VOM as it originally appeared. It still looks good, but electrically it was falling apart.

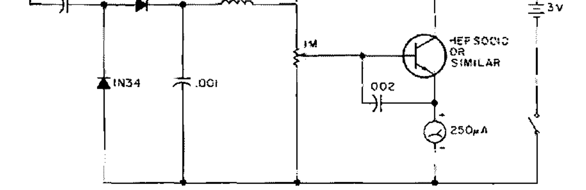

Fig. 1. Broadband voltage-doubler/rectifier and dc amplifier used in the converted VOM.

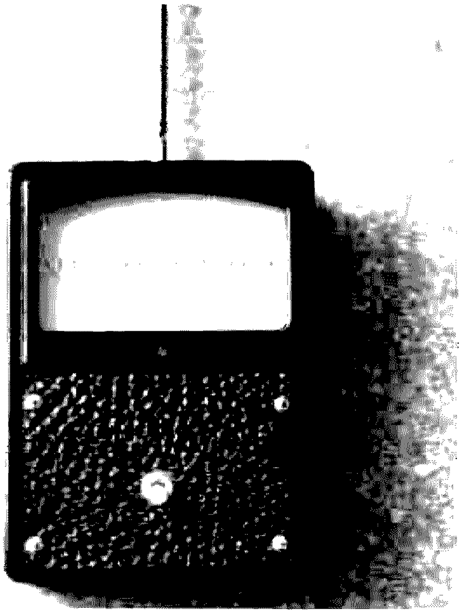

Photo B. *Front of the converted VOM.*

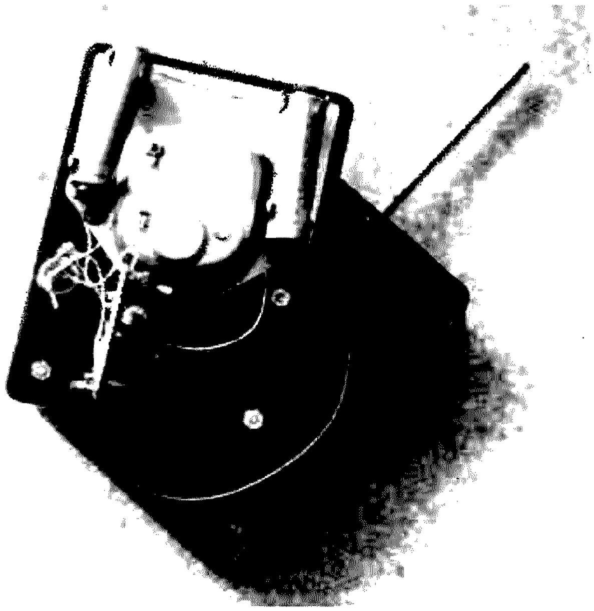

Photo C. The VOM removed from its case, showing the placement of the dc amplifier. The battery holders are the original ones.

ready reasonably sensitive. However, it was decided to add the simple dc amplifier stage shown in Fig. 1 to increase the sensitivity. In this circuit, the diodes are arranged in a voltage-doubling circuit to develop a dc voltage to drive the amplifier stage. The meter is placed in the emitter lead, so even if the battery is open the meter will still function as a simple, non-amplified field-strength meter. Using a small telescoping antenna, the meter would easily indicate rf from low-powered transmitters up to 144 MHz.

One may prefer other dc amplifier circuits, depending on the sensitivity of the meter in a VOM and perhaps the battery voltage in a VOM (since the battery-mounting clips can be retained for use). Fig. 2 shows two very useful circuits. The FET circuit requires a 9-volt battery, but is quite good when a meter movement with only modest sensitivity is available. It will convert a 0-1-mA movement into the equivalent of a 0-2-μA movement. The 1k-Ohm "zero set" potentiometer need be only a trim type mounted internally since it will not require frequent adjustment.

The bipolar transistor circuit has the advantage that only a single 1.5-volt battery is necessary for operation. Again, the "zero set" control need be only an internally-mounted trim potentiometer.

The sensitivity of any field-strength meter can be still further greatly increased if a simple parallel resonant circuit is placed at its input. A suitable circuit for the HF bands also is shown in Fig. 2.

The photograph of the field-strength meter removed from its case shows the internal wiring. The batteries mount in their original clips, and the amplifier components mount on a small piece of perfboard. The on/off switch is seen to the right of the board and a miniature potentiometer for a sensitivity control is seen to the left of the board. The board is held in place simply by the stiff wiring to the switch and potentiometer. The telescoping antenna, which is a simple portable radio replacement type, is mounted in the top of the case using shoulder washers for insulation. However, one could just as well mount a binding post in the case and use a short wire antenna.

This article has presented just one realization of an idea. Many more will probably occur to the reader. So, don't throw away those old VOMs. Convert them and have a field-strength meter as good as or better than any of the commercial units in the $15 range. ■

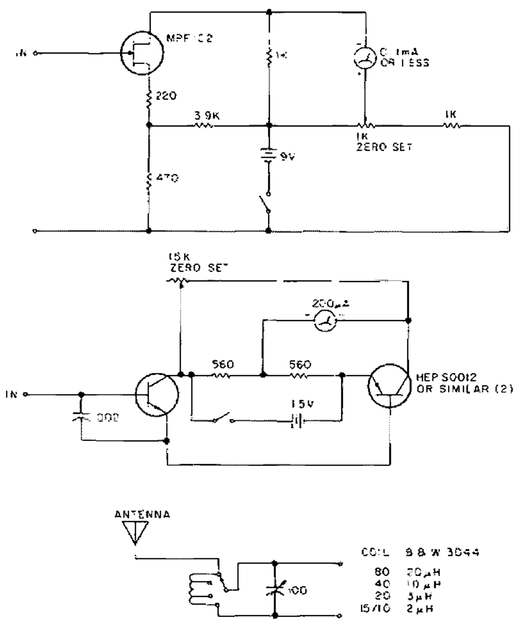

Fig. 2. Two other useful dc amplifier circuits which could be used following the 1-meg potentiometer shown in Fig. 1. Also shown is a simple tuned circuit for the HF bands which would further increase the sensitivity of the field-strength meter.

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5611 Middaugh Avenue
Downers Grove IL 60515

The QRM Killer

—antenna alternative for 40

Like many people, I have a special problem. While I dearly love amateur radio, my actual operating time is quite limited. Having a busy young family with varied interests, I find that it is usually quite late in the evening by the time things settle down. My job demands that I rise no later than 6:00 am during the workweek, so any hamming I do usually occurs somewhere between 9:30 and 11:00 pm. (I should add that this is further complicated by the fact that I have come to enjoy 40-meter phone operation. Have you ever tried to work the General portion of 40 phone late in the evening?)

The following is a list of common problems I'm sure that many of you can identify with:

● Only 75 kHz is available (7.225-7.300 MHz) in the General portion of the 40-meter band, and it appears that the entire ham population in America wants to operate there in the late evening.

● Foreign broadcast stations mysteriously appear (seemingly out of nowhere) all evening long, usually right after I think I've found a spot clear enough to get a CQ through. These stations also have the temerity to use AM, which is all but uncopyable on most SSB transceivers—so I often don't even know who they are. Generally, however, they tend to wait until I have engaged some unfortunate in a QSO before they fire up on frequency.

● High ambient rf noise level seems to intensify as the evening proceeds. For example, it might be an S6 level at the start and then various QRM levels may combine to bring this to an S9 within a few hours or so. I should add that I am basically vertically polarized, so this may act to compound the problem somewhat.

● QRM is compounded by those who can't hear me (or anyone else) on the frequency because they, too, have trouble hearing much of anything in the evening.

● I've tried more power, such as provided by a linear, and it solves nothing. The problem is in reception.

● I haven't the desire or space to erect wire beams that are switchable in all directions. Besides, I would never be able to get them high enough to realize their full potential. (Even a fraction of a wavelength at 40 meters is big!)

A few points may be worth mentioning here because they are probably not unique to my situation: First, the high QRM level is hard to combat—period. Second, the Q5 QSO problem cannot be solved with a linear. Third, and most important, it is necessary to appreciate the fact that the yagi beam (or something comparable) will not solve the problem either. Why? Well, on 40 meters in the evening, we are not exactly facing a traditional type of problem. As a result, simplistic solutions won't work. To illustrate:

● A few weeks ago, using split-frequency operation, I worked two Italian stations in succession on 40-meter phone. One gave me an S9, the other an S7. I copied both Q5 because they were in the clear. The message was gratifying for someone like me who normally has trouble holding a Q5 QSO with either American coast. QRM is clearly the problem. I certainly don't need more power or a beam in order to be heard or to hear anyone else, if I have a clear frequency.

● If I switch from a vertical to a horizontal antenna on receive, sometimes a complete transformation results

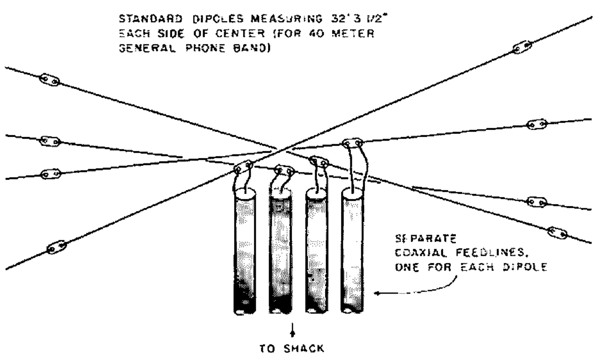

Fig. 1. The basic principle for the QRM Killer evolved from this simple matrixing of crossed dipoles.

—depending upon where the station is that I'm listening to. He could go from Q2-3 to Q5 because of an improved signal-to-noise ratio.

Short Antennas

Much has been written lately about short antennas for the low bands. However, you must build entirely new antennas and the tuning can be difficult. Top hats are also most peculiar-looking. I cannot, somehow, picture my XYL seated under a top-hat umbrella (as depicted in a recent article on short antennas). In addition, I am convinced that I need antenna help primarily for receive.

Why go through an elaborate antenna investment just to solve what is basically a receive problem? What can short antennas accomplish on receive? Well, judging by the latest Sony and Panasonic double- and triple-conversion, battery-powered, allband portable receivers—plenty. (I copied the Italian station mentioned earlier on a Sony that my XYL got me for Christmas. But get this: I received them on the Sony's built-in one-foot telescoping antenna while underground in my basement ham shack. Their signals were every bit as good as they were on my transceiver, which was hooked to a outdoor hamband antenna.)

Clearly, receivers (including transceivers) have more gain than they need on the low frequencies, so antenna gain itself is not necessary. This is not the case on VHF or on 10 meters, where beams do perform a needed service.

What this does tell us, however, is that short antennas—perhaps those that can be rotated—could be a practical consideration on 40 meters. You might not want to transmit on them, but they certainly might improve the receive situation in the evening.

Here are a few practical considerations:

- While helically-wound elements can "shorten" antenna size on 40, they may not be necessary if we're not planning to load up with rf.
- Element spacing, necessary to achieve directivity and front-to-back ratio, cannot be shortened. So, what good are one-foot elements if we must space them 15 feet apart?
- If a short vertical antenna is constructed, what's the advantage? We still have a vertical, with no directivity, no front-to-back ratio, and no signal-to-noise improvement—probably a degradation.

But, what about a short dipole? The more I thought about this, the more possibilities came to mind.

The Progression

Like tens of thousands of amateurs today, I use a multi-band commercial vertical. Mine is a roof-mounted Hy-Gain 14AVQ-WB which has the minimum number of radials required (2 for each band) per the manufacturer's recommendations. Operationally, it actually performs as a ground plane when elevated in this manner.

On 40 meters, the radiating element is about one-eighth of a wavelength; the radials, however, are a full quarter of a wavelength.

I have experienced exceptionally good luck with this very simple antenna system. After much study, I feel there are two reasons for this:

1) The antenna height is almost exactly one quarter of a wavelength on 40 meters.

2) All radials are elevated above the roof.

With these points in mind, let's go back and see if such a system can solve our basic problem.

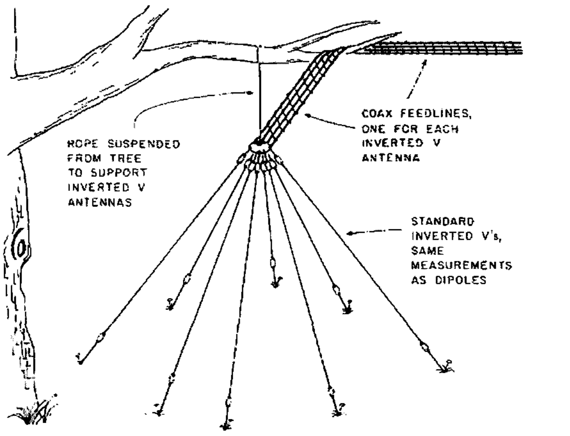

Fig. 2. More appropriate for most hams—at least those who use 40 meters—might be this crossed system of inverted vees. (Notice how this resembles most rooftop vertical radial systems.)

If a dipole, even a short receive dipole (as contrasted with the vertical), could possibly solve the 40-meter QRM problem, a switchable dipole array might also afford the directivity necessary to null out unwanted signals (see Fig. 1).

This idea has its drawbacks, however. First, it would mean that I must install another antenna system in the trees. Second, it would take up a lot of space, especially if I were to go full size with the elements, although that might not be necessary.

A variation of this, though, would be the same principle used in an inverted-vee fashion (see Fig. 2). This might be somewhat easier to erect, but could run the risk—depending upon apex angles—of functioning as a vertically-polarized array. Either system holds potential, especially in short-element configurations.

What about interaction between the dipoles? What would happen if we could select one dipole and ground all unused dipoles? This concept of grounding unused elements is an interesting one and, as far as I know, has not yet been fully explored. It holds some fascinating potential in the areas of pattern changes, broadbanding effects, and general quieting.

Take another look at Fig. 2. What does it resemble? Right—the radial system of a roof-mounted vertical.

Notice how easily we have progressed to the central idea: Why not work up a system that will selectively activate a portion of a radial system, converting it to dipole operation while leaving the remaining radials functioning as is, and feed this dipole through a separate coaxial line for receive? It wouldn't have to work exactly like that, but the central idea seems to be well worth exploring.

Results

Let me disgress a moment and summarize what has happened since this idea first struck. At first I looked far and wide to find someone who had tried it, to no avail. Second, I reviewed every antenna article I could find published over the last 20 years and could find nothing on this approach. So, I resigned myself to having to actually construct something and give it a try.

I have conducted a series of tests on the air, and the results are extremely en-

couraging and worth reporting. In my ham shack I now have a remote-control unit which will select any given radial on the roof, remove it from the antenna circuit, convert it to a dipole, and allow me to use it as a receive antenna. Here's a summary of how it operates:

- Surprisingly, I find I can load the selected radial/dipole on transmit as well. Only one radial/dipole presents an swr change from the basic 1:1 of the vertical, and that one only presents 1.24:1.
- The basic unit *does* solve the receive problem that has plagued me for years now. I can pull any signal out of the noise/QRM by "rotating" the system until I hit the optimum antenna.
- No receive preamplifier is necessary, even though several radials are cut for other frequencies.
- So far, I have not lost one QSO! I can copy everything!
- Noise level is reduced considerably. For example, if one examines the ratio of noise level to overall signal strength when comparing the old vertical with the new system, the results are shown in Table 1.
- It is possible to null foreign broadcast QRM. In all cases, I've been able to lift the desired station above the foreign broadcast QRM level.
- In 40% of the cases, my own signal report goes up one to two S-units when I transmit over the radial/dipole, in contrast to the vertical. This difference diminishes with distance, of course, as the vertical continues to excel over DX hauls.
- If I call CQ and several stations reply, I now find myself eager and able to select the weakest signal respondent for the QSO. I'm finding a whole new world of DX and QRP people out there who were probably there all along—but I simply couldn't hear them.

Call	Vertical Q factor	Percent of noise	New Q factor	New Percent of noise
WB8CHJ	Q4	60%	Q5	20%
KA3AVP	Q4	50%	Q5	15%
K2ZTL	Q3	70%	Q5	20%
K3VK	Q2-3	60-75%	Q5	25%
W9UPV	Q4-5	40-50%	Q5	10%
K9HW/Ø	Q1	98%	Q5	20%

Table 1.

Now, I don't want to mislead anyone into thinking that this system eliminates all 40-meter evening-hour difficulties. It does not. It does, however, solve more problems in this area than anything else I've ever seen.

So far, everyone I've spoken with has requested (over the air) a detailed explanation of the system and how it works. I've found that this is not the best way to disseminate the information. It takes too much time and reaches too few people. This article will, hopefully, inform a large enough audience and spark other experiments in this direction. Most conversations, once I've explained the system, usually end with the other station saying, "How simple. I wonder why no one has done it before?" I have the same question myself!

Other Benefits

Aside from performance, there are several other benefits to be derived from this configuration:

1) No "new" antenna(s) must be constructed.

2) The switching unit is not ugly and, thus, no new neighborhood eyesore is created.

3) It is incredibly easy to construct.

4) It can be expanded easily, so that additional radials/dipoles can be added if desired.

5) It is quite inexpensive to put together as all parts are readily available from either a junk box, hamfest flea markets, ham parts dealers, or your local Radio Shack or Olson Radio outlet.

6) It will work almost as well on other bands as on 40 meters.

I honestly feel you'll enjoy building something that, until now, has not been done and is not yet commercially available. This means you'll be able to configure the design for your own particular requirements and be able to completely baffle others who will be wondering how you are suddenly able to do so much better.

How It Works

While this may not be the most effective example of the principle, the unit I constructed functions quite simply.

Each radial on the vertical is disconnected from the antenna, and an insulator is inserted as close to the original tie point as possible.

Next, a short jumper wire is affixed to the radial, which then is connected to a relay at the antenna. The relay, unless activated, grounds the radial back to the antenna. In this fashion, the vertical performs as usual unless a relay is turned on.

Two radials, opposite each other, tie to a single

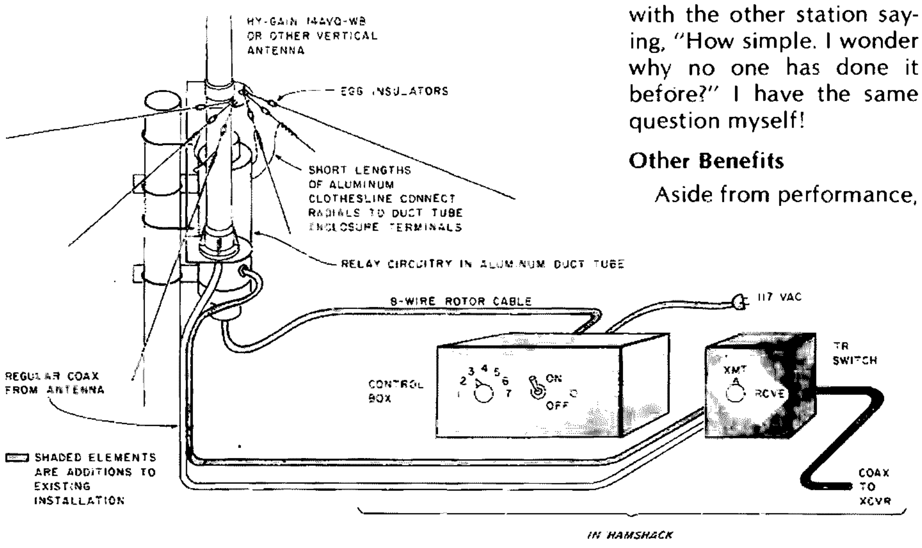

Fig. 3. Overall view (not drawn to scale) of the QRM Killer system, composed of the existing rooftop vertical, the adapter box attached to the antenna, a new feedline and length of rotor cable, and the control box at the ham shack. In operation, the radials/dipoles are steered remotely from the shack. Relays in the adapter unit on the roof select any given radial pair, disconnect them from the overall antenna, and re-configure them into an active-dipole antenna.

relay (I used a 3PDT type). When the relay is turned on, both radials are removed from the vertical antenna ground circuit and connected, instead, to a separate (new) coaxial line feeding down to the shack. One of the two radials is connected through the relay to the shield of the coax, the opposite radial to the center conductor. The effect realized is a sloping dipole, with the angle depending solely on your own particular rooftop.

I find that fascinating effects can be realized by the interaction which results from the fact that the existing design leaves all deactivated radials still functioning as radials. Similarly, by selectively removing the activated radial pair from the system when using the vertical in its normal state, interesting things happen to the otherwise normal omnidirectional vertical pattern. It is entirely possible, I'm finding, to actually improve transmit effectiveness by eliminating a particular radial pair, depending on where the other station is located.

How does this thing work? I'm not completely sure myself. From an equipment standpoint, my system uses a standard 8-wire rotor cable to interconnect the antenna-mounted relay bank with the remote-control switcher in the basement ham shack. There, a single-pole rotary switch fires a transformer-reduced (to 6 V ac) current to the desired rooftop relay. When the transformer unit is switched off, the entire system shuts down and the vertical system operates as usual.

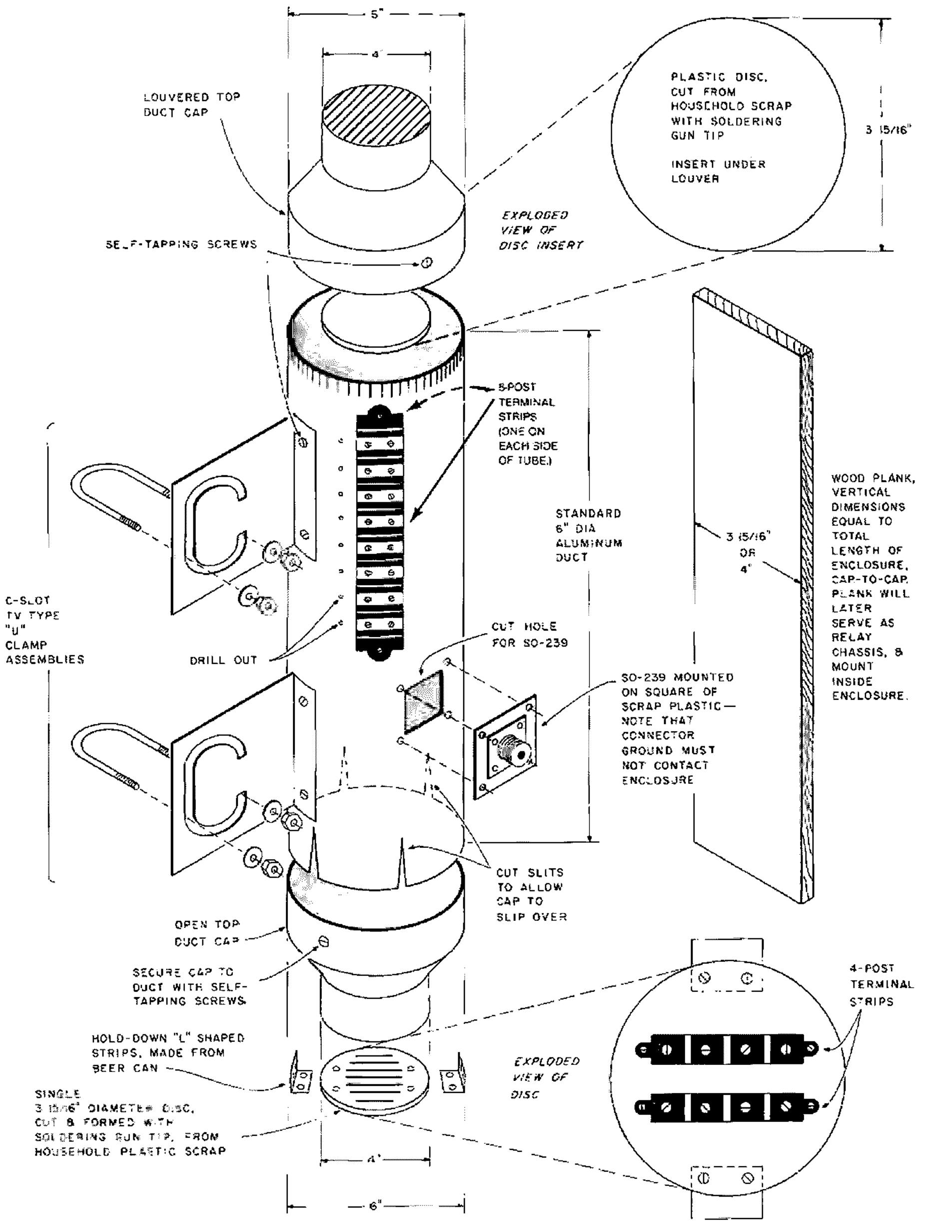

Fig. 4. Detail of the rooftop enclosure, fashioned from standard small-diameter aluminum duct work, available at any hardware store.

Construction: The Enclosure

While I can now think of a multitude of other and perhaps better ways to operate this system, let me first discuss exactly what I constructed. If you wish to follow the approach I used, at least you can be assured that it won't cost you very much for parts. (Later, we'll discuss practical variations, including one that I have added to my own unit.)

I suggest that the first item you obtain should be the enclosure. (I failed to do this myself and ended up doing some rewiring that otherwise would not have been necessary.)

For the primary rooftop enclosure, I wanted something that could be readily mounted at the antenna itself and as close to the radials as possible in order to eliminate long leads that might otherwise alter resonant frequencies. I wanted it to be made of aluminum, easily weatherproofed, easy to get inside of if necessary, and capable of circuit expansion later, if so desired.

My only other consideration was that it should be vertical, to complement the existing 14 AVQ-WB antenna from a visual standpoint. The perfect solution for this was found just around the corner at the neighborhood hardware store—heat ducting.

What I obtained was just the ticket and ended up only costing about two dollars:

1) A standard 6" diameter aluminum duct tube, about two feet long.

2) A reducing vent cap to fit the top of the tube,

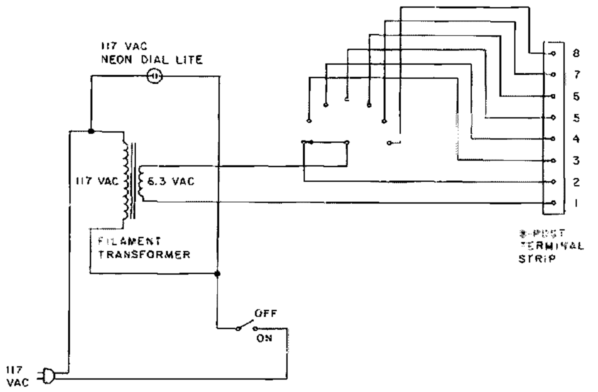

Fig. 5. Schematic of the control box used to activate and steer the system.

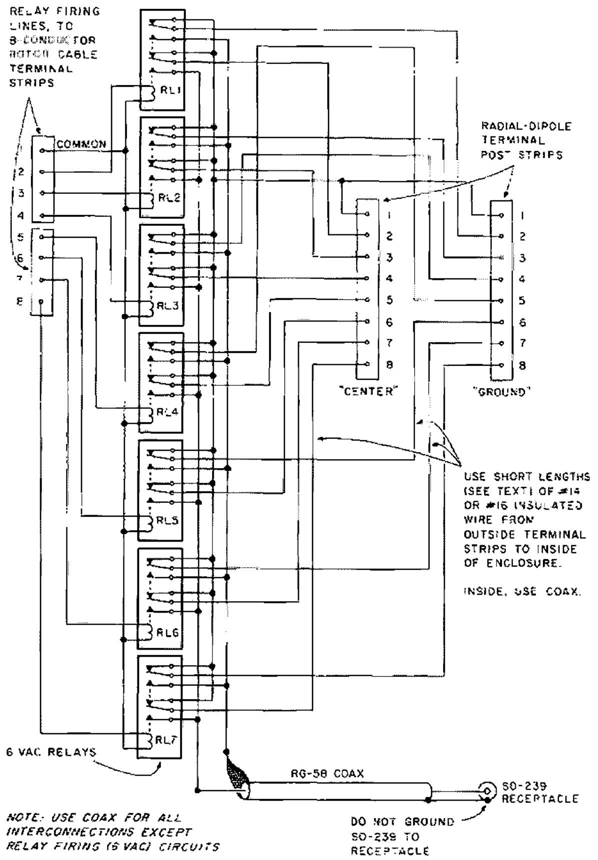

Fig. 6. Schematic of the relay-switching circuit, heart of the QRM Killer. This circuit is mounted on a wood strip and inserted into the duct-tube enclosure at the antenna.

which looks like a round, 4" louvered lid. This vent cap slips over the 6" diameter tube with a 1½" to 2" lip.

3) An open-ended reducing cap, much like the louvered one, which also can be made to fit over the duct tube. (See Fig. 4 for more detail on this enclosure.)

As with any piece of ducting, one end is ridged to be able to slip into another identically-diametered piece of duct work. To cap off both ends as I did, however, you'll need to slot the bottom end of the duct with a pair of metal cutters in order to permit the open-ended cap to slip over the end.

The temporarily-mounted caps should then be drilled through to permit two self-tapping screws on either side of each cap to serve as fasteners.

Next, find some plastic scrap around the house. I used a split clear-plastic shoebox.

With a heated soldering-gun element, "cut" two disks to fit inside the 4" diameter caps. The top disk is simple. The bottom disk should be formed the same, except that it should have two rectangular holes to allow for installation of two screw-type outboard terminal strips used later to connect to the rotor cable. I bought 4-post terminal strips at the local Radio Shack. Drill holes to install the terminal strips in the bottom disk, affixing them with small nuts and bolts.

To connect the radials to the system, you'll find it useful to use two 8-terminal strips mounted vertically near the top or upper center of the enclosure on opposite sides of the duct tube. These should be positioned at right angles, away from the U-clamp assemblies. More on this shortly.

Drill a hole through the enclosure duct next to each terminal-strip connection, for a total of 8 holes per strip. You'll ultimately feed insulated wires through these holes which will terminate at the RG-58/U coax used to connect to internal relays.

At this point, the enclosure is almost complete, save for the coax connector and a means of mounting.

First, drill out a hole in the tube's lower section and install an SO-239 connector.

The mounting method really had me perplexed until I stumbled onto the solution while at Radio Shack. They make an unusual U-bolt hardware assembly that is circularly slotted. This means that the U-bolts, which come with the assembly, can be turned in one direction for clamping even though the duct tube runs in another. Perfect! (See Fig. 4 again for some idea of what these things look like.)

Gads! I almost forgot to tell you how I affixed the bottom plastic (with terminal strips) to the end cap! Get out the tin snips and prepare to operate on a beer can. Cut yourself a 1" × 3" strip for each side of the disk. Connect them by bolt and nut to the disk and use self-tapping screws to connect them to the aluminum cap.

It is also important that the enclosure be conductive, for two reasons:

1) Primary electrical ground to the vertical antenna will be accomplished through the U-clamp to the grounded vertical masting below the radiating element of the 14AVQ-WB.

2) The entire enclosure functions as a very effective shield for the circuitry inside, enabling radial resonance to be maintained on the antenna itself. This shielding enclosure also helps to minimize stray-lead pickup of signals.

All I know is that it works well the way it is, although the more ingenious among you may easily devise another means of electrically grounding and shielding in a simpler way.

The Control Box

This part is so simple that I will go over it rather quickly. I happened to have an available panel box that I'd used before for a different antenna-switching system.

The key elements are:

- A 6.3-volt filament transformer (chosen because I didn't want to ever run the risk of electrocuting myself).

- A piece of 117-V ac line cord.
- A single-pole rotary switch with at least 8 available positions.

If you wish to add a few refinements (as I did), you'll need a miniature 117-V ac toggle switch and a panel-mounted neon lamp.

The circuit that I used for the control box is shown in Fig. 5. I also installed an 8-post terminal strip on the rear of my control box for easy interconnection to the rotor cable. For the common lead, I used the black rotor wire.

Relay Switching Circuit

For my own system, this was the really fun part. I enjoyed wiring and testing the relay system which does the actual conversion of radials into operating dipoles. Here's what I used:

1) Seven 6-volt ac 3PDT enclosed relays. You actually need only two of the three operating circuits, but these relays came cheap for me.
2) Two more 4-post terminal strips.
3) Two more beer cans (to make clamps to hold the relays in place).
4) Some RG-58/U coax.
5) Some hookup wire.
6) A plank of wood, as long as the enclosure, yet narrow enough to fit snugly inside the 4" diameter enclosure caps. This wood becomes your chassis.

You could probably eliminate the beer cans if you obtain relays which could be fastened down or socketed. Mine could not be, so I had to empty the beer cans and fabricate some hold-down strips from them.

For the circuit, refer to Fig. 6. This is much simpler than the original version, which was designed before I realized the advantage of using the conducting enclosure—which eliminated a lot of ground wiring.

However simple, it works very well. For clarity, the schematic (Fig. 6) shows the radials as dipoles. In reality, though, remember that they are opposite radial pairs—the same ones now on the vertical.

The only change you must make later is to install egg insulators at the antenna to force the radials to go through your relay-switching circuit in order to function normally.

If you are a typical BTV or 14AVQ owner, you've noted by this time that I've several more relays going here than you have radial pairs (four are normal, one each for 10, 15, 20, and 40 meters). This allows for further expansion of the rooftop system, which we will discuss later. However, you could simply use four relays and do just fine.

There is nothing particularly tricky about this circuit, except its objective—which you may want to change somewhat to suit your own needs. Personally, my desire is to have all radials functioning as radials at all times, except when I select a pair by activating the corresponding relay.

In the circuit shown, the selected pair of radials is removed from the antenna circuit completely and connected in dipole fashion to a second feedline going down to the ham shack. This "receive" dipole can then be switched into the primary transceiver antenna feed whenever desired. Another option, of course, would be to use the transceiver relay to automatically kick in an antenna changeover relay on receive that would be connected to the new relay system. However, at the moment, I enjoy the manual select operation because it permits me instant comparison with the vertical system.

In wiring the relay circuits, I found myself making errors. Initially, I used insulated wire throughout. However, because I had to rewire anyway (because of the errors), it seemed like a good time to switch over to RG-58 coax for all the active rf circuits. In retrospect, it is probably a good idea to do this at the outset to minimize the length of "free" wire, carrying either primary or ground-circuit rf. If I hadn't done this, I probably would have had to shorten the antenna radials to return them all to resonance.

Mechanically, I mounted each relay about one relay-length from each other on the long strip of wood mentioned earlier. This was more than ample, and there was plenty of room both in-between and alongside to run the wires and coax (see Fig. 7).

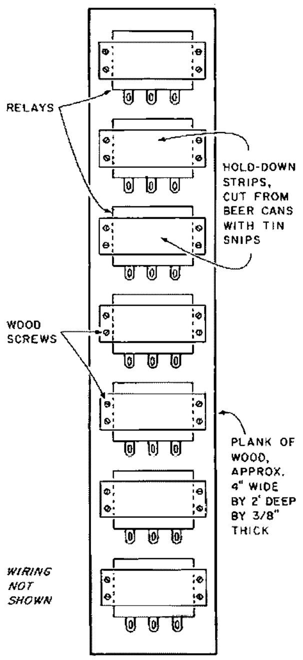

Fig. 7. General mechanical layout of the relay-switching circuit.

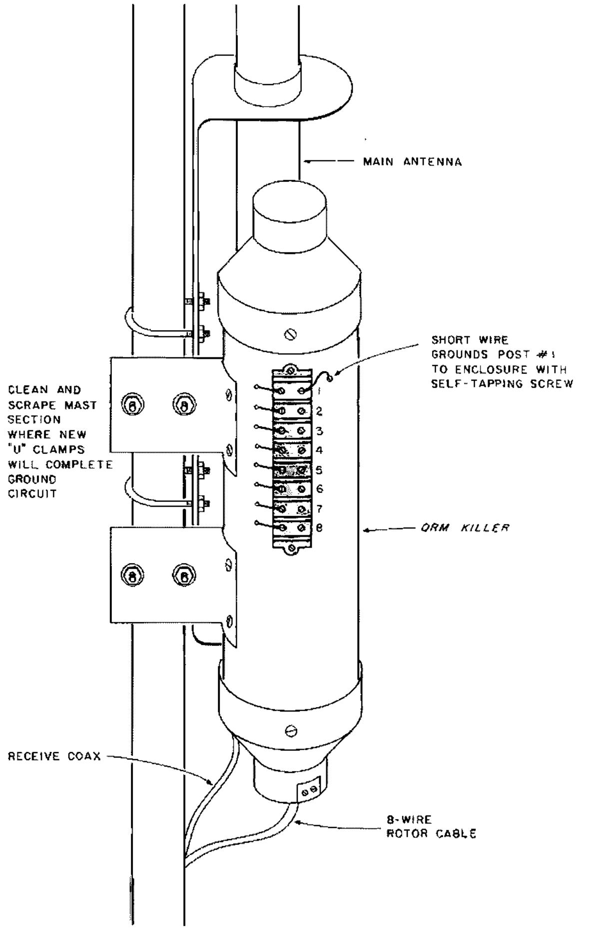

Fig. 8. Pictorial shows how the enclosure is mounted to the rooftop antenna, after assembly is complete and tested.

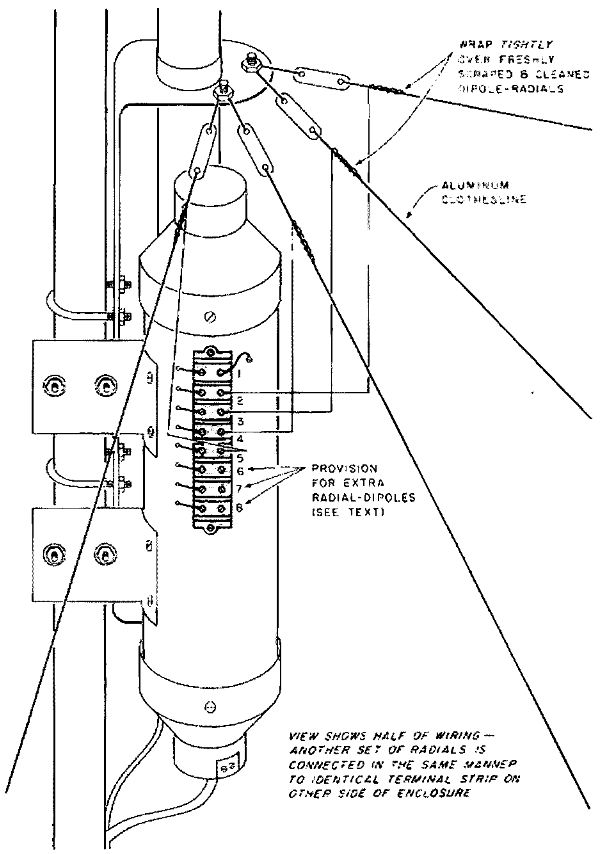

Fig. 9. This view shows how the radials are connected to the enclosure unit. A simulated wire-wrap technique using short lengths of aluminum clothesline does quite well.

Mounting the Relay Assembly in the Enclosure

Before attempting to put the relay assembly and the rooftop enclosure together, you'll want to do a few more things to the enclosure. Specifically, add the interconnecting wiring as follows (see Fig. 8):

1) Cut 14 lengths of stranded insulated wire, each about a foot long. This can be #14, #16, or whatever. Strip the ends and pass them through all the 8-post terminal holes on the side of the enclosure except the top two—terminal one at the top of each strip.

2) Make certain there is some play between the diameter of the holes you drilled and the size of the wire; too tight a condition might lead to an inadvertent stripping of the insulation and a shorting-out of the leads to the enclosure ground.

3) Next cut two short pieces, strip the ends, and terminate each of these to the top screw-down terminal posts. Remember that there are two 8-post terminal strips on each side of the enclosure. To summarize:

Terminal one gets the short lead. Drill a hole through the enclosure near terminal post one on each strip, insert a self-tapping screw, and terminate the other end of the short terminal #1 lead to ground in this manner.

Terminate terminals 2 through 8 on each strip to the long 1′ wires.

The total of 14 wires now passing through to the inside of the enclosure will later be terminated to coax from the relay circuits.

4) Next, take the long coax feedline that goes into the relay circuit (the receive line) and connect it to the SO-239 receptacle connection points on the inside of the enclosure. Allow enough feedline so that you'll be able to slip in the entire relay strip later. There will be ample room inside the enclosure to house any extra coax length that may be necessary here.

Now the relay firing wires must be connected to the terminal strips on the underside cap of the enclosure. Again, leave ample room for maneuvering later on. These should, of course, be connected in sequence to correspond with the control-box switching system.

You are now ready to insert the relay strip and its associated wiring into the enclosure. You'll want to slip it through from the bottom.

Once this has been accomplished, pull all the coax ends from the relays through the top of the enclosure. Do the same with the insulated terminal-strip wires. Match them carefully, strip the coax, and connect them, using as short a length of the insulated wire as you can and still be able to move the relay strip in and out of the enclosure.

For simplicity's sake, I use one of the outside vertical 8-post terminal strips as "center" and the other as "ground" and I mark them that way on the outside of the enclosure. This greatly eases coax wiring at this stage.

Each terminal-strip-wire number (corresponding to a given post point) is either soldered to a coax center or to a coax-shield ground. In this manner, for example, the "center" terminal strip post-2 wire goes to relay one's coax center conductor. The shield from that relay goes to the "ground" terminal strip post-2 wire. This sequence is repeated until all posts are so terminated.

At this point, before everything is permanently capped off and bolted shut, it is a good idea to check performance. If you have done everything correctly, you should be able to interconnect the control box to the enclosure assembly, connect a piece of interconnecting coax from the SO-239 connector to your transceiver, and give it a whirl on receive.

All this can be done in the shack. To check out the switching, listen for a sequential relay clacking as you rotate the control-box switch through its various positions. So far so good?

Next, connect a couple of wires to the antenna lead coming from your rooftop antenna. Connect the ground side to the "ground" terminal strip, terminal 2, and the center conductor to the "center" terminal strip, terminal 2. Activate the control box and switch to the first relay. At this point it should be quite obvious to your receiver that this thing is working. In this position, you should have normal reception, with next to nothing on all the other positions.

Repeat this test on terminals 3 through 8 until you are satisfied that each works as it should. You may hear some signals very weakly on the posts not connected to your antenna, but most of this pickup comes from exposed wiring. This will all but disappear after you connect the assembly to your antenna.

If everything is okay, you have a little more work to do at this point:

1) Position the relay strip inside the enclosure, center it vertically, and stuff all the wiring inside.

2) Now, insert the plastic disk into the top ventilating cap (to keep the rain out), center the wood strip, and

slide the cap over the relay wood strip and then on down over the duct work. Now, using self-tapping screws, secure the top cap to the main enclosure.

3) Follow pretty much the same procedure for the bottom cap assembly. Make certain the wood inserts into the smaller diameter of the cap.

4) Once the bottom cap is secured, drill and use woodscrews through the sides of the enclosure into the edges of the wood at one or two places. This will relieve the duty of the caps (which should be for positioning and centering only) and give more support to the wooden relay strip.

When you are all through, the entire unit should be able to be jarred without rattling. As a safety precaution at this point, repeat the testing procedure conducted earlier, running the circuit through posts 2 through 8 to verify that everything is still okay.

Rooftop Installation

Before the unit is installed, you'll want to electrically disconnect all the radials from the antenna itself.

Depending on how many radials you're using, you'll need a number of egg insulators. Cut the radials a few inches out from where they are terminated to the antenna. You'll need this extra lead length (I left 6-8 inches) to secure the egg insulator at the antenna. Do this all around the antenna.

If your radials also serve as guys, you'll want to reconnect the radial ends to the insulators as you go—to prevent your antenna from crashing down on the rooftop. In some cases, you may have to readjust the end lengths so that they will free enough extra radial lead at the insulator to wrap around sufficiently to ensure a secure termination (see Fig. 9).

Important: If you have followed these instructions fairly well, the radial lengths, even though they are now shortened a mite because of the new insulators, will still resonate well at the operating frequencies for which they are intended after installation is complete. This is because of the internal wiring from the two 8-post terminal strips to the coax. The rest of the needed length will be accomplished later.

Once the radials have been insulated off and resecured, it is time to mount the unit. As indicated earlier, it mounts vertically, but note that the U-clamp assembly mount causes a mechanical standoff condition to exist, so that the duct tube parallels the antenna mast about two inches away.

The two U-clamps are all that is required to connect the unit to the antenna mast. Position the unit as high as possible under the antenna, so that the terminal strips will be immediately underneath the radials. This will allow your connections to the radials to be reasonably short.

Now, for connection of the radials to the unit. I found that aluminum clothesline is perfect for this job (see Fig. 9). I removed the screw from post 2 of the terminal strip, bent the end of a short length of clothesline around it, and then screwed it back down into the terminal post.

The free end of the clothesline is now *tightly* wrapped around a *cleaned* section of radial. If you use a couple of pairs of pliers when doing this, you'll have a neat, wire-wrap effect. Now find the opposite radial and connect that to terminal post 2 of the opposite terminal strip. Do this in rotation all the way around the antenna until all radials are connected.

Once this is done, your

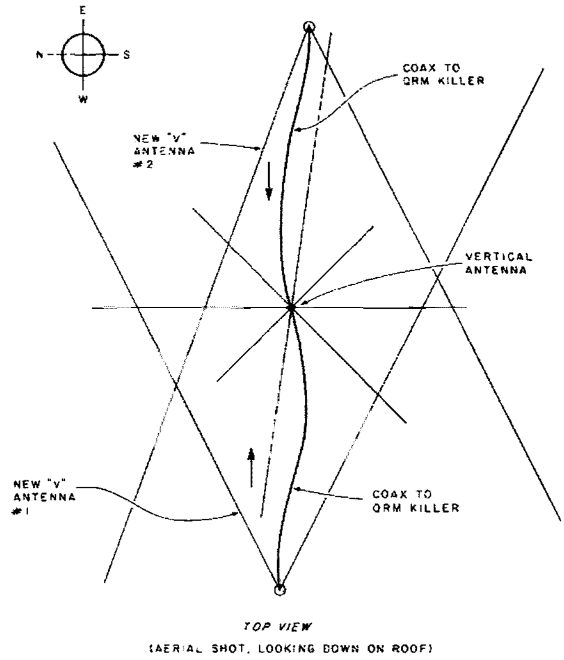

Fig. 10. This view shows the rooftop system with two vees added by the author. While these are east and west of each other at my QTH, the vee configuration not only fits the roof but also concentrates the beam in the desired direction.

installation is complete. All you need do now is install a length of RG-58/U (or RG-8/U, or whatever) to the SO-239 on the enclosure and wire up your rotor cable correctly to the bottom of the unit. You may want to tape these connections or otherwise seal them from the weather.

Return now to the shack and give her a try! Your swr should be the same as it was originally, before the new system was installed.

Modifications

As was noted, I provided for more relays than I had original radials.

How I took advantage of this is shown in Fig. 10. I set up two new vee antennas on the roof, each firing in an opposite direction, although both are basically capturing east-west signals because of the layout of my particular roof.

For these vees to be optimum, they need to be elevated from the roof somewhat. TV-type standoff insulators are ideal for this purpose.

To feed these vees, I use RG-58/U and terminate it to the unit at the 8-post terminal strips.

Other modifications are possible which might markedly improve the ease with which this system operates. One would be a system which would use the transceiver relay to automatically trigger a T-R relay. Another possibility would be to add a circuit at both the box and the relay strip to switch in the primary coax at the antenna, thus eliminating all need for a separate receive feedline to the ham shack. I would guess that many of you may elect to go this route. If you would like to do this, simply wire up one of the relays provided to permit this to happen and see that it remains activated no matter which of the other relays is selected for receive.

Another modification that some may wish to experiment with would be to change the basic wiring

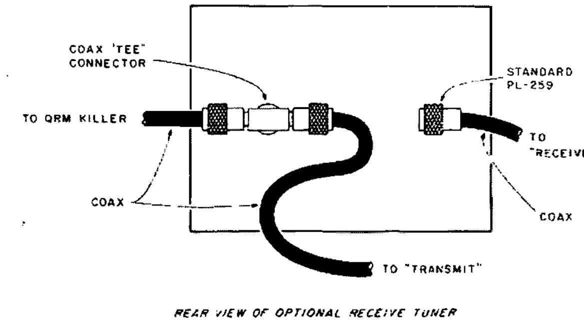

Fig. 11. This shows how the optional receive tuner is wired into the circuit to allow for automated transceive. When configured in this manner, the tuner optimizes selected radial/dipole performance at receive frequency, but does not directly couple transmit rf. This allows you to use common receiver-type junk-box components for the tuner instead of having to worry about the power-handling capacities of individual components.

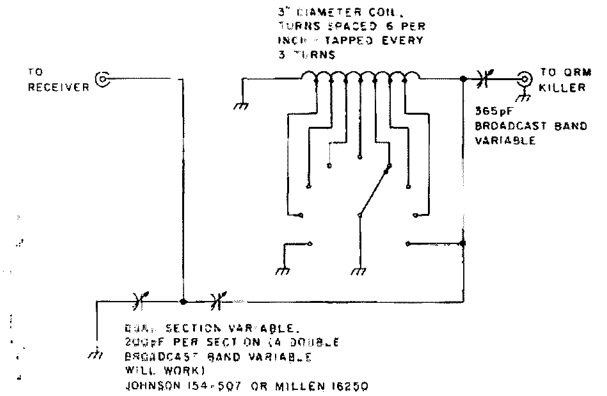

Fig. 12. Schematic of optional receive tuner.

principle I have applied—that is, that all radials not used as dipoles remain in the circuit as operating radials. It may be interesting to some to remove (electrically) the radials immediately adjacent to each of the opposite activated radials (now one dipole) so that the dipole would not be "looking" at closely adjacent grounded elements. I chose not to go this route because I didn't want to remove more radials than I was using on receive.

However, if an antenna T-R system is automated, then it would be entirely possible to extend this experimentation considerably. As it is right now, the removal of a single radial/dipole does not hinder normal antenna operation at all. In fact, as indicated earlier, it is interesting to see what it does do to the antenna pattern. At no time does an swr problem present itself.

A Receive Tuner for Purists

I fully realize that there are many among you who won't want to see a sudden drop in antenna gain occur when switching over to the new system. Actually, if Q factor on receive (clarity) is the main objective, it should hardly matter. But it is certainly true that the 10-meter radial/dipole pair, for example, will not produce the gain that the normal vertical antenna will.

So, for those who would like to freely switch, or rotate, their system with no significant change in antenna gain, I would suggest construction of a simple receive tuner. Figs. 11 and 12 show how I did it. The reason that Fig. 11 is included is to show that it is possible to use a low-power tuner in the circuit all the time and still be able to transmit. The T-connector is the secret.

The tuner is constructed of handy junk-box components, similar to any tuner you have ever seen in articles or handbooks. In my case, the tuner is quite broadbanded at 40 meters and peaks all the radials/dipoles equally.

Your receive S-meter will be your guide here. With the tuner in the circuit at the ham shack, you can simply tune for maximum signal strength over the various radials/dipoles until the signal levels equal what you are getting on the regular main vertical antenna. Once this has been set, you can pretty much forget it.

Now you have a system that will be truly amazing to demonstrate to your ham friends. It is particularly intriguing because the QRM can be tuned out, yet the basic gain of the system remains the same.

Transmitting

I have had extraordinarily good luck in also being able to transmit over this system. As discussed earlier, there are certain times when a selected radial pair will out-perform the ground-plane effect of the basic vertical antenna—substantially.

I should, however, describe my station. This is because I normally do have a 3-kW tuner in the circuit at all times. The rig consists of a Kenwood TS-520 into a Heathkit SB-220 linear, which, incidentally, I don't find myself using as much as I used to.

On transmit, it is necessary to readjust the tuner on some radials/dipoles, depending on which are selected. However, this adjustment is *very* small. And, if I didn't have the separate receive tuner in the circuit, this adjustment might not be necessary at all. The adjustment is required because the receive tuner, when feeding in the way it does to the transceiver, produces a different impedance from that which the main tuner is accustomed to seeing. So, when transmitting over a radial/dipole, I will either peak the main tuner (hardly ever) or the receive tuner (more often than not). Depending upon just how you have your particular system interconnected and switched, you might find the reverse to be true for you.

But transmitting over this system can be fun and even startling for others whom you talk to during a demonstration. The reason is simple: When you use this arrangement on receive, no one but you appreciates how well it works. When you get into an on-the-air demonstration of the system's rotational qualities, however, it will produce a dramatic effect at the other end if you are transmitting on it.

I find it fun. However, it is exasperating to try to explain this thing over the air to someone who is not basically an antenna buff. For example, to begin with, it is necessary for the other guy in the QSO to be able to realize that a rooftop vertical is not a "vertical" at all, but functions, instead, as a ground plane. Surprisingly, very few people think of their antennas that way. (If you want to test this out yourself, listen to people describe their Hy-Gain 14AVQs on the air. I have yet to find one who refers to a 14AVQ as a ground-plane type.)

Measuring Results

If you are at all like me, you like to try to work out

some system for measuring results. Well, I'm still in the process of doing that with this array:

- First, I check for improved receive Q-factor. My system (shown in Table 1) is a simple listing of existing Q-factor and existing noise level expressed as a percentage. I "rotate" my system, find the optimum position, and record the findings. Once a pattern has been established, you should be able to find the "right" radial/dipole fast.
- Next, I check the antenna pattern. This is a bit more difficult because there are several patterns to deal with here. However, a simple method is to begin with the "nulling" out of identified foreign broadcast signals.

As for me, I'm still working on the pattern situation and don't know if I'll ever really get it all figured out. The most intriguing situation, at least to me, is the primary-antenna pattern change which sometimes occurs as a particular radial/dipole is removed from the circuit. Often, it produces startling results to just listen on the main vertical antenna and then rotate through the radials/dipoles.

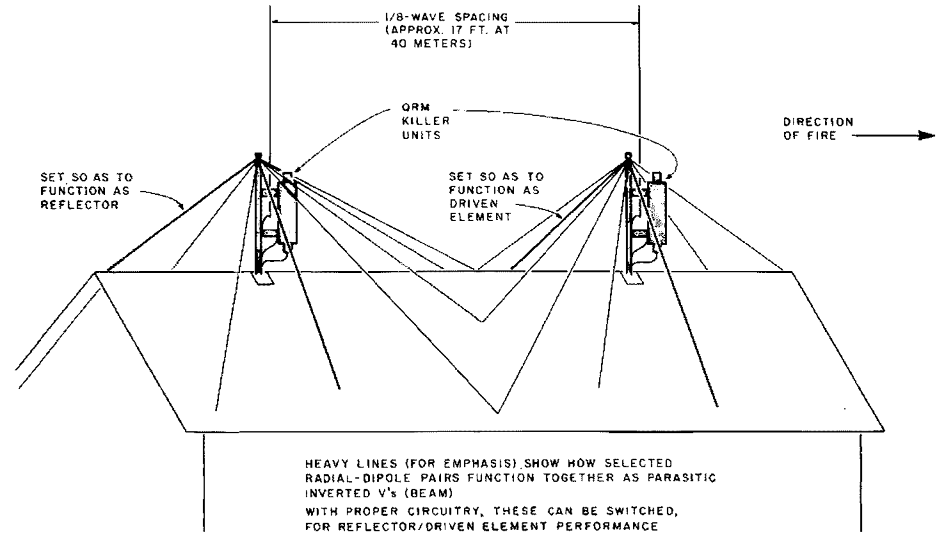

Fig. 13. Layout of a double QRM Killer array, showing how parasitic coupling could be achieved, if desired, for added 2-element directivity. See text for details.

Conclusions

While this design undoubtedly will be refined and improved upon by many over the years ahead, I have formed a few preliminary conclusions based on my own results to date:

1) It works better on 40 meters than on just about any other band. On 20, it is gangbusters on receive, but does not perform as well on transmit as would a rotatable yagi or quad.

2) It proves (through active use of radial elements not cut for 40) that short antennas are very effective on receive, with nothing needed (as far as loading coils, etc.) to make them work well.

3) The system should work well for anyone now using a roof-mounted vertical (ground-plane) antenna.

4) Signal-to-noise ratio is dramatically improved, particularly if the noise is QRM-generated.

5) A degree of directivity is achieved, directivity which can be beamed in a particular direction by rotating the system remotely.

One Final Thought

Though I have not yet tried this, it seems entirely possible that parasitic element performance—and, hence, even greater directivity—could readily be obtained by adding another vertical array.

I plan to do this in the near future. What I will install is another Hy-Gain 14AVQ essentially for phasing purposes.

However, for simplicity's sake, one could forego phasing and simply place the two arrays about 15 feet apart for 40 meters (if this is the desired band for this effort).

A second array could be wired into the same control box so that, as radial/dipole "A" is activated from antenna #1, the same thing happens at antenna #2. That is, the corresponding radial/dipole "A" on antenna #2 is also activated by removing it from antenna ground and putting it into a parasitic relationship with that on antenna #1. The next logical step would be to work up a system for lengthening either of the two radials/dipoles on command from the ham shack. Doing so would enable you to realize pattern reversibility, as one radial/dipole functions as the driven element while the other functions as a reflector. This would make for a most interesting study. And the very least that could happen (which would be nothing) would still leave you with an omnidirectional overall system gain of 3 dB, as the two verticals are driven together (less fading would be noticeable, also).

If one were to add phasing to the system, spacing at 40 meters should probably be about 17 feet between the two antennas (1/8 wavelength) (Fig. 13). If you went out to the full 40-meter ¼-wave spacing (34 feet), you might be too far out to realize any desired parasitic interaction. However, with a correct phasing system and corresponding delay-line switch box at the ham shack, you should be able to pick up 10 dB or so when flipping between endfire and broadside positions. Then, when firing up the paralleled systems discussed in this article, considerable additional directivity and front-to-back ratio might be achieved through the reversal of the driven element and reflector and relay-controlled "rotation" of the radial/dipole element. (This assumes that the phasing system would also be flipped into the activated radial/dipole circuit as well.)

If everything worked out, you could easily end up with the same effect (and maybe better) that you would realize with a full-size rotatable 2-element 40-meter beam. Plus, you'd have the advantage of being able to switch polarization to take advantage of DX.

Well, regardless of what you end up doing with this thing, I'll continue tinkering and will report results of other designs as they evolve. Meantime, if you are troubled with 40-meter QRM and are thinking of giving it all up for 2 meters, do give this system a try. You'll be pleasantly surprised. ■

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PC Boards— A Photographic Method

—it's easy when you take it step by step

Modern electronic equipment, be it digital or analog, is dependent upon printed circuitry for cost effectiveness, reproducibility, and ease of assembly. The home-brew enthusiast will sooner or later consider acquiring the equipment, materials, and skills to produce his or her own boards. If you've never tried it, be prepared for a pleasant surprise. Very little investment of time or money is required for quality results.

There are two general methods of PC board construction. Both result in a hard, acid-resistant coating on copper-clad board made from any one of several materials. This coating duplicates the conductor pattern and solder pad layout for the actual components. Therefore, when immersed in an acid bath, the copper is removed where not protected by this coating. Following acid etching, only the desired copper pattern remains on the board. Holes are then drilled for the component leads, and away you go.

The two methods differ only in the manner in which this acid-resistant coating is put on the board. Let's compare them.

Direct-Resist Versus Photographic Methods

In the so-called direct-resist method often used by beginners and old hands alike, the coating pattern is hand-drawn directly on the copper surface. First, a pencil drawing is made of the layout so that any mistakes hopefully will be made there and easily corrected. Next, either before or after drilling the component holes, the layout is drawn on the board. This usually is done with black lacquer dispensed by a felt-tip pen and/or a small brush.

This procedure works and works well. It does, however, suffer from several drawbacks:

- The method is inefficient when more than one copy of the board is to be made.
- Altering the layout once it is drawn on the board is difficult and messy.
- Tracing from published layouts can still result in errors since a direct overlay cannot be used.
- The finished product may unavoidably turn out sloppy looking. This impedes troubleshooting if nothing else.
- Intricate patterns with close-spaced conductors and components are difficult to implement.

Photographic procedures cure all the above-mentioned ills. And you may be surprised at the low cost and skill level required to get started in this method.

The Five Steps of Photo PC Board Construction

Photographic methods break down into five steps:

- Design the component and conductor path layout in pencil if a published pattern is not available.
- Reproduce this layout as "positive artwork."
- Photographically reverse the positive to make a negative.
- Expose a sensitized copper-clad board, using the negative as an exposure mask. Then develop the sensitized surface.
- Etch the developed board in an acid bath, then drill the lead holes.

Description	Source
a) Thin lead drawing pencil (Pentel or equivalent)	Office Supply
b) Plastic circle template	Office Supply
c) Two 30° × 60° plastic triangles	Office Supply
d) Plastic engineer's scale	Office Supply
e) 10-by-10-to-the-inch grid paper	Office Supply
f) Drafting or masking tape	Office Supply
g) Drawing board (optional)	Office Supply
h) T-square (optional)	Office Supply

Table 1. Equipment and materials for original layout.

The first and last steps are essentially the same as in the direct-resist method. In between will be the crux of our interest. Here is a discussion of these steps and the materials and equipment—mostly home brew—required to perform them. Stay with me; it really is simple.

Preparing the Layout

Unless a published board pattern is available for your project, one will have to be designed. A list of equipment and materials for this purpose is given in Table 1. The utility of most items listed should be self-evident, but a few comments are in order.

The 10-by-10-to-the-inch grid paper is an especially good choice for the drawing. Many component leads, those of integrated circuits in particular, are on .1-inch centers or multiples thereof. So, this paper lets you dispense with a lot of actual measurements.

Also, while a plain wooden pencil is fine for your drawing if kept sharp, the Pentel™ thin lead drawing pencil is a pleasure to use. It dispenses .5-mm lead, allowing very neat and precise drawings to be made.

To begin your layout, it is helpful to have the pinout description for all ICs and transistors ready at hand. Any non-standard-sized other components such as electrolytic capacitors should also be available. Then the proper lead spacing and so forth can be allowed for.

To proceed, define the overall board dimensions. If possible, make these such that you don't waste a lot of an available piece of board material. Define tentative board edges on the grid paper. They can be enlarged or cut down later if necessary. Then study the schematic and form a general layout plan in your mind's eye. Having done this, draw the component pad locations on your layout and begin adding the interconnecting conductor paths. The whole process is a little like working a puzzle, and there is nothing wrong with several false starts. It's really a matter of using your own ingenuity, but here are some useful hints that come to mind:

1. Board appearance and troubleshooting are enhanced if component packages and conductor paths are placed parallel to the board edges insofar as possible.

2. Choose a standard lead spacing for similar components. For example, I use ½ inch for ½-Watt resistors. Stick to this spacing except in special cases and board appearance will be better.

3. Don't be afraid to use jumpers—several, if necessary. On the other hand, don't give up too easily in your puzzle-working efforts. Take note of the fact that a component such as a resistor or capacitor which will be in series with a line apparently needing a jumper can itself be the jumper.

4. Remember that in some cases the pin connections on digital ICs and multiple-unit op amps, as shown in published schematics, are not always the only way to implement the circuit. For example, a 16-pin hex inverter IC contains six identical and independent units. It may be helpful to juggle which inverter is going to serve which input to simplify your layout.

5. Take special care when looking up the pinouts for ICs to note whether you are looking at a diagram from the bottom or top of the IC. What is needed, of course, is the bottom view, since you are drawing the foil side of the board.

6. If your layout begins to

Description	Source
a) Technical drafting pen (Rapidograph or equivalent)	Office Supply
b) Ink for pen (Pelikan™ #17 black, or Leroy™ Lettering Ink #58-0005 or equivalent)	Office Supply
c) Small plastic French curve	Office Supply
d) Sharp knife (X-acto or equivalent)	Office Supply
e) Transparent plastic sheets (mylar or equivalent)	Office Supply
f) Assortment of conductor path tape of various widths	Kepro or Bishop Graphics
g) Assortment of adhesive-backed component pad patterns	Kepro or Bishop Graphics

Table 2. Equipment and materials for positive artwork.

really complicated, requiring many jumpers, consider the use of a double-sided board. Although plated-through holes usually found on commercial products are next to impossible to implement at home, you can use eyelets instead. Sometimes most of the problem may be solved by just moving one set of conductors (such as the address bus on a computer board) to the second side of the board. If only a few connections must be made to the bus, you can jump from one side to the other with wire through holes.

These little hints could go on forever. The best thing to do is dive in and design a few boards yourself. Most of the knacks to it will become evident quickly.

Finish your layout and check it carefully against the schematic. If satisfied, you can go on to make the positive artwork.

Making the Positive Artwork

Having made a pencil layout that satisfies the circuit schematic, it must be duplicated in a form suitable for photographic reversal. The base material for this drawing must be a clear or very translucent material such as mylar™.

The layout is drawn using a good dense ink, precut opaque black pad patterns and tape, or a combination of the two. For a complete list of drawing equipment and other materials required, refer to Table 2.

The Rapidograph™ pen listed is a must unless you think all your patterns can be reproduced using only the stick-on transfers. Invariably, however, there will be a few strange shapes which will require the pen. With it, precise inked lines and circles can be drawn. As a further benefit, you will save a good bit of money by using the pen instead of the stick-ons for all but the most exacting work. In any case, just any drafting ink won't do. It must be very dense to block light during the reversal exposure process to be described. The two inks listed in Table 2 are satisfactory.

The stick-on patterns, on the other hand, are a pleasure to use and are a must for integrated circuit patterns, card edge connectors, and the like where precise dimensions are required. Also, the use of tape for conductor paths is actually quicker than drawing with the pen once you get the hang of it. What I do is place the end of the tape at one end of a conductor run, lay it out, then at the other end press down with the X-acto® knife blade while simultaneously pulling up on the rest of the roll. This cuts the tape off cleanly and quickly. You may come up with a better technique yourself.

To proceed, lay the transparent base over your pencil layout or published

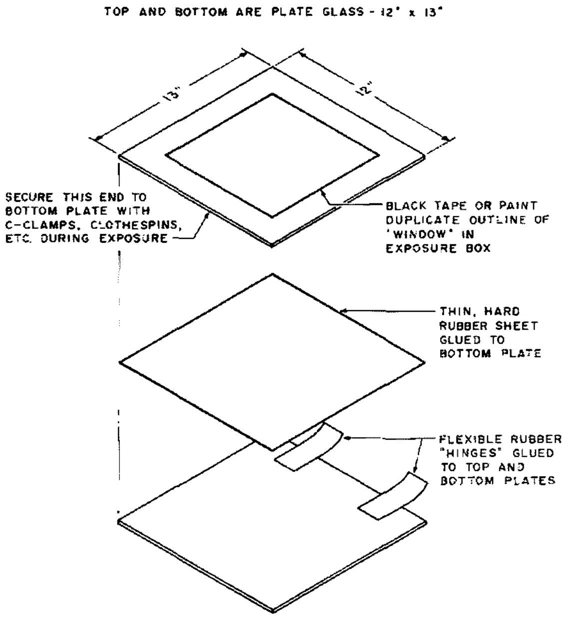

Fig. 1. The print frame sandwiches the positive tightly against the negative film to make a sharp, clear, and accurate exposure.

pattern and square up the edges of the sheets. Then place the pads for the individual component leads, ICs, etc., where required. Follow this with the interconnecting conductor paths.

After the layout has been duplicated as positive artwork, be sure to delineate the corners of the board with registration marks. This will aid in positioning the positive on your negative film and, ultimately, the negative on the board, prior to exposure. Corner registration is particularly critical on double-sided boards where holes and solder pads must be in alignment from side to side.

Preparing the Negative

This step, the photographic reversal of the positive artwork to yield a negative, involves procedures which may be foreign to many electronics hobbyists. They were to me since I had never dabbled in photography past the instant camera stage. Don't be put off, though; the procedures and equipment are really simple and inexpensive.

The actual methods involved belong more to the realm of graphic arts than anything else. The film used is known as lithographic film and is of a high contrast nature (either completely black or clear image).

Production involves exposing a negative film which is in intimate contact with the positive to the proper amount of light for an appropriate period of time. The amount of light and time required are inversely proportional to one another, as you may surmise.

With the litho film recommended here, an ordinary 7½-Watt incandescent light bulb in an appropriate enclosure, coupled with exposure times on the order of one-half to one second, will do the trick. Before proceeding, let's discuss the simple, mostly home-brew, equipment required to implement the exposure.

The Print Frame

This item, used not only for exposing the negative but also for board exposure, can be as simple as two pieces of plate glass. However, you will probably be ahead if you build up something like the one shown in Fig. 1. The hinged construction keeps everything together and is easy to use. The only real purpose for this gadget is to sandwich the positive artwork tightly against the negative film during exposure. This results in a reversal pattern that is sharp, clear, and of the same dimensions as the positive. You may want to get the two sheets of glass to start with and use them later to build the frame. Use clamps of some sort in the interim to secure the pieces together.

The Exposure Box

For reproducible exposure intensity and time, something like the box shown in Fig. 2 should be built. It is not much more than a box with a window of sandblasted glass in the top and a light bulb inside. The sandblasted (or ground) glass is used to diffuse light from the bulb for a more even exposure. The momentary contact switch in series with the 110-volt line gives enough control over timing.

A closed box arrangement is used instead of an open frame construction to allow a heavy towel to be laid over the top, thus sealing in most of the light during exposure. This allows making several "shots" in the darkroom without having to worry about exposing other film which may be lying about or being developed at the same time.

This piece of equipment and the print frame mentioned above constitute our "camera." Not very fancy, maybe, but it works like a charm.

A Safelight

Unless you want to do all your work in complete darkness (a pain), you will need a safelight. This can be purchased, with a Kodak™ No. 1A red filter, or you can make one yourself. To do this, all you need is a 7½- to 15-Watt red light bulb available at any department or drug store.

Description	Source
a) Print frame (see text)	Home brew
b) Exposure box (see text)	Home brew
c) Safelight with Kodak #1A filter (or home-brew light; see text)	Photo Store
d) Three plastic developing trays	Photo Store
e) 1-liter plastic darkroom graduate or other measuring cup	Photo Store
f) Three 1-pint plastic bottles with caps	Photo Store
g) Plastic funnel	Photo Store
h) Plastic stirring rod	Photo Store
i) Darkroom thermometer	Photo Store
j) Sheet film (see Table 4)	Photo Store
k) Developer and fixer (see Table 4)	Photo Store
l) Acetic acid stop bath	Photo Store

Table 3. Equipment and materials for making negatives.

Film	Developer	Fixer
Polychrome Accu-Rep™ Line Ortho Film: .004" polyester base	Polychrome A & B Liquid	Polychrome Liquid & Hardener
Kodak Kodalith Ortho Type 3: No. 2556 .004" Estar™ base	Kodak Kodalith A & B Powders	Kodak

Table 4. Films and developing chemicals.

Then buy a small can of red spray enamel paint. Spray the bulb with this enamel to cover up the inevitable pinholes in the bulb's red ceramic coating. A safelight made in this manner will work fine. Just don't hold the film up to the bulb for any length of time. Keep the light about three feet or more away from any undeveloped film.

Films and Chemicals

Other than the miscellaneous items listed in Table 3 and the equipment described above, you will, of course, need some film and developing chemicals. Two suitable types and their associated chemicals are listed in Table 4. There are others, but these should be easy to find. Films for this purpose are known as "graphic arts" film with the Kodalith™ being among the better known.

Be sure, whatever film you use, that it has a so-called "stable base." Usually this material will be polyester, and it simply means that it won't shrink. Size changes would, of course, be a no-no for our purposes. The film comes in quantities of 25 to 50 sheets per box and in sizes from about 4" X 5" on up. It is very economical, with a box of 50 sheets running about $10.00.

With respect to the chemicals, I have used one brand of chemical with another of film quite successfully. However, you would probably be ahead to get matching products to start with to cut down on at least one variable.

Mix up about one pint each of developer, stop bath, and fixer which can be stored in the plastic bottles mentioned in Table 3. The Kodak chemicals come in powdered form. There is an "A" part and a "B" part for the developer and just one powder for the fixer. These are mixed with ordinary tap water in the proportions given on the package. About the only critical thing here is that for easy mixing, the water must be in the temperature range given on the package (about 80° to 90° F). The powder must go completely into solution to avoid spots on the negative, so mix everything well.

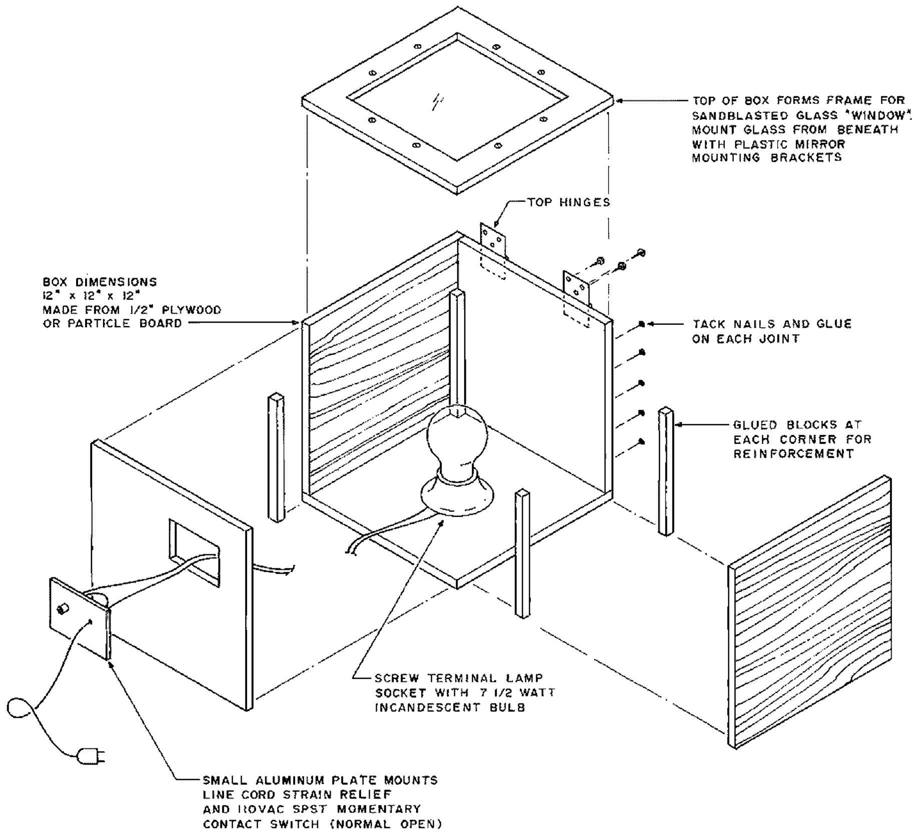

Fig. 2. The exposure box, which gives control over the amount of exposure light, is the "camera" for making a PC board negative from the positive artwork.

The Polychrome™ materials come in liquid form and are therefore somewhat easier to use. The stop bath is nothing more than an acetic acid solution that is sold for use with almost all films.

Film Exposure and Developing

Next get yourself situated in a completely dark room. The film to be used is not terribly sensitive, but it will be ruined if any white light actually falls upon the surface with any intensity to speak of. Don't be too fanatical about absolute darkness, but if you consistently get negatives with poor contrast, light leakage is almost certainly the culprit. At any rate, a bathroom, preferably one with no windows which must be blocked off, is your best choice since the film must be washed in running water after development.

The developer, stop bath, and fixer should fill their respective trays ½ inch deep. Set up your safelight, print frame, and exposure box. Then, with some sheets of film and a positive available, you are ready to go.

I suggest that you make up a small positive with some tape lines, an IC package pattern or two, and some individual component pads for testing purposes. Make some lines and pads with ink as well as with tape and stick-ons to see if you are using dense enough ink in the technical pen. Then, with everything set up, turn off the room lights and turn the safelight on. In a few moments you'll get used to the red light and will be able to work quite well under these conditions.

Open the film package and lay out one sheet. After replacing the rest of the film in its light-tight plastic bag, reseal it with electrical tape and put it back in the box. Next, cut the sheet of film into several pieces about the same size as your "test positive."

Now note, by gently stroking the film, that one side is very slick and the other has a matte texture, or rougher feel. The matte side is the emulsion side. Place a piece of film in your print frame emulsion side up. Next, place the positive, with the artwork side down, on top of the film. The positive artwork will be

Description	Source
a) Print frame (same as for negative)	Home brew
b) No. 2 Photoflood bulb	Photo Store
c) Metal developing tray (cake pan, etc.)	Dept. Store
d) Blank PC boards sensitized with Kodak KPR-4	Kepro
e) Kepro Type KD Developer	Kepro

Table 5. Equipment and materials for board exposure and developing.

reversed from the pattern actually required as you look at it in this attitude. Clamp the print frame pieces securely to force the positive and film tightly together.

Next, place the print frame over the "window" in your exposure box with the positive side down. Now the positive artwork will be between the film and the light source. Either cover the extra pieces of film you cut out earlier or place a heavy towel or equivalent over the whole exposure box-print frame assembly and you're ready to take the picture. Press the button on the exposure box and hold it down for one second. Remove the film from the frame and clip one corner off to indicate your first exposure. Cover the film up and reload the frame with another piece. Expose it as above except make the exposure time ½ second this time.

Remove your second exposure from the frame and clip two corners off to mark it; then cover it up. Make a final exposure with the button pressed and released about as fast as you can. Clip three corners off this piece and then develop all three exposures together as follows:

1. Place the film, emulsion side down, in the developer for a second or two. Next, turn it over and agitate for about ten seconds. Push the film to the bottom of the tray and leave it for 2½ minutes. (Handle the film by the edges at all times.)

2. Remove the film from the developer, allowing excess liquid to drain off in the tray, then transfer the film to the stop bath. Agitate it in the bath for about 30 seconds.

3. Remove the film from the stop bath, draining the excess, and place it in the fixer tray. Leave it in the fixer for about three minutes, agitating periodically.

4. Remove the film from the fixer and place it under running water for 20 to 30 minutes. Ordinary room lights may be turned on after removal from the fixer.

5. Dry the film with a squeegee and hang it up with film clips or clothespins to dry completely.

You should actually see the pattern image on film shortly after beginning Step No. 1. It will appear white on a dark background. After a few seconds of agitation in the fixer, however, it should seem to disappear. Holding it up to the safelight will reveal that the white areas have actually turned clear on a black background.

The shortest exposure probably will turn out to be the best of the three. Examine them all carefully, though, as you should be able to see some effects of exposure time.

After thorough drying, the negative is complete and may be used to expose PC boards to produce the pattern as many times as is desired.

Board Exposure and Developing

This final step, the equipment and materials for which are listed in Table 5, is the simplest of all. However, since the board material, unlike our litho film, is expensive, you should take a little extra care to avoid ruining a board. About the biggest danger is that you may inadvertently expose the photosensitized surface to too much light before the negative is in place. Fortunately, they are sensitive to ultraviolet light; subdued ambient light will not ruin them. The Kepro instructions call for a 15- or 25-Watt incandescent (not fluorescent) bulb at least seven feet away and shaded from your work area when setting up the board for exposure. They also say the red safelight is satisfactory, but I've not tried this.

To continue, you would do well to take one 4" X 6" board from the light-tight package and, under proper lighting conditions, as above, cut it into pieces which will fit your previously-obtained test negative. Place a piece of sensitized board in your print frame with the copper side up. For this and all subsequent operations, handle the board only by its edges.

Next, position the negative on top of the PC board with the pattern showing as you want the board to look (i.e., make sure it isn't reversed). Take some pains to align the negative correctly, using your registration marks. Press the board and negative firmly together by clamping the print frame closed.

Expose the board using a #2 photoflood bulb about 12 inches away from the print frame for about five to six minutes. The exposure time here is not critical. Next, put the board copper side up in a metal tray with about ½ inch of developer. Leave it in the developer for three minutes, with periodic agitation.

Remove the board from the developing solution and rinse it well under running water for a minute or two. A sink spray attachment works well for this. Note that after being in the developer for the prescribed time, the board is no longer light sensitive. After rinsing, hold the board at an angle to the room lighting and your pattern should be visible as a texture difference on the board surface.

The final step is to let the board dry overnight or in a warm (150°) oven for about five minutes. As mentioned before, avoid touching the copper surface at any time. Prior to drying, the resist pattern is soft and can be damaged. Also, the other areas of the board will not respond as well to the acid bath during etching if oils from your fingers are on it.

Board Etching

After the drying step, you may proceed to etch the board as you would with the direct-resist method. Place it in a plastic tray with about ½ inch of the ferric chloride etchant solution. Agitate the tray during etching to speed up the process. Also, if you can raise the temperature of the bath to about 100° F, the time required will be reduced. Depending upon the amount of agitation, temperature, and how fresh the etchant is, the etching process should take roughly 30 minutes to one hour.

After all unwanted copper has been etched away, remove the board from the tray and rinse it well under running water for two or three minutes to stop the chemical reaction. Then, using fine steel wool, remove the resist from the copper pattern. Now drill your lead holes and the job is done.

Troubleshooting

As mentioned several

times previously, this whole process is very simple. However, below are listed some possible glitches and their solutions.

● *Problem:* Poor negative contrast.
Likely Causes: Exposure time too short for the given light intensity; developing chemicals are old or improperly mixed.

● *Problem:* Good contrast but pattern edges fuzzy, and/or line widths and pads are smaller than on the positive.
Likely Causes: Exposure time too long for the given light intensity; positive and negative not clamped tightly enough together. (A similar problem might occur when exposing the board.)

● *Problem:* Board takes excessively long to etch.
Likely Causes: Insufficient agitation; temperature way too low; etching solution is old and loaded with copper from previous use.

● *Problem:* Small patches on the board take excessively long to etch.
Likely Causes: Oil from fingers or other foreign material on the board surface.

The above are the most likely possible difficulties you may encounter. In all honesty, though, you probably won't have any trouble at all. If you do, an SASE to me with a description of your problem will fetch a prompt reply. ■

Supplier Addresses

Kepro Circuit Systems, Inc., 630 Axminister Drive, Fenton MO 63026; (800)-325-3878 outside Missouri, (314)-343-1630 in state. Kepro will sell direct to user.

Bishop Graphics, Inc., 5388 Sterling Center Drive, Box 5007, Westlake Village CA 91359; (213)-991-2600. Bishop Graphics has begun selling mainly through distributors, but write and ask for their catalog No. 106.

Victor Yingst WD5DDR
RR #1, Box 216
Terlton OK 74081

Free CMOS Timers

—build one-shots from spare inverters

Most articles published in ham magazines use the 555 IC for timing (one-shot) purposes. An alternative, for most purposes, which uses less power and can be operated directly from a 12-volt power source, is the 74C14 inverter. Fig. 1 shows the schematic of the 74C14 hex inverter from which (see Fig. 2) you can obtain three or more one-shots.

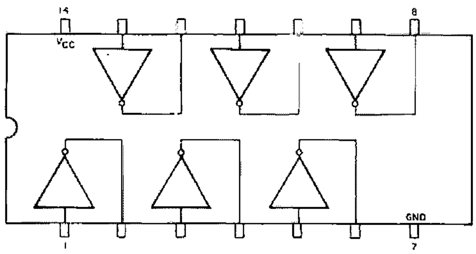

Fig. 1. The 74C14 integrated circuit.

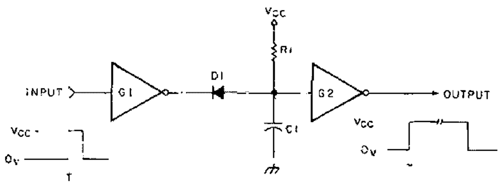

Fig. 2. The 74C14 used as a one-shot.

Time (Seconds)	RI (Megohms)	CI (Microfarads)	DI
0.1	1.0	0.1	1N4148
1.0	1.0	1.0	1N4148
10.0	5.0	2.0	1N4148
100.0	5.0	10.0	1N4148
0.2	1.0	0.2	1N4148
2.0	2.0	1.0	1N4148
20.0	10.0	2.0	1N4148
200.0	3.3	25.0	1N4148

Table 1. Approximate values for timings.

The 74C14 is a Schmitt trigger-type inverter, and the one-shot makes use of the Schmitt trigger action. A Schmitt trigger is a very stable, noise immune, gate circuit. The output changes state rapidly at a very select area of the input voltage shift—usually well within a range of 8 volts.

Because of the tolerances built into the 74C14's triggering voltage range, a stable time period is obtained. By using the input (G1) gate to discharge C1, then the charging time of C1 through R1 provides a time period for the output of G2. This simplest of circuits is, of course, a resettable one-shot, but proper latching-gate circuits can be added on the G1 side to provide a not-resettable function.

The stability of this type of one-shot is dependent upon the quality of capacitor and voltage-source stability, but for most ham radio purposes normal ceramic and tantalum capacitors provide sufficient stability.

Most less complex devices (ten or so ICs) usually end up with extra, unused inverter stages, hence the "for free" one-shot. The diode is a general-purpose switching type (1N914, 1N4148 variety) and the only critical factor is that your capacitor *not* be of high leakage (the currents involved in CMOS dictate this consideration).

I have used this type of one-shot in several projects with perfect results, including stability requirements of less than 5%.

Another advantage of this use of the CMOS one-shot circuit is that for long duration timings the size of the capacitor is drastically smaller. For extremely long timing periods, a resistor must be added in series with the diode going to the output of G1 to counter the leakage of larger value capacitors; 2k or 3k Ohms is correct.

Some approximate values of C are given in Table 1 for various timing durations.

As always when working with CMOS, remember to be alert for sources of static charge; keep yourself, your tools, and your work area at ground potential. ■

Leonard A. Stefanelli N8AD
260 Columbus St.
Elyria OH 44035

Late Check-Ins Come Now

—zero-beat on this computerized NCS system

```
L=END LIST      R=LIST ENTRIES  T=LIST TRAFFIC  C=LOOK FOR CALL
F=FIND CITY     E=EDIT          X=DELETE CHECK-IN
---------------------------------------------------------------
 THIS IS A SCRATCH PAD FOR CHECK-INS
? _
```

Fig. 1. Program initializes to this display.

```
L=END LIST      R=LIST ENTRIES  T=LIST TRAFFIC  C=LOOK FOR CALL
F=FIND CITY     E=EDIT          X=DELETE CHECK-IN
---------------------------------------------------------------
 THIS IS A SCRATCH PAD FOR CHECK-INS
? N8AD
? KB8AM
? UCS
? WB4VI
? L_
```

Fig. 2. Full and partial callsigns entered during check-in.

```
          N8AD

WHAT IS THE CORRECT CALL SIGN?

WHAT IS THE NAME? LEN

WHAT IS THE QTH? ELYRIA

WHAT IS THE TRAFFIC (NONE-PRESS ENTER)? OBERLIN
 NOT AVAILABLE YET
(PRESS ENTER)? _
```

Fig. 3. After last check-in, additional information is entered for each station.

```
          KB8AM

WHAT IS THE CORRECT CALL SIGN? KB8AM

WHAT IS THE NAME? BILL

WHAT IS THE QTH? OBERLIN
KB8AM CALL N8AD  LEN  HE IS LOOKING FOR YOUR CITY

WHAT IS THE TRAFFIC (NONE-PRESS ENTER)? DETROIT
 NOT AVAILABLE YET
(PRESS ENTER)? _
```

Fig. 4. When KB8AM's QTH was entered, the program immediately announced that N8AD was looking for that city (Oberlin).

During my years as an amateur radio operator, I have served as a net control station for a few different nets. One of the requirements of a good net control station is the ability to keep track of all the stations that have checked in and to know where they are located and if they have any traffic. I used to use quite a bit of paper to do this, and my penmanship during busy sessions was more of a hindrance than an aid in operating. Since the TRS-80 Level II has such good string-handling ability, I decided it was time to do away with all my chicken scratching.

"Net Control" has been used at my station for about a year now, and it sure makes for a much smoother operation.

Normally, in net operations, the net control operator asks for people to check in with him by giving their callsigns. After he has gathered a certain number of check-ins, he goes back and systematically "runs" each station through the net.

Basically, what the program does is ask for a list of new check-ins. When net control asks for check-ins, there usually is mass confusion and not all of the callsigns are intelligible. It is up to the control station to get enough of each call to separate them one from another. So, for the program, it is necessary only that a portion of each call is entered. (It is desirable to have the complete callsign go in, but it is not necessary.)

When everyone has checked in, or when the service control station determines that he's had enough, he halts any further entries. The program's list is halted by typing the letter L on the line after the last callsign. This tells the computer to start doing its thing.

```
#  CALL      NAME      QTH        TRAFFIC
------------------------------------------------------
1  N8AD      LEN       ELYRIA
2  KB8AM     BILL      OBERLIN    DETROIT
3  WA3UCS    STEVE     ERIE       W9ILU
4  WB4VIK    JOHN      GUSTON

  END OF LIST  SO FAR ? _
```

Fig. 5. The R command lists all check-ins.

```
THIS IS A LIST OF ALL THE TRAFFIC WE ARE LOOKING FOR
****************************************************************
DETROIT  -----  BY  KB8AM      W9ILU  -----  BY  WA3UCS

(PRESS ENTER TO CONTINUE)? _
```

Fig. 6. The T command lists unresolved traffic.

```
WHAT CALL SIGN ARE YOU LOOKING FOR? N8AD
LEN N8AD IN ELYRIA CHECKED IN # 1


(PRESS ENTER TO CONTINUE)? _
```

Fig. 7. The C command looks for a particular callsign. F does the same for cities.

```
N8AD               LEN               ELYRIA

  WHAT DO YOU WANT TO CHANGE :
     1  CALL
     2  NAME
     3  QTH
     4  TRAFFIC
     5  NOTHING
  ---------------
       ? _
```

Fig. 8. The E command allows you to edit an entry.

Since a new check-in list has been set up, the program will now go to the top of the list and take each station separately, just as the net control normally would. On most nets, the NCS would ask for the operator's name, his location, and for any traffic he may have. The program starts out by asking for the correct callsign, since the NCS may have gotten only part of it the first time. If the NCS was quick and got the call right the first time, he merely hits ENTFR and the call will be retained.

When the right call is entered, the system asks for the name of the check-in. Some nets do not want this, but it's my opinion that it adds a more personal touch. If no name is given, simply press ENTER and an N/A is substituted.

The program next asks, "WHAT IS THE QTH?" This is entered. I use an abbreviation for almost every city to save time and memory. (Being an air traffic controller, and since almost every city has an airport, I use a prescribed three-letter airport identifier. For example, St. Louis = STL, Chicago = ORD, Cleveland =CLE, etc.) Watch out if you do this, however: If an abbreviation is used for a city or for traffic, it must be used throughout the entire session.

After the QTH, the computer asks if there is any traffic. If there is none, simply press ENTER. If traffic is listed, enter it—either the callsign of the station needed or the location sought, and ENTER.

The computer now will store all of the information and repeat the above steps for each check-in left on the list. When it comes to the last entry (the one before the L), it will "run" him and return to the command mode; the TV will display "THIS IS A SCRATCH PAD FOR CHECK-INS." (See Fig. 1.)

There are seven commands available to the user:

L = LIST END
R = LIST ENTRIES
T = LIST TRAFFIC
C = LOOK FOR CALL
F = FIND CITY
E = EDIT
X = DELETE CHECK-IN

Their functions are more or less self-explanatory. L stops the check-in scratch pad and sends the program to gather all the info about each station.

Once the first check-ins are entered, the other six commands are useful. If R is typed in, the program will give you a list of all the stations entered so far (#, call, name, QTH, traffic). Ten stations will be displayed at a time until all have been read out.

Command T lists all the traffic that is being looked for and the stations that have that traffic.

If you have a long list of checked-in stations and don't want to read through the whole mess with the R command to see if a particular station is on the net, use the C command. Type C and ENTER; the computer asks "WHAT CALL SIGN ARE YOU LOOKING FOR?" and you answer, then press ENTER. If the station has been entered previously, the program will come back with his (or her) name, call, QTH, and the number assigned on the list, or it will tell you that he hasn't checked in yet by the fact that he's *not* listed.

The F command works the same as the C command except that it looks for cities instead of callsigns.

The E command was programmed probably because I am a lousy typist. It allows the user to edit any previous check-in already on the list. When the computer is in the command mode ("THIS IS A SCRATCH PAD FOR CHECK-INS"), type E and press ENTER. The program then asks "WHAT NUMBER DO YOU WANT TO EDIT?" The number can be found using the R command as described above. If you want to edit the last station on the list, just hit ENTER.

The computer now will respond as shown in Fig. 8, and you reply with the appropriate number. The computer then asks for the correct information, which you enter.

Command X drops a check-in from the list. Type X in the command mode and press ENTER. The computer then asks "WHAT NUMBER DO YOU WANT TO DELETE?" (which can be found with the R command). Enter the number for the station leaving and hit ENTER. The station will be removed and everyone after him will be moved up one to fill his slot.

There is one more command that is transparent to the operator: the D command (DROP). In the command mode, typing D and ENTER will get the prompt "WHAT CALL SIGN DO YOU WANT TO DROP?" If you answer with a call on the list, the program will place an asterisk at the end of the call string and also at the end of the QTH string. It also deletes any traffic the station had listed. The addition of the asterisk makes string comparison impossible for the other functions (unless you add the asterisk to the call or QTH when you use the other commands).

This command could be used when a station hooks up and moves off the net frequency or says he is checking out but will be back in a few minutes.

The description of the program so far makes it seem like a TV typewriter program for storing a list of all the stations that have checked in. It is much more than that, however, and here is where it shines.

When someone checks in, a data base is set up with call, name, QTH, and

```
10 REM INITIALIZE
20 CLEAR1500 : DIM C$(100),N$(100),Q$(100),T$(100)
100 REM MAIN PGM
105 X=1:Z=1
110 CLS:PRINT"L=END LIST","R=LIST ENTRIES","T=LIST TRAFFIC","C=LOOK FOR
     CALL","F=FIND CITY","E=EDIT","X=DELETE CHECK-IN": PRINT STRING$(63,"-
     "):PRINT" THIS IS A SCRATCH PAD FOR CHECK-INS"
130 INPUT C$(X)
135 IF C$(X)=""THEN GOTO130
137 IF C$(X)="X" THEN GOTO1500
140 IF C$(X)="L" THEN GOTO 200
150 IF C$(X)="R" THEN GOTO300
160 IF C$(X)="T" THEN GOTO400
170 IF C$(X)="F" THEN GOTO500
180 IF C$(X)="C" THEN GOTO600
190 IF C$(X)="D" THEN GOTO700
195 IF C$(X)="E" THEN GOTO900
197 Y=X : X=X+1
198 GOTO130
200 CLS:FOR X=ZTOY
210 PRINT@200, C$(X)
215 IF C$(X)="L" THEN GOTO 110
220 PRINT:INPUT"WHAT IS THE CORRECT CALL SIGN";C$(X)
225 GOSUB 1100
230 PRINT:INPUT"WHAT IS THE NAME";N$(X)
235 IF N$(X)="" THEN N$(X)="N/A"
240 PRINT:INPUT"WHAT IS THE QTH";Q$(X)
242 IF Q$(X)="" THEN Q$(X)="N/A"
245 GOSUB 1200
250 PRINT:INPUT"WHAT IS THE TRAFFIC (NONE-PRESS ENTER)";T$(X)
252 IF T$(X)="" THEN GOTO 260
255 GOSUB 1000
260 CLS:NEXT X
270 Z=X : GOTO110
300 CLS:PRINT" #  ";"CALL","NAME","QTH","TRAFFIC" :PRINTSTRING$(63,"-"):
     FOR X=1TOY
310 PRINTX;"  ";C$(X),N$(X),Q$(X),T$(X)
320 W=W+1 : IF W=10 THEN PRINT:INPUT"(PRESS ENTER TO CONTINUE)";G$:W=0 :
     CLS : PRINT" #";" CALL","NAME","QTH","TRAFFIC" : PRINT STRING$(63,"
     -")
330 NEXT X
335 PRINT:INPUT"   END OF LIST  SO FAR ";G$
340 W=0:GOTO110
400 CLS: PRINT" THIS IS A LIST OF ALL THE TRAFFIC WE ARE LOOKING FOR":PR
     INTSTRING$(63,"*")
410 FOR X=1TOY
415 IF T$(X)="" THEN NEXT X ELSE PRINT T$(X);"  -----   BY  ";C$(X), : N
     EXT X
440 PRINT:PRINT:INPUT " (PRESS ENTER TO CONTINUE)";G$ : GOTO 110
500 CLS :PRINT:PRINT:PRINT:INPUT"WHAT CITY ARE YOU LOOKING FOR";F$
510 FOR X=1TOY : IF F$=Q$(X) THEN PRINT N$(X);" ";C$(X);" IN ";Q$(X);" C
     HECKED IN # ";X : Q=1
520 NEXT X
525 IF Q=0 THEN PRINT F$;"  IS NOT AVAILABLE YET"
530 PRINT:PRINT:INPUT" (PRESS ENTER TO CONTINUE)";G$
540 Q=0:GOTO 110
600 CLS : PRINT:PRINT:PRINT:INPUT" WHAT CALL SIGN ARE YOU LOOKING FOR";F
     $
610 FOR X=1TOY : IF F$=C$(X) THEN PRINT N$(X);" ";C$(X);" IN ";Q$(X); "
     CHECKED IN #";X : Q=1
615 NEXT X
620 IF Q=0 THEN PRINT F$;"   IS NOT AVAILABLE YET"
630 PRINT:PRINT:INPUT "(PRESS ENTER TO CONTINUE)";G$
640 Q=0:GOTO110
700 CLS
710 PRINT:INPUT" WHAT CALL SIGN DO YOU WANT TO DROP ";F$
720 FOR X=1TOY : IF F$=C$(X) THEN C$(X)=C$(X)+" *":Q$(X)=Q$(X)+" *":T$(X
     )=""
730 NEXT X
740 GOTO 110
900 CLS : N=Y :INPUT "WHAT NUMBER DO YOU WANT TO EDIT";N
910 CLS:PRINT:PRINT C$(N),N$(N),Q$(N),T$(N)
920  H=5:PRINT:INPUT " WHAT DO YOU WANT TO CHANGE :
    1  CALL
    2  NAME
    3  QTH
    4  TRAFFIC
    5  NOTHING
---------------
    ";H
930 IF H=1 THEN INPUT" WHAT IS THE CORRECT CALL SIGN";H$ : C$(N)=H$
940 IF H=2 THEN INPUT" WHAT IS THE CORRECT NAME";H$: N$(N)=H$
950 IF H=3 THEN INPUT" WHAT IS THE CORRECT QTH";H$: Q$(N)=H$
960 IF H=4 THEN INPUT" WHAT IS THE CORRECT TRAFFIC";H$ : T$(N)=H$ :T$(X)
     =T$(N) : C$(X)=C$(N) : GOSUB 1000 :T$(N)=T$(X) : T$(X)=""
990 GOTO 110
1000 FOR C=1TOY-1: IF T$(X)=C$(C) THEN PRINT C$(X);"---"; N$(C);"  ";C$(
     C);" IN ";Q$(C);" CHECKED IN # ";C : Q=1
1004 NEXT C
1005 IF Q=1 THEN T$(X)="":GOTO1015
1015 FOR C=1TOY-1:IF T$(X)="" THEN GOTO1016 ELSE IF T$(X)=Q$(C) THEN PRI
     NT C$(X);"---";N$(C);" ";C$(C);" IN ";Q$(C);" CHECKED IN # ";C: R=1
1016 NEXT C:IF R=1 THEN T$(X)="":GOTO1030
1020 IF Q=0 AND R=0  THEN PRINT " NOT AVAILABLE YET" : INPUT "(PRESS ENT
     ER)";G$: RETURN
1030 Q=0:R=0 : INPUT" (PRESS ENTER TO CONTINUE)";G$ : RETURN
1100 FOR C=1TOY-1 :IF T$(C)=C$(X) THEN PRINT C$(X);" CALL ": C$(C);"  ":
     N$(C);"  HE IS LOOKING FOR YOU" :Q=1
1105 IF Q=1 THEN T$(C)="" : Q=0
1110 NEXT C
1140  Q=0:RETURN
1200 FOR C=1TOY-1 : IF T$(C)=Q$(X) THEN PRINT C$(X);" CALL ";C$(C);"  ";
     N$(C);"  HE IS LOOKING FOR YOUR CITY" : Q=1
1205 IF Q=1 THEN T$(C)="" : Q=0
1210 NEXT C
1240 Q=0 : RETURN
1500 CLS:INPUT"WHAT NUMBER DO YOU WANT TO DELETE";D
1510 FOR K=DTOX:C$(K)=C$(K+1):N$(K)=N$(K+1):Q$(K)=Q$(K+1):T$(K)=T$(K+1):
     NEXT K : X=X-1:Y=Y-1:Z=Z-1: GOTO110

DONE
```

Program listing.

traffic. As each element is entered for the station—for example, his correct callsign—the program scans everyone else's traffic to see if that call is being looked for. If it is, the program automatically lets the NCS know. The same is true for the check-in's QTH; as soon as his location is entered, it is compared to the list to see if anyone can use it. If so, the program tells you who is looking for the city, his callsign, and his name. If matches are found, the program reworks the data base and deletes the traffic from the appropriate station(s), keeping everything up to date.

If the check-in has traffic, upon entering it, the previous stations are scanned, and if someone has what he's looking for, the computer lets you know and updates the data base.

From my experience, this system sure beats looking through five pages of log trying to see if you can match up one station with another.

It is my impression that non-programmer types like myself who submit programs for publication are apologetic for their technique. I am not. There is no structure and I do not imply that good technique has been used. Undoubtedly, memory was wasted and speed could be improved, but the algorithm works and, as far as I have seen, no bugs are prevalent. Please change things around if you are inclined to do so.

Program Modifications and Explanations

I do not have a TRS-80 computer. I use a homebrew Z-80 system with 7K of static RAM. My system is configured the same as Radio Shack's, and, to the operator, there is no difference between the two except for all the flashing LEDs and a slightly larger size.

If you are using a Level II with 16K of memory, you should change line 20. It is not necessary that the change be made, but since I run only 7K of RAM, I have to limit my string space. Line 20 dimensions how many stations can be put into the program and clears string space.

Line 920 probably needs explanation (see program listing). What you see is what actually is entered, but after each line of printing, press the DOWN ARROW key; don't enter a bunch of spaces. Everything else should be pretty straightforward.

Final Notes

Sometimes the obvious is not so obvious! When the program is first run and a list of check-ins is entered into the system, another list can be added whenever the command mode appears. The new list is added to the existing list(s) and, in actual operation, I have gotten up to about 75 stations in the program at one time. Execution time with this number is fast enough for smooth operating, but, of course, is not instantaneous.

My system topped out at around 80 stations listed, but only because there is not enough string space available with the CLEAR 1500 statement in program line 20. 16K systems should have no problem handling the full 100 stations, if CLEAR 1500 is changed to a value of, say, 2500.

There are no error-handling routines, so if you feel you will exceed the 100-station limit or the string space that's set aside, use the X command to remove all the stations that are no longer around. If the above are exceeded, the program will BOMB and you will lose all the information that has been entered. Error-trapping in the main program would have been nice, but I didn't have the memory to sacrifice. If you feel you are close to string-space limits, BREAK the program and print the string space available, (PRINT FRE(A$), then type CONT.■

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A Computer-Controlled Talking Repeater

—part I: Introduction

One of the most natural combinations of microcomputer technology and amateur radio is in repeater control. Using the real strengths of the computer to build in features not feasible without it is the challenge. But selecting the features that are truly useful for the average user is also part of the challenge.

Ideally, the repeater should be clean, pleasant to listen to, and be responsive to simple commands of its users. The fact that the repeater is controlled by a computer should be transparent to its users; once the project is complete it's the features, not the computer, that are important.

This article describes a control system built for a small, closed 220-MHz repeater in northern California. The work was shared by Bruce Martin WA6EQS. The features incorporated include all those on our original "wish list"—everything within reason that we felt would be useful on the machine. The controller has been in operation, performing as intended, since June, 1979.

This isn't intended to be a construction article, but hopefully it will present ideas helpful to anyone considering a similar project for repeater control or for other dedicated microcomputer applications.

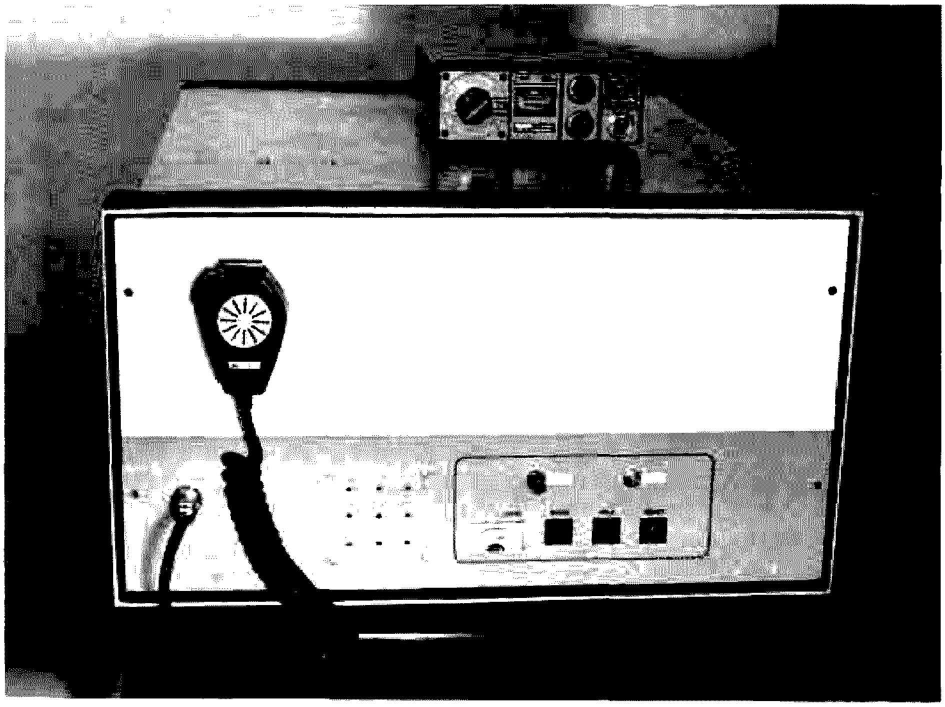


Photo A. Repeater is self-contained inside a 19"-wide cabinet, with the exception of IC-22S two-meter remote base and audio tape cartridge machine (not shown).

Repeater Features

A key to an interactive, well human-engineered repeater is the use of speech synthesis. With a voice, commands can be echoed and information can be provided on almost a conversational basis. The voice should sound natural and be intelligible. Speech-synthesizer boards from Telesensory Systems[1] were used, which provide the voice. They're easy to control and are highly intelligible.

With the widespread use of low-power handie-talkies, it's often useful to check how well you're getting into the machine. Often, when inside a building it's helpful to find a "hot spot." By simply pressing touchtone™ keys, the repeater reads back an S-meter reading. Similarly, frequency error can be measured and read back to check on frequency drift or to net a new crystal onto channel.

The autopatch operation

is simplified and refined to allow easy access and, at the same time, to protect the repeater owner against unauthorized and long distance calls. The phone number entered is read back to the user, allowing him to cancel the request if he entered it wrong. The repeater actually does the dialing, virtually eliminating wrong numbers. Before dialing, the repeater checks the phone number prefix against a table of local dialing prefixes to determine if it's a toll charge. Toll calls can be made, but require more user interaction. This makes the user aware that the call will be billed, and prevents abuse by unauthorized users.

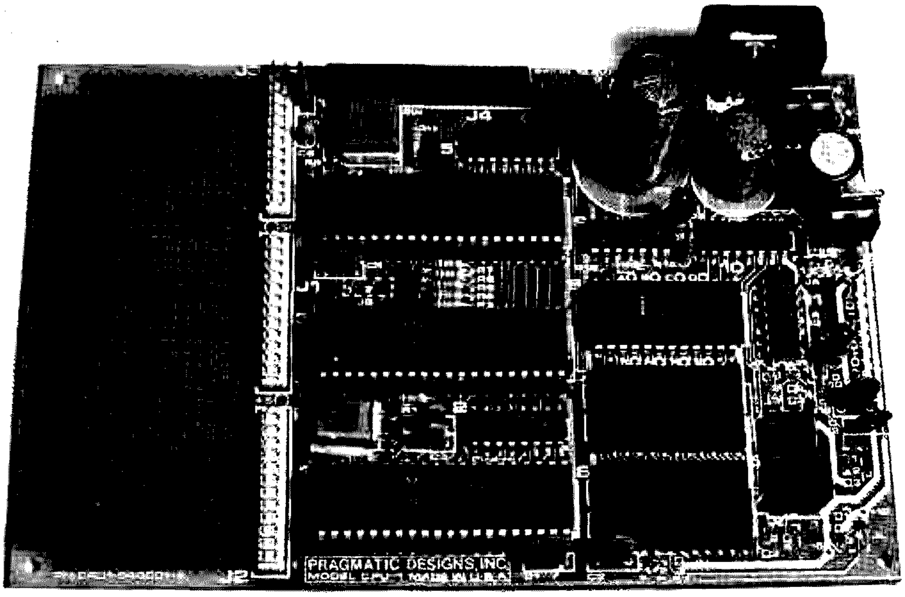


Photo B. Pragmatic Designs CPU-1A microcomputer for dedicated applications. I/O interfaces through 26-pin Great Jumper™ cables (A P Products). Breadboard area allows customizing to fit the application.

Aside from standard phone-patch operation, a versatile autodialer is available for frequently called numbers. Storage of phone numbers is in CMOS RAM, with independent battery backup, allowing users to enter any local phone number into any of sixty autodialer locations as well as to change or move them at any time. The numbers are loaded over the air using touchtone commands. The autodialer greatly improves the safety of patch operations when the user is driving. Autodialer location and phone number readback ensure dialing the correct number.

Single-digit access to the telephone operator simplifies emergency communications. A simple touchtone sequence accesses the "time lady," so there's no need to build a time-of-day clock into the repeater (got away easy on that one).

The reverse autopatch has been taken a step further, allowing a directed ringback. When someone wants to contact a user of the repeater, a phone call to the repeater and entry of the correct command causes the machine to say the call of the individual, then "ring" until picked up or until a one-minute timer times out.

The repeater can be tied to two meters as a remote base. The two-meter equipment is an Icom IC-22S and is programmed by the user to any frequency between 145.8 and 148 MHz, for simplex or plus or minus 600-kHz transmitter offset. The repeater reads back the frequency and offset when changed. The remote base transmitter is enabled independently, allowing monitoring only and talking over the two-meter signals. The remote base allows flexible emergency communications should the need arise.

Since the control over the air is by touchtone commands, a touchtone pad test feature allows checking pads by reading back any sequence of keys sent.

The repeater operates with a long hang time, with a beeper to indicate the end of a transmission and timer reset. An audio-delay line is used to allow muting of the received signal squelch tail, as well as to mute touchtone command signals. The absence of the double kerchunk heard on most repeaters makes the machine far more pleasant to listen to.

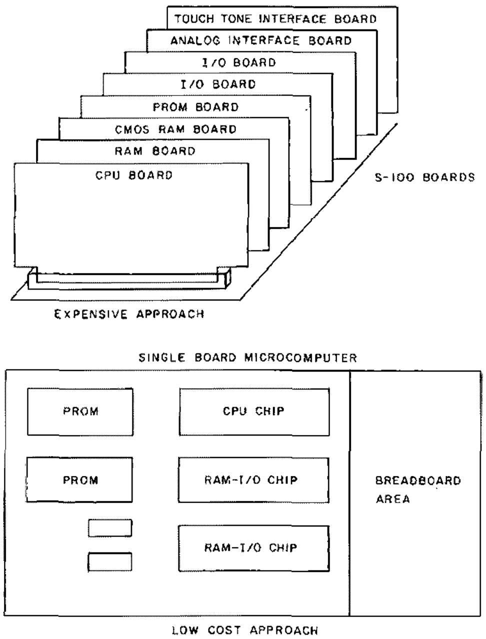


Fig. 1. Expensive approach vs low-cost approach to dedicated application microcomputer.

The speech synthesizer allows voice rather than CW IDs. Exor, the little man with the voice, tries hard to avoid interrupting a conversation and will never talk

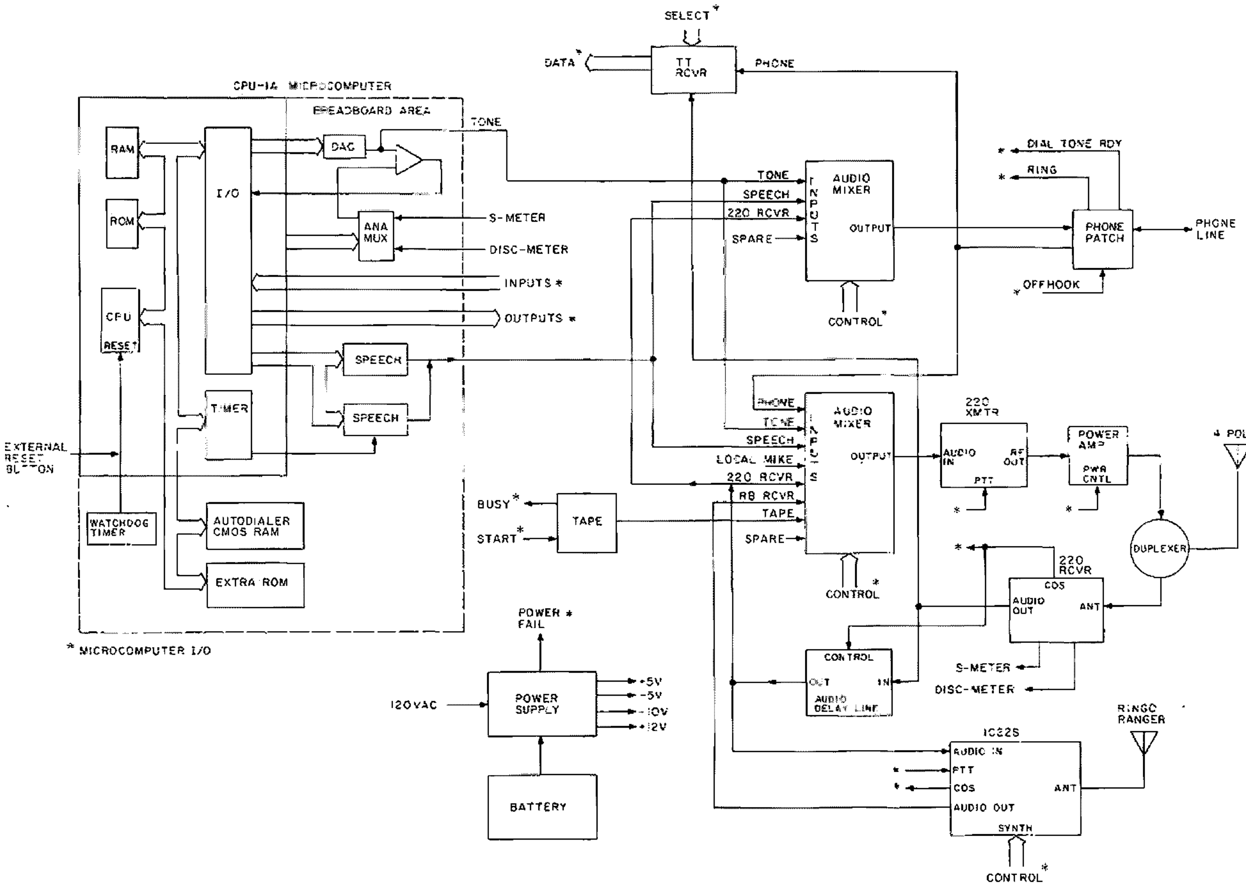


Fig. 2. Repeater hardware block diagram. Microcomputer provides all timing and control.

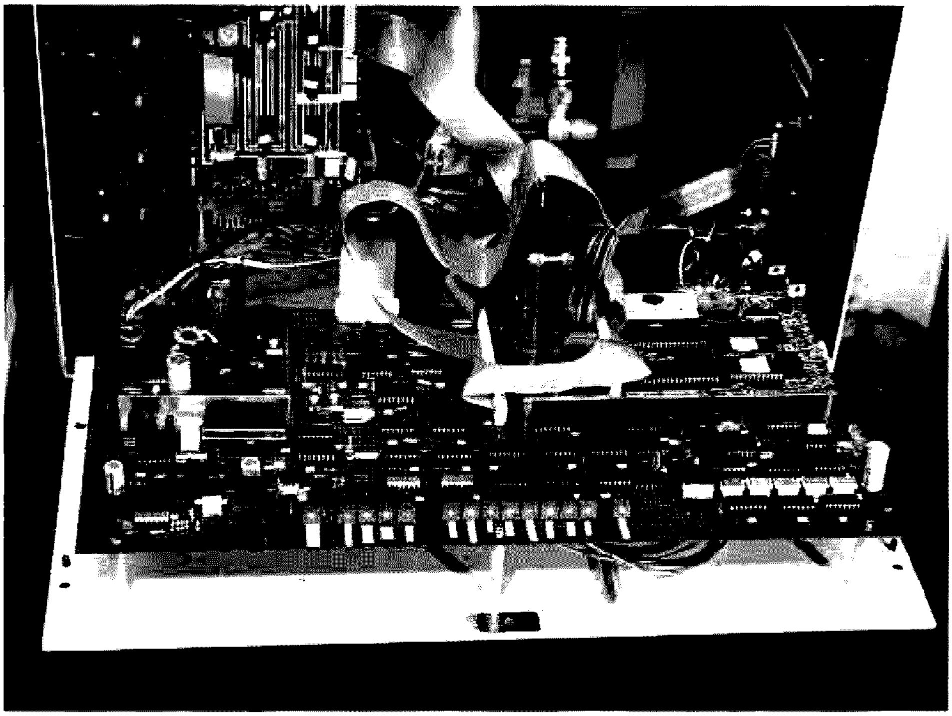


Photo C. Repeater control board. Main board mounts on the cabinet's "front door." Clockwise from upper right are CPU-1A microcomputer, audio delay line, audio mixers, phone patch, and dc-dc converter.

over anyone. Since an ID is required at least every ten minutes, starting at six minutes in the repeater looks for a hang-timer time-out to work in its ID. By nine minutes in, it will try to ID at the end of a user's transmission and, if all else fails, Exor will get out his key and ID in Morse code over a conversation at ten minutes in. If someone starts to transmit while he's speaking, he'll stop and wait for another opportunity so as not to be rude.

An audio tape cartridge machine contains another voice ID—this one by Nancy. She is touchtone commandable and also comes up every thirty minutes on the hour and half hour for a time-reminding ID. If a QSO is in progress when she's scheduled to speak, she waits until the end (hang-timer timeout). As a result, she never inter-

rupts but often gets in the last word of a QSO.

Design Approach

Several approaches can be taken in selecting the computer used in a repeater controller. A number of commercially available boards—CPU, RAM, ROM, I/O, and other special function boards—could be assembled to form the computer. For example, an S-100 motherboard plus off-the-shelf S-100 cards would do the job nicely, but would cost well over $1000! A more cost-effective approach (and the one used in this project) is to use a single-board microcomputer specifically intended for dedicated applications. The computer is treated as a programmable logic block in the system. The board selected includes enough breadboard area right on the board for customizing and interfacing to the rest of the repeater and costs only $160 as a kit. Aside from the low cost of this approach, reliability is enhanced because of the very many fewer components and interconnections of a single board computer.

The 8085A CPU was selected based on programming experience and development capability. The 8085A is also ideal in that it can be configured for a very low parts count but complete computer, with all the software power of the original 8080. It also has a versatile interrupt structure built in, high speed, and single +5-volt supply.

The Pragmatic Designs[2] CPU-1 Single-Board Microcomputer uses the 8085A and its LSI companion, 8155, which provides 256 bytes of RAM, 22 I/O lines, and a programmable counter/timer. The CPU-1A uses two 8155s and was selected for this project. Up to 4K of EPROM can be accommodated directly on the CPU-1. Customizing and interfacing can be placed neatly in CPU-1's breadboard area.

A fundamental design decision made at the beginning of the project (one made in any microcomputer project) was determining which functions would be implemented in hardware and which in software. In general, this decision is based on minimizing overall cost, which primarily includes development cost and manufacturing cost. Since software is largely a one-time development cost while hardware costs are attached to each unit produced, the decision depends on how many units are to be produced. If many are to be built, a software-intensive design is preferred because the development cost is spread out over the large number of units, while manufacturing cost is minimized because of the reduced amount of hardware.

In this project, where only one repeater controller is to be built, implementing in

Photo D. Development system consisting of IMSAI 8080, dual floppies, keyboard, and 9" CRT. ROM-simulator boards connect to small dedicated application microcomputers for in-circuit emulation-type software debug.

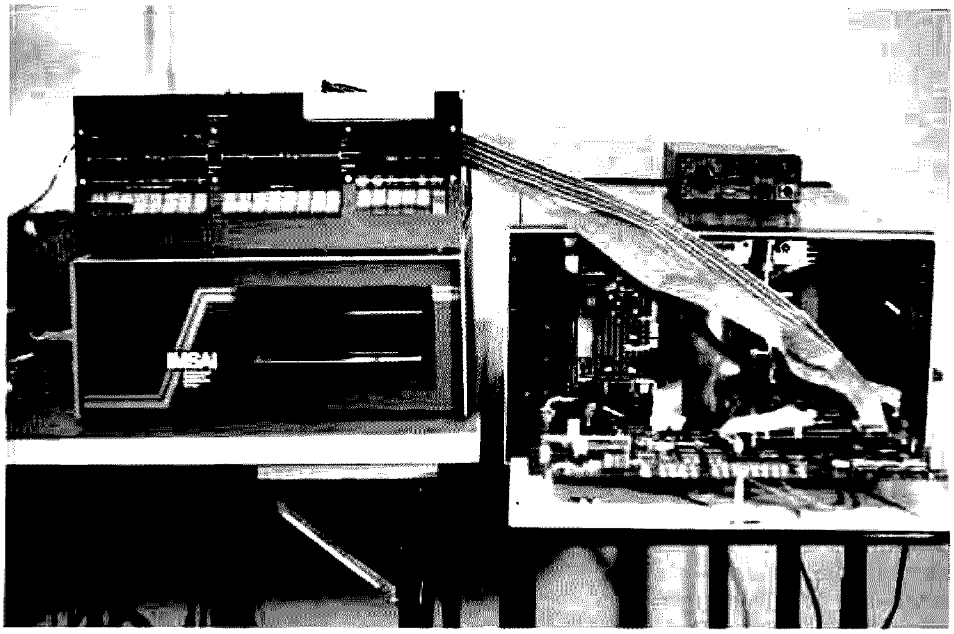


Photo E. Repeater in final checkout. Program runs out of ROM simulator in IMSAI to allow rapid program changes.

and shortens the repeater hang time to conserve power.

Software

Writing a large program to control a system in real time is quite a bit different than writing small applications programs which run on a general-purpose microcomputer. There are lots of books that describe assembly language instruction sets in detail and guide the newcomer through examples of writing small programs. Real-time control programming, however, where the computer is apparently performing many control tasks simultaneously, is an area that hasn't been widely written about. We're pretty much on our own.

There exists from Intel a Real-Time Multi-Tasking Executive (RMX/80™) which provides the software nucleus for a system such as the repeater controller. Since it costs $2100 and requires use of their $15k development equipment and their $500 single-board computer, I chose not to use it.

The key to approaching the software development in a project such as this is to find or design a simple, general-purpose nucleus with enough capability to handle the specific job. The nucleus will be described in detail in part II of this article, but Fig. 3 illustrates its fundamental organization.

An Initialization module sets up the hardware and program variables on power-up or reset.

The Foreground module manages "foreground tasks," which include activities such as speech synthesizer control, tone generation, and command sequence detection.

The Background module is an interrupt routine executed every 5 ms. It monitors receiver squelches, phone ring, and other status

software only those functions difficult to implement in hardware would be reasonable. But since the goal of a hobby project is not to minimize cost but to learn, I bit the bullet and made the design heavily software-intensive. A general-purpose, real-time software nucleus was developed which has been applied to other projects since starting the repeater design. The control system illustrates the capability of a minimum-configuration microcomputer. Reliability and power consumption are improved in the system as a result of the minimum-hardware approach.

Hardware

The repeater hardware will be discussed in detail in parts II and III of this article, but an overview can be provided by the block diagram in Fig. 2. The rf portion of the machine consists of a split-apart Midland 13-509, with a preamp and 50-Watt power amplifier. A duplexer allows use of one antenna for both transmitting and receiving.

The microcomputer provides all timing and control required by the repeater. The CPU-1A contains the CPU, RAM, ROM and I/O for the microcomputer. Mounted in the breadboard area of the CPU-1A is a digital-to-analog converter (D/A) for tone generation. A software-controlled analog-to-digital (A/D) converter is formed with the D/A plus the comparator and analog multiplexer. The Telesensory speech synthesizer boards and a small CMOS RAM board with battery backup plug into connectors mounted on the CPU-1A. A watchdog timer generates a reset pulse if a software bug or noise glitch causes the computer to crash and be unable to service the timer.

The touchtone receiver connects to the 220 receiver and to the phone line. Audio mixers under computer control connect the proper audio sources to the 220 transmitter and to the phone line. The audio-delay line circuitry allows muting of squelch tails and touchtone signals before they reach the transmitter audio input.

The two-meter IC-22S synthesizer is programmed by ten output bits from the microcomputer, with simplex or plus or minus 600-kHz transmitter offset.

The power supply contains a dc-dc converter for the negative supply so that only +12 volts is required for repeater operation, simplifying battery backup. If ac power fails, the microcomputer reduces the power level of the transmitter

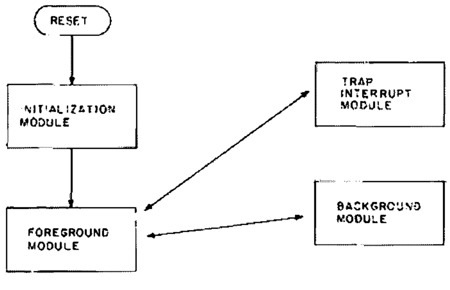


Fig. 3. Software nucleus block diagram.

signals. It decides transmitter off/on and phone off/on hook. The Background module also performs periodic A/D conversions and stores the results in memory.

An important element in the Background module is a general-purpose timer structure. Any number of independent timers may be implemented, with limitations based only on total execution time relative to the interrupt period. Each timer has a unique routine associated with it which is executed on timeout of that particular timer. The repeater controller uses 19 timers, for such functions as beep timer, hang timer, phone-patch timeout, phone-answer delay timer, etc.

Finally, a separate Trap Interrupt module loads touchtone commands into a RAM buffer when received, to be evaluated later by the sequence detector in the Foreground module.

While developed specifically for the repeater-control software, the nucleus is general purpose and can easily be adapted to many similar real-time control applications.

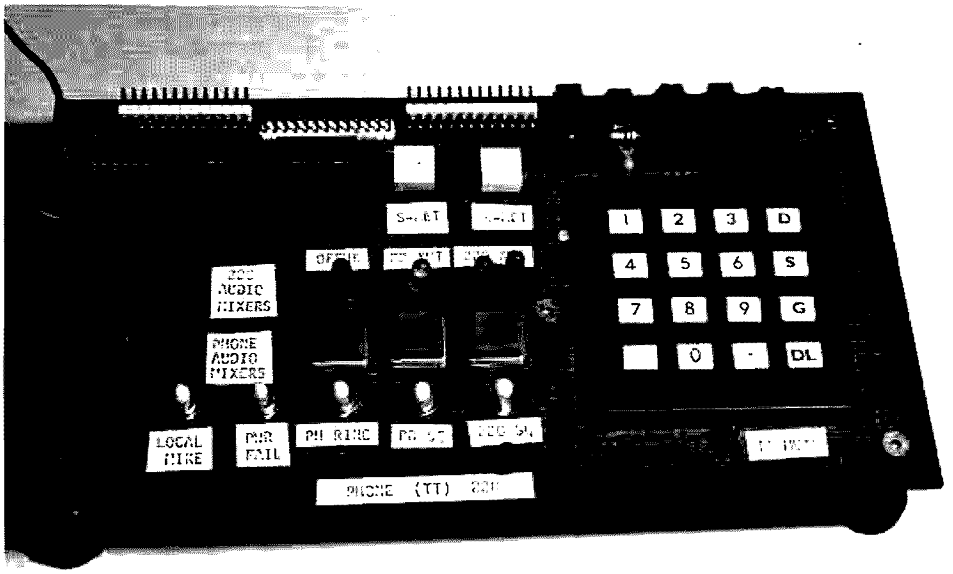


Photo F. Repeater simulator used during software development before checkout was possible on actual repeater.

Development Equipment

The development approach used in this project was ROM simulation—the program ROM of the repeater's computer during development was actually RAM inside an IMSAI S-100 computer. Three Pragmatic Designs DBM-1, 2K-byte ROM simulator boards were used.

The ultimate approach to microcomputer development is CPU in-circuit emulation. The CPU in the microcomputer under development (target) is replaced by a cable which goes to the development system computer. The development system can then emulate the target computer's CPU and any combination of RAM, ROM, and I/O. The cable is the link between the powerful diagnostic capability of the development system and the realities of the target computer hardware.

Development systems with full in-circuit emulation capability, such as the Intel MDS or Tektronix 8002, cost $15-20k, putting them beyond the reach of many potential users. Emulation of just the program ROM rather than the CPU is an effective alternative approach to developing and debugging small- to medium-sized programs which run in target hardware. The link from a low cost S-100 computer can be through the target computer's ROM sockets. A ROM simulator looks like RAM to the development computer, and like ROM to the target. The target program can be loaded and modified from the console of the S-100 development computer but can run in the target computer, allowing rapid program changes as bugs are found and corrected.

The development equipment used in this project consisted of an IMSAI 8080 with 28K of RAM, a pair of Persci full-sized floppy disk drives, and three Pragmatic Designs DBM-1, ROM simulator boards to simulate up to 6K of program memory in the repeater's computer.

One of the most critical requirements for effective use of any development hardware is good quality, reliable system software—disk-operating system, assembler, and debugger. Such software exists for 8080/Z80-based systems from Digital Research. The CP/M™ disk-operating system manages access to information stored on disk and includes file-handling utilities, a text editor, an 8080 assembler, and a debugger program. Also available from Digital Research[3] is MAC™, a nicer assembler with macro-capability, and SID™, a debugger program which allows symbolic as well as absolute references.

This software must be the greatest bargain in the world of microcomputers today. Comparable software packages from Intel for their development systems can cost several thousand dollars, while CP/M—in many ways better than other industrially-available system software—costs about $100!

Since the software development was spread out over several months and the repeater was not available until final checkout, the bulk of the software was checked out on a repeater simulator—LEDs and switches simulating the repeater's functions (Fig. 4). A simple circuit with keypad simulated the Mostek MK5102 touchtone receiver. An audio amplifier and speaker were used to listen to the speech synthesizer and tone generator during development.

The microcomputer hardware was designed and built in parallel with the software development. The hardware was tested first using simple routines run with the ROM simulator before attempting to bring up the repeater software.

When the hardware was known to be working, the basic software foreground/background nucleus was brought up. Just a switch simulating receiver squelch and an LED indicating transmitter status were used to test a simple COR and timer function. Af-

ter the nucleus was known to be working, the various foreground and background routines were written and tested to implement the features desired.

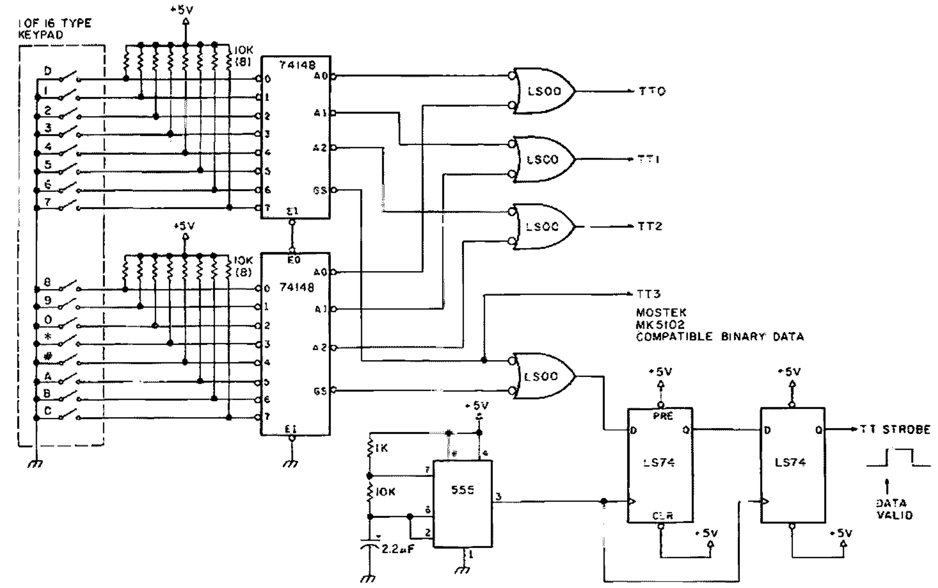
When the software was complete and the remainder of the interface circuitry was completed, the system was ready to be integrated into the repeater. The machine was brought down off the hill and the mechanical work was done to mount the new hardware. The repeater simulator was unplugged from the computer, the control board was plugged in, and presto!—within a couple of hours the repeater was back on the air. The machine stayed at the low level site for two weeks to complete mechanical work, do some rf work, make minor software changes, and let the system burn in.

Next Time

Part II of this article will describe details of the microcomputer hardware and the software nucleus. Part III will discuss hardware and software interfacing of peripheral circuits including the speech synthesizer, remote base, audio delay line, and other sections that may be of particular interest.■

References

1. Telesensory Systems, Inc., 3408 Hillview Avenue, PO Box 10099, Palo Alto CA 94304.
2. Pragmatic Designs, Inc., 950 Benicia Ave., Sunnyvale CA 94086.
3. Digital Research, Box 579, Pacific Grove CA 93950.



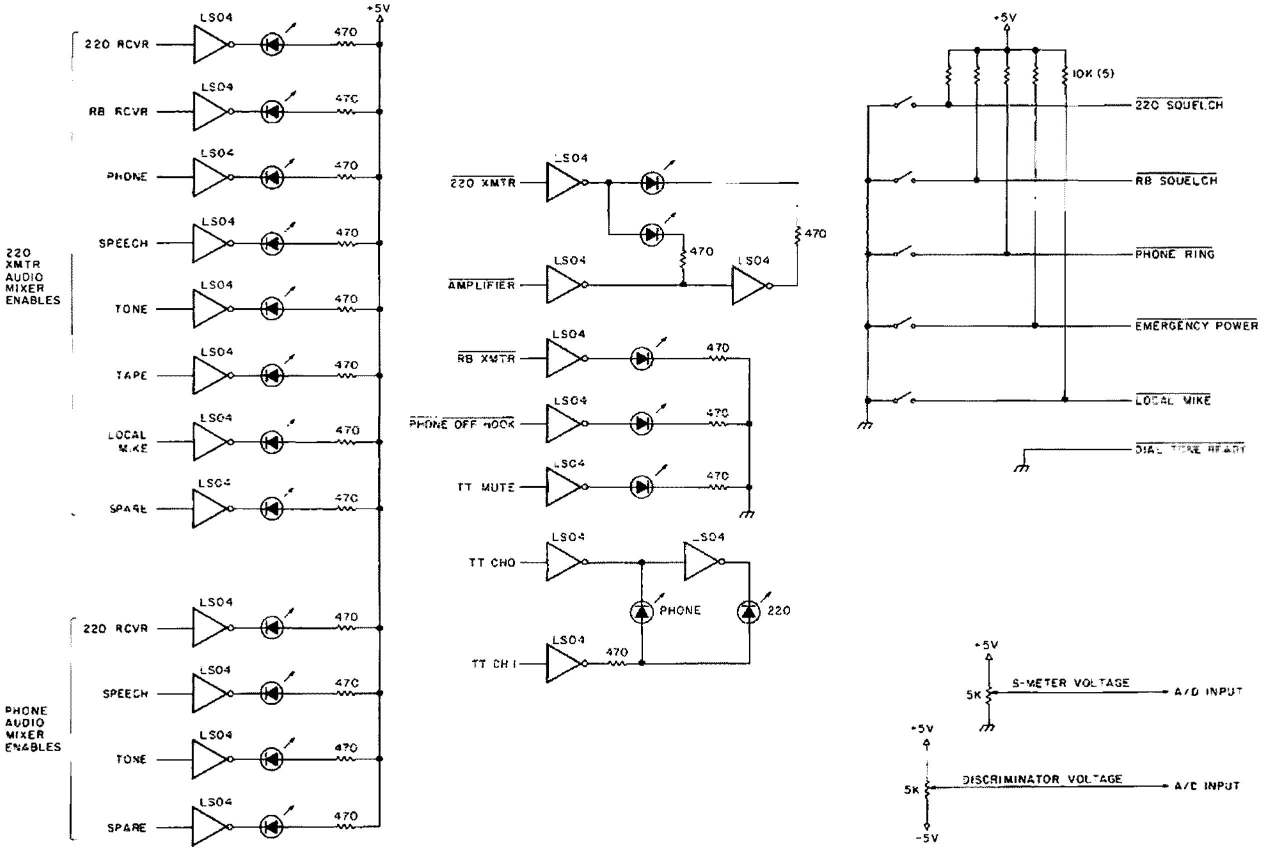


Fig. 4. Repeater simulator. Switches and LEDs simulate the repeater's status inputs and control outputs during software development. Keypad plus logic simulates Mostek MK5102 touchtone receiver.

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Murphy's Own OSCAR Tracker

—simple pointer for satellite antennas

I had decided to embark on the video RTTY route by way of the Radio Shack TRS-80 and the Macrotronics M-80 ham interface. Since N6EE has done all of the work on the M-80, there was little involved in getting the system going on teletype. However, I had chosen that system over a dedicated RTTY video system because of my interest in OSCAR. Once I had a program to obtain antenna bearings for satellite passes, it seemed a logical step to let the computer control the antenna directly.

As I considered the problem, I realized that there could be many possible approaches from the trivial to the elegant. Recalling that one computer corollary of Murphy's Law states that the likelihood of a program working is inversely proportional to its complexity, I decided on a trivial approach. The M-80 hardware has both solid-state- and relay- (or optoisolator) controlled switches which respond to commands from the computer. For example, the BASIC statement X=INP(3) will cause the normally-closed relay contacts to open, while X=INP(4) will close them again. It seemed then that once antenna bearings were known, a simple timing routine to turn the antenna rotor on and off through the M-80 board would suffice.

To do that, I needed to know a bit about the timing features of the computer. I decided to use the engineering (try and try again) rather than the scientific (figure it out) approach to this problem. Program 1 is a short program that will cause the computer to function as a clock. Statement 1 allows entrance of current (or just future) time in hours and minutes. The input statement then holds execution until ENTER is hit. Print CHR$(23) sets up a 32-character line instead of the usual 64-character line. Statement 2 prints the time in hours, minutes, and seconds in the center of the screen. The loop does the timing (that is the reason for the program, after all) while the following statements take care of adding minutes after 60 seconds and adding hours after 60 minutes. If you run this program on your machine, you will be able to see how many executions of the FOR-NEXT loop equal one second. I found that 551 came quite close. The longer you let the program run, the more accurate will be the estimate.

With that done, the rest of the task is really easy. Program 2 shows the routine for controlling the antenna—it is not a complete program in itself. My satellite-tracking program calculates antenna bearings (azimuth and elevation—though I currently control only azimuth) for each minute of a satellite pass. These are stored as

```
1 INPUT "ENTER TIME IN HRS, MINS";H,M:INPUT"HIT
  'ENTER' TO START CLOCK";Z:CLS:PRINT CHR$(23)
2 PRINT@534,H;":";M;":";S
3 FOR I=1 TO 551:NEXT
4 S=S+1:IF S<60 THEN 2 ELSE S=0:M=M+1:IF M=60
   THEN M=0:H=H+1
5 IF H=24 THEN H=0
6 GOTO 2
```

Program 1. Trivial clock.

```
600 IF D(INT(I9/2))<360 AND D(INT(I9/2))>180 THEN FOR
     I=1 TO I9:IF D(I)<90 THEN D(I)=360:NEXT ELSE NEXT
605 I9=I9-1:FOR I=1 TO I9:D(I)=ABS(D(I)-D(I+1))/6:NEXT:
     X=INP(4):PRINT "SET ANTENNA TO PROPER INITIAL
     HEADING AND SET TRACKING SWITCH":INPUT"HIT 'ENTER'
     TO START TRACKING";X$
610 FOR I=1 TO I9:FOR J=1 TO 15000:NEXT
615 X=INP(3):FOR J=1 TO 500*D(I):NEXT:X=INP(4)
620 FOR J=500*D(I) TO 15000:NEXT:NEXT:GOTO 555
```

Program 2. OSCAR tracking routine. Note: I9 is a variable set in the body of the program. It equals the total number of minutes that the satellite is available for communication.

D(I) during the computation process. The program allows the user to see these on the screen or to obtain a printout. After all values are obtained, the machine asks, "Do you want antenna control?" If you indicate "yes," then the program branches to line 600, which is where Program 2 begins.

This routine is relatively straightforward. After some housekeeping which I will explain in a moment, the program begins keeping time. It is started by the user hitting ENTER. It then delays 30 seconds, rotates the antenna for a sufficiently long time to get to the bearing for minute 2, it delays for the balance of minute 1, then delays another half minute before rotating to the bearing for minute 3.

Here are the details. Since the bearings may begin just east of north then continue to the west, as with a morning pass, I decided to let the antenna sit at north and then track west, which is what I generally do when controlling manually. Therefore, line 600 asks if the middle of the pass has bearings to the west of the QTH (between 280 and 360 degrees). If so, any bearings which are less than 90 are converted to 360. This means that several bearings will be 360, then bearings will decrease in value toward 180.

Line 605 changes the D(I) to values which will be usable in the timing routine. They are changed in the following manner. D(1) now equals the original D(1) minus D(2) divided by six. Actually, the absolute value of the difference is used. The difference is the difference in degrees between the antenna bearing at minute 1 and that at minute 2. The division by six is done since my rotor moves at 6 degrees per second. Thus, D(I) is now the number of seconds that the rotor must be turned on to move from bearing 1 to bearing 2, etc.

Line 610 starts the timing process after ENTER has been hit. The I loop is used once for each minute of tracking. The first J loop—for 1 to 15000—provides a 30-second delay. Then, in line 615, the X = INP(3) statement turns on the rotor, J loop keeps it on for D(I) seconds, and X = INP(4) turns it off. Line 620 then continues to delay for 30 − D(I) seconds, then the process begins again. Line 555 is in the body of the main program and asks the user if computations are required for the next orbit.

I should make one comment about the hardware. I am using the 5-volt supply and normally-open relay contacts to control a second relay which I have placed in the housing of my rotor control. That relay, in turn, controls the rotor. An SPDT switch determines whether closure of the relay will cause clockwise or counterclockwise rotation. So, at the start of a pass, I place the antenna in the correct initial position and set the switch according to which way I want the antenna to move. At the proper time, I hit ENTER, and then tracking will be done automatically during the pass.

There are certainly more elegant ways to perform this task, but I doubt if there is a much simpler way. Even with the two programs shown here, though, you can make some nice refinements. For example, you can use the clock in program 1 to display time until the pass is to begin, then automatically trigger line 610 and begin tracking. ■

Counting with Class

—build this 500-MHz LSI frequency counter

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After deciding that I could no longer do without a frequency counter, I began to look through my back issues of *73* for ideas. It seems that the accepted way to build a counter is by stacking together as many counter-latch-display driver sets as you want digits. Looking at the ads for today's commercially-built counters, it's obvious from size alone that this approach has become outdated. The way to go is LSI (large-scale integration).

The choice of ICs that are available is very broad. There are quite a few companies putting a lot of great circuits on LSI. After reviewing many data sheets, I decided that LSI Computer Systems LS7031 had everything I wanted. It's billed as a "6-decade MOS up counter with 8-decade latch and multiplexer."

What this means in an 8-digit counter is that it replaces six of the eight decade counters, all eight latches, and requires only one external decoder driver for the display. This is a savings of 21 standard TTL ICs. Other considerations which made it ideal were: TTL compatible I/O, single 5-V supply operation, and external decade-counter inputs for the first two digits. Due to the provision for external TTL decade counters, 1-Hz resolution can be obtained since it is not limited by the relatively slow MOS circuitry. The pinout given in the data sheet is included.

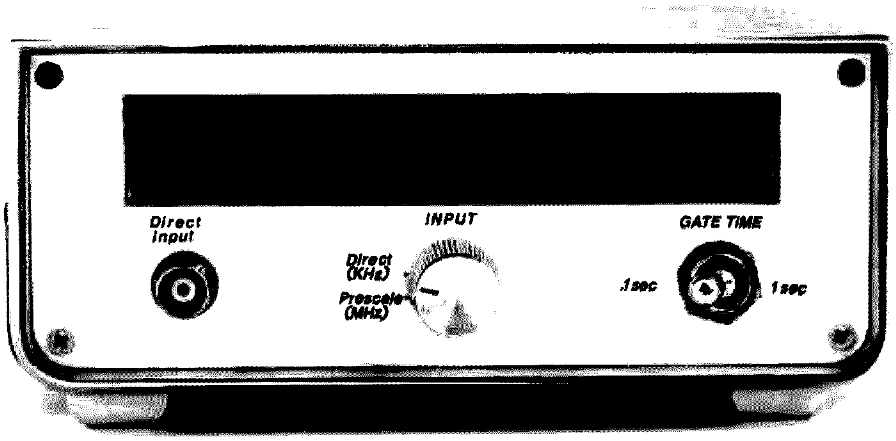

Photo A. Front panel.

Operation

An 8-digit counter which I designed around the

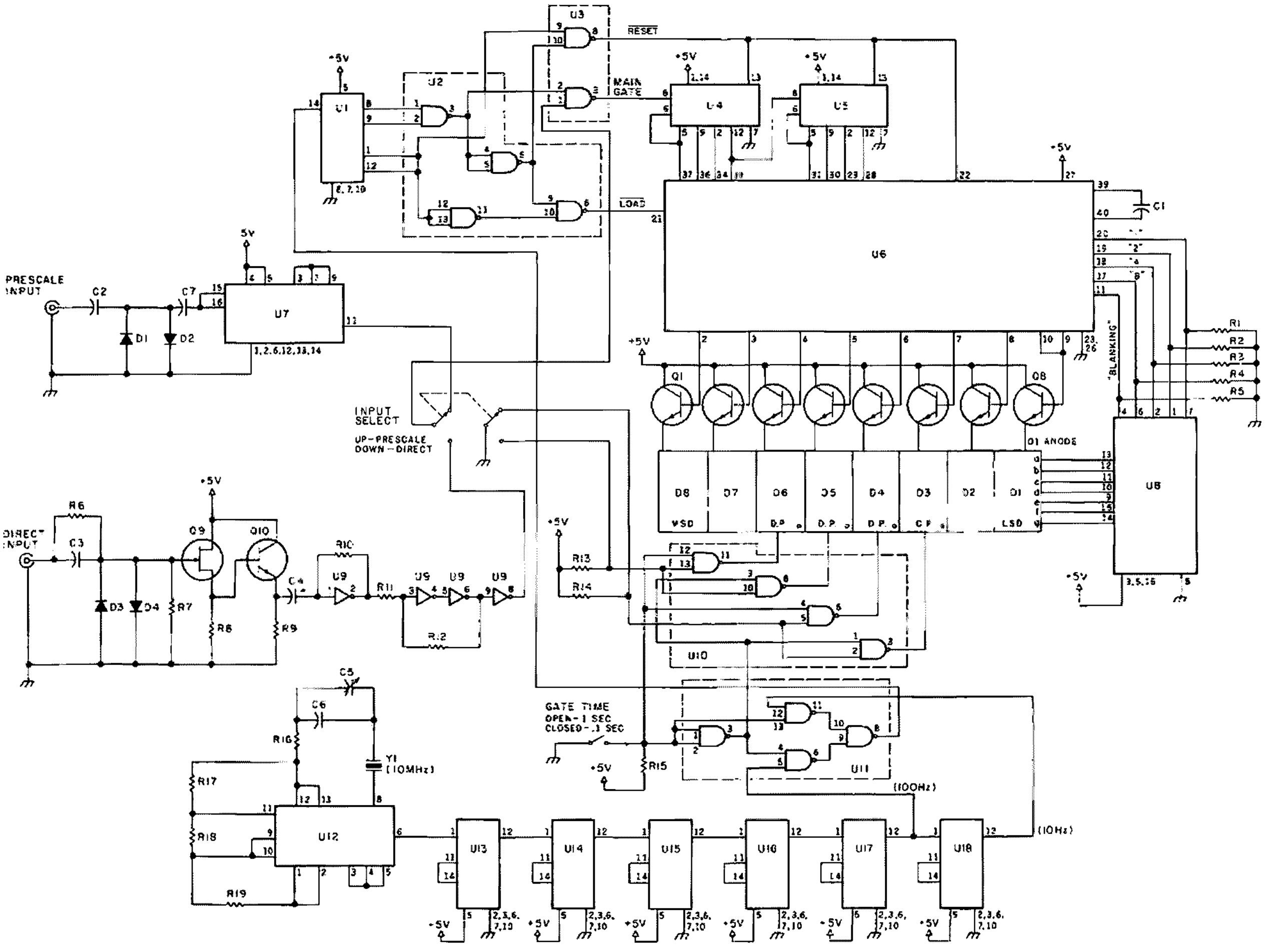

Fig. 1. Schematic. For U2, U3, U9, U10, U11, and U12, Vcc = pin 14 and ground = pin 7. Note: Two gates in U3 and two inverters in U9 are not used; ground all unused inputs.

LS7031 is described below. It has 1-Hz resolution on direct or 10-Hz resolution on prescale using 1-second gate time, or 10-Hz resolution on direct and 100-Hz resolution on prescale using .1-second gating. The direct input is good to at least 50 MHz, and the prescaled input should exceed 500 MHz. The counter has leading 0 blanking, and, if turned on with no input signal, will just display a 0 at the least significant digit position along with the decimal point to remind you what range you are on. In the direct mode, the decimal point is placed to read in kHz; in the prescale mode, the display is in MHz.

Circuitry

As can be seen in the block diagram, the LS7031 greatly simplifies the circuitry. The prescaler is an 11C90 ECL IC which divides the input signal by 10 and outputs in TTL. The direct input preamp was taken from "The Latest in Counters" by WA1UFE, in the December, 1976, issue of *73*.

The input-select switch chooses the source. This signal is gated by U3 during the 0 to 9 counts of U1. At count 10, the $\overline{\text{Load}}$ input to U6 goes low, latching in each digit's value and displaying it, and at count 11, the $\overline{\text{Reset}}$ line goes low, resetting to 0 all the counters, both internal and external. Then it begins to tabulate a new value during the

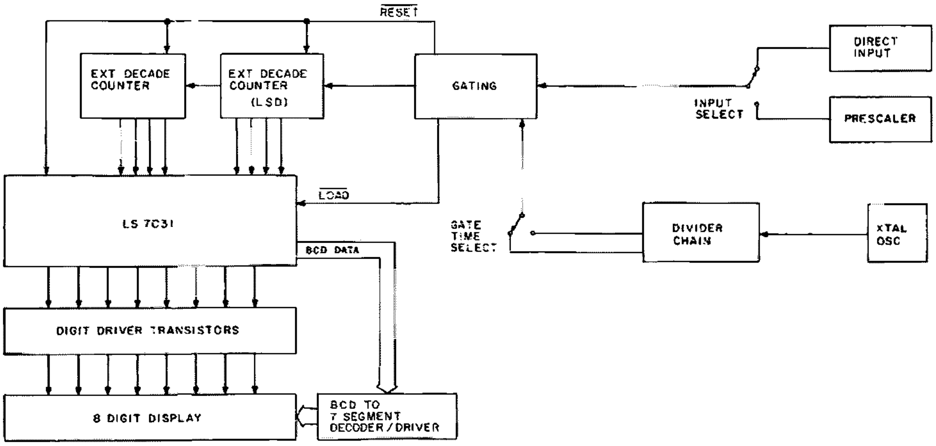

Fig. 2. Block diagram of LSI-based counter.

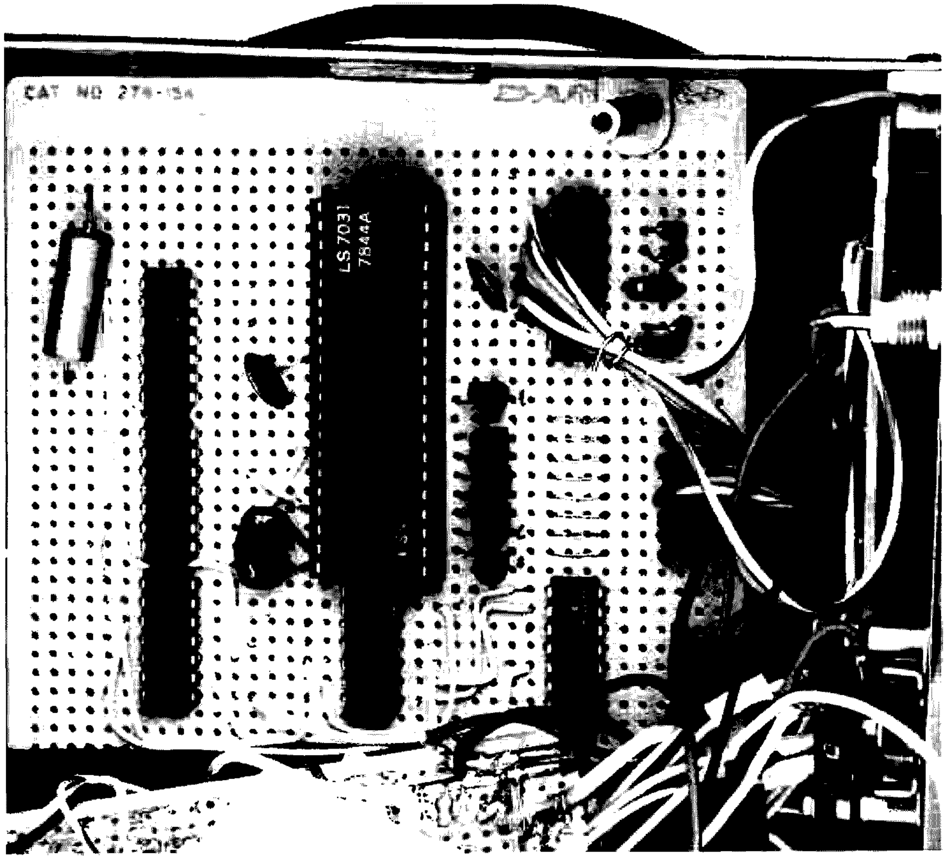

Photo B. Count/gate/display board, showing placement of parts — especially the digit-driver transistors.

0 to 9 count of U1, but the display keeps the old value until a new one is available, making a nice, steady display.

The crystal oscillator and divider chain provide 100 Hz or 10 Hz to U1 for .1- or 1-second gating, respectively. U10 places the decimal point in the proper place depending upon the gate time and input chosen. All of the cathodes for each segment should be wired together from display to display, except for the decimal point cathodes which go to U10 for D3 through D6. U8 takes the BCD data from U6 and drives these segment buses. C1 on U6 provides the display multiplexing rate.

Construction

I assembled the counter on two Radio Shack multipurpose edge card boards. One board was used for the oscillator-divider chain, prescaler, and direct input preamp, and another was used for all the other components. For the latter, the board style with two voltage source buses etched on it was used. This made connection to U6 easier and provided a neat layout for the display driver transistors, where the bases went to the U6 lands, the collectors soldered directly to the 5-V bus, and the emitters spanned across to their own land for easy connection of wires to the display.

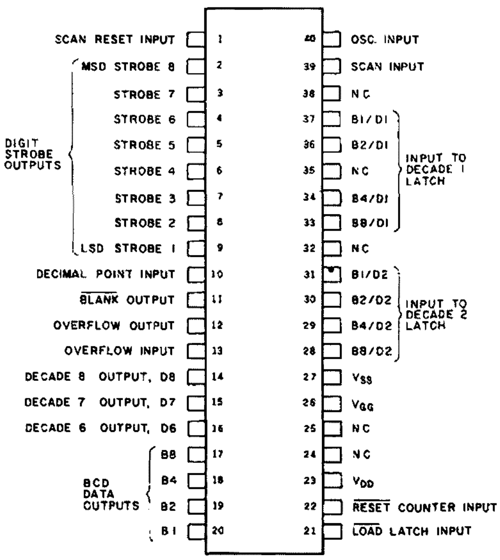

Fig. 3. Top view, pinout for LS7031.

Parts List

ICs	
U1	7492
U2	7400
U3	74LS00
U4,U5	74196
U6	LS7031
U7	11C90
U8	7447
U9	74LS04
U10,U11	7400
U12	74LS00
U13-U18	7490
LM309K	
Transistors	
Q1-Q8	2N3704
Q9	MPF102
Q10	2N708
Diodes	
D1-D4	1N914
D5-D8	1N4001
Resistors (all ¼ Watt)	
R1-R4	1k
R5	560
R6	100k
R7	1 meg
R8	4.7k
R9	220
R10	560
R11	470
R12	15k
R13-R15	1k
R16	220
R17	1.8k
R18	220
R19	560
Capacitors	
C1	500 pF
C2, C7	.01 uF
C3	68 pF SM
C4	47 uF, 10 V
C5	20 pF trimmer cap
C6	15 pF
Pwr. Sup.	2500 uF, 15 V
	1 uF, 6 V tantalum
Displays	
D1-D8	FND-507 or any other common-anode display

Misc.
Y1 — 10-MHz crystal
Gate time switch, SPST
Input select switch, DPDT
On/Off switch, SPST
BNC or SO-239 connectors for inputs
40-pin DIP socket

A 40-pin socket must be used for the LS7031, and be careful not to touch the pins when you insert the chip, as MOS is static-sensitive.

If you use FND-507 ½" displays, there's an excellent mounting technique I thought of which you may wish to use. Since these displays have their pins in a horizontal DIP configuration, they can be mounted as if they were ICs. Both CSC and Radio Shack offer an experimenter's PC board which is etched to match a protoboard-type breadboard socket. It just so happens that eight FND-507s fit perfectly on one of these boards.

Before installing them, use bare wires as jumpers on the component side of the board, and wire together all the segments (all "a" segments together, all "b", etc.). There are ten holes in each column; subtracting two for the display, that leaves room for the seven horizontal bus lines to be run on the component side. Two of these will be under the display, so wire them first. Now solder on the displays, and you have an instant display multiplexing board. One final construction note: Make sure that you use a 560-Ohm resistor for R5.

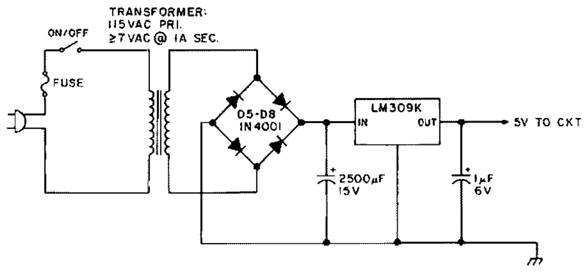

Fig. 4. Power supply for frequency counter.

Parts

All of the parts except the 11C90 prescaler and the LS7031 are extremely common and inexpensive. The LS7031 can be bought from the manufacturer: LSI Computer Systems, Inc., 1235 Walt Whitman Road, Melville NY 11746. The 11C90 can be ordered from a number of *73* advertisers.

Conclusion

I used an old cabinet from a Lafayette low-band police monitor and even used the SO-239 connector on the back and some of the switches. The opening for the dial accommodated the display perfectly.

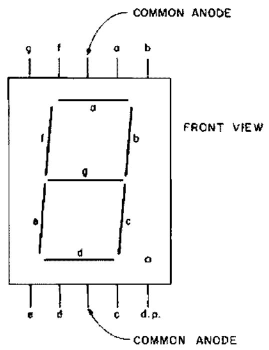

Fig. 5. Pinout for FND-507 or -510 common-anode display.

This is a good project to customize with, as no placement or other problems are important. I happened across a crystal oven for mine, but accuracy without it is completely acceptable (depending, of course, on the crystal used). It's fun to use LSI, and the fewer parts, the less room for error.■

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A Transistor for True Believers

—tubes forever? Not with FETs!

Some time back, I decided to build the world's finest ham receiver. It would be my home-station receiver, so I would not have to compromise on *anything*. It would not matter if it weighed a ton and used a thousand Watts. Maybe I would even bolt it down to a concrete foundation block and wire it right into the fuse box.

W7KJM came into my shack and stood warming his hands by the fire. The snow melted off his overcoat and dribbled on the floor. "What for are you testing all those tubes?" he asked.

"I need to have spares for anything I design into this. Can't get tubes hardly anywhere no more, Ed." And I told him my plans.

"So go solid state, already," he advised.

"Solid state is for *appliance* operators. They see it in the catalog. They send in a thousand bucks. They plug in their grey boxes and don't even know how to replace a fuse. I am a *real* ham, now. First I bought junk and repaired it. Then I bought surplus and converted it. Next I bought kits and built them. Now I am going to do what I should have been doing all along. I will design my own and build it out of my junk box."

"Well, Glenn, with a half-acre junk box you ought to have plenty of material."

Ed was right. I must have had ten tons of electronic surplus, all Army green and Navy grey.

"But I must say," he continued, "you would be much happier with solid state. You could design your own and . . ."

"Transistors don't make sense. Only a graduate engineer with a million-dollar lab and a billion-dollar computer could ever figure out a single circuit. You lay a soldering iron to one of those tin bugs and you fry it before the solder melts. You scuff your foot on the carpet and you curdle its innards with static electricity. You hit one with a strong signal and its thermals all run away. If you abuse a tube, you may weaken it, but one volt too much on a transistor and it's lost and gone forever. Only transistor equipment I have is my signal tracer, and I'm ashamed of having been weak enough to get the stupid little thing. Maybe I can change the battery in it, but darned if I have any idea how it works. Probably Black Magic, anyway."

Ed listened to my ranting

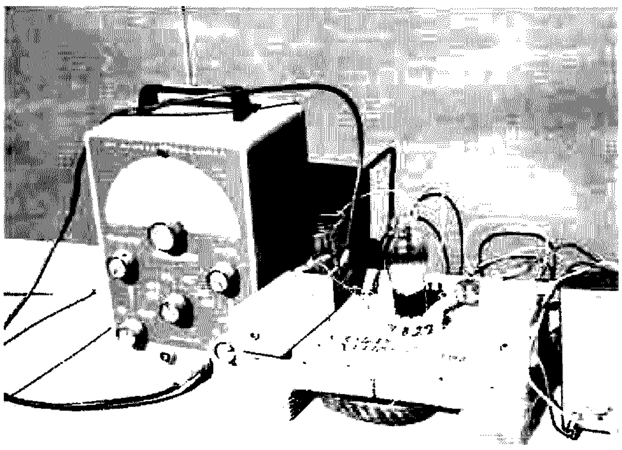

Photo A. *The experimental cold-cathode tube being tested as an i-f amp.*

until it changed tone and wound down, like a Victrola that needs cranking.

"Glenn, what you say is true about some types, but . . ."

"And furthermore, if the Lord had meant us to use the nasty little things, He would have had Thomas A. Edison discover geraniums instead of emission!"

"That's germanium, Glenn."

"Oh."

"And some types of transistors behave a lot like tubes."

"*Sure* they do! You drop them and they fall."

Ed left. He came back much later that day. He handed me a nice big vacuum tube. It had a high-wall octal base. I couldn't see inside much because the glass was silvered and blackened 'most everywhere. The only marking was on a stick-on label, in felt-tip pen: 40673.

"Glenn, here's a peace offering. Since you're set on building your new receiver with tubes, you might just as well use the latest. This one is an experimental cold-cathode, low-voltage tube."

"Now you're talking, Ed."

"What do you want to use it for?"

"Will it make an i-f amp?"

"I guess. Here're the parameters."

"Hmmm . . . Hey! Which pins are the filaments?"

"Ain't no filaments. I told you, it's cold-cathode emission. Whole new concept."

"How much voltage on the plate?"

"Oh, five, ten, fifteen, whatever's handy."

"And on the screen grid?"

"That's just a second control grid, Glenn."

"How 'bout that! We can run the signal into one and the automatic gain control into the other. Ed, how much do these babies cost? Ten bucks?"

"Lot less than that. About a buck."

"You gotta be *stealing* 'em! Let's see . . . say it draws twenty mils average and the cathode bias resistor wants to drop two volts . . . E equals IR, so then R equals E over I and two over two hundredths is a hundred Ohms for the bias resistor. See what I mean? Anybody can dope out a tube circuit. Only those pointy-headed dudes at Em-Eye-Tee could get a transistor circuit to work."

"Yeah."

"Tenth-mike ought to bypass the cathode resistor about right for this frequency. Now for an RC network to keep the agc from acting instantaneously. What's that formula for time constants?"

"Time equals R times C?"

"I think so. Is that with Ohms and farads? Megohms and microfarads?"

"Either way."

"O.K. Say we want a hundredth of a second agc time, and we got a hundredth of a microfarad capacitor, then we use a megohm. Simple."

"Glenn, I left something on the stove. You have this all under control. I'll see you tomorrow after I get the mail. By the way, why did you start with an i-f amp?"

"Have to start somewhere. And the i-f is where all the selectivity and gain come from. It's the real guts of a receiver, no?"

After Ed left, I drew the circuit in Fig. 2 and commenced to breadboard it. It went together in a few minutes on a little slab of pine. I hooked up a signal generator and a signal tracer to it and a pair of lantern batteries. It worked the first time around. I sat gazing at it, wondering about this new, low-voltage, cold-cathode emission technology. Imagine! *A tube that needs no warm-*up time, no filament wiring, and only a few volts to run it. This would sweep the world as soon as it got into production. I would have Ed get me a couple dozen of these experimental 40673s and build the entire receiver with them. I vowed right then and there I would write the whole thing up for *73 Magazine* so that everyone could get in on this marvel.

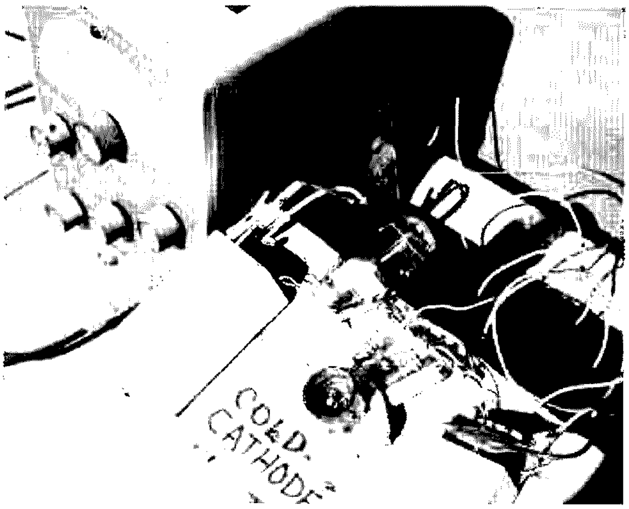

Photo B. Busted-off short and still going!

The next day, Ed came in again. I had the circuit still on the breadboard, still working, and still hooked up to the signal generator and the signal tracer.

"Looks good. Here, let me screw this tube in tighter," he offered. Before I could stop him, he twisted the glass bulb of my 40673. I heard a sickening snap. The entire beautiful envelope came out of the base in his hand!

"Ed! You broke it! You know tubes don't screw into their sockets! You did that on purpose! Why . . ."

Then I noticed my signal tracer was still tracing signal. I noticed that Ed was grinning from ear to ear. I looked at my breadboard amplifier. There, inside the "empty" bakelite tube base was a little-bitty metal cylinder with a rim around the base and four wires running into the tube pins. A transistor!

"Welcome to the twentieth century, Glenn," laughed Ed. That 40673 is a modern dual-gate, insulated, diode-protected field-effect transistor—a ninety-seven cent MOSFET. You pointy-headed genius, you designed the circuit for it without any roomful of computers!"

"Oh," I said. ■

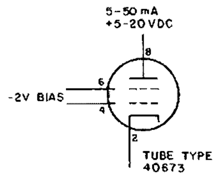

Fig. 1. The experimental cold-cathode, low-voltage tube.

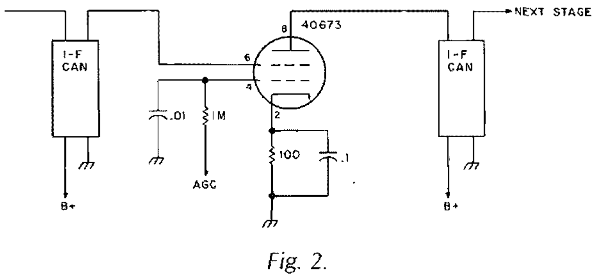

Fig. 2.

John F. Sehring WB2EQC
PO Box 306
Oradell NJ 07649

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—use thermostat modulation to lower your heating costs

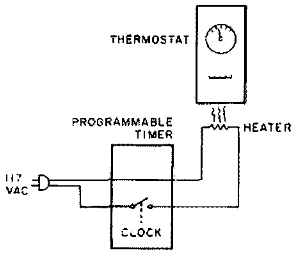

Fig. 1.

Perhaps hams are more sensitive than most people to the value of energy since they depend on electricity to run all of their equipment. So, the energy crunch found me looking for ways to conserve energy inexpensively, with a minimum loss of comfort and convenience. If the thought of painlessly saving from 5 to 20% on your home heating costs by using a simple-to-make device appeals to you, then read on. No, this is not a ham radio project, but it is right down our alley, being electrical in nature.

Numerous studies have shown that setting your thermostat back to a lower temperature at night and when no one is at home can provide significant savings in heating costs. The convenient way to accomplish this setback is, of course, to use a timed thermostat. Unfortunately, they are priced from $35 to $100 or more! There just has to be a better way, I thought; let's put that fabled ham ingenuity to work!

After a while, a very simple idea occurred to me: Why not just install a small source of heat right under the existing thermostat? When activated, the extra heat would fool the thermostat into thinking that the surrounding environment was warmer than it really was. The thermostat would then regulate at a lower room temperature, thus accomplishing our setback. The heat source could consist of a small resistor controlled by an inexpensive programmable timer. See Fig. 1 for the basic circuit.

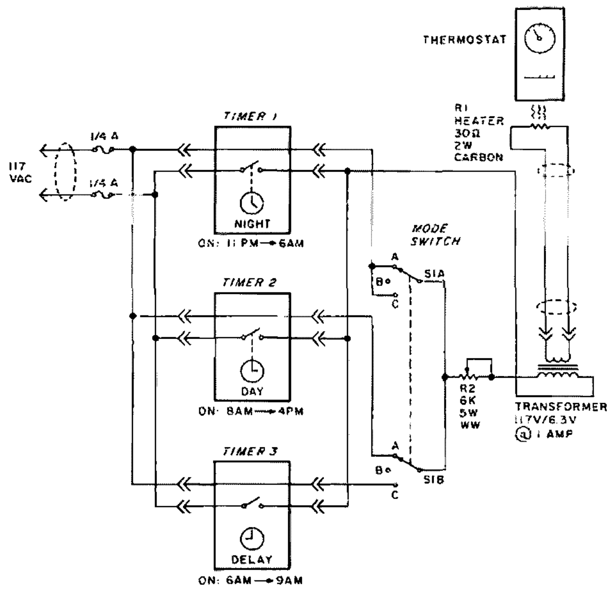

Fig. 2.

The actual system as it shaped up in my mind had the following features:

- Adjustable temperature setback.
- Nighttime setback cycle.
- Daytime setback cycle.
- Weekend cycle to disable the daytime setback and delay the morning heat-up cycle.

It was easier to do than you'd think, and Fig. 2 shows the final circuit. Using the resistance values shown, you should get at least 12° of setback: A thermostat set for 67° would regulate at 55° when the heater (R1) was on. A smaller value of resistance will allow even more setback by running hotter. Remember the formula $P=V^2/R$: A resistor's heat output will increase as its resistance is decreased. Here, $P=(6.3)^2/30=1.3$ Watts.

Two fuses are included for safety's sake, and the 6.3-volt transformer keeps high voltage away from the thermostat. Resistor R2 allows you to reduce the amount of setback temperature, if desired. Mode switch S1 is a DPDT toggle type with a center-off position. Mode A gives both day and night setback cycles, Mode B shuts off all setback cycles, and Mode C eliminates the daytime setback and delays the morning heat-up cycle for weekend use. If you don't want the latter delay, just eliminate Timer 3; if you don't need the daytime setback at all, just leave out Timer 2.

I constructed my system on a piece of 12" x 6" x ½" wood; the layout is entirely non-critical, but do follow safe wiring practices here! Each of the plug-in timers is mounted on a flat-surface, 3-way electrical outlet. You'll have to watch the polarity of your wiring carefully, as the timers use SPST (not DPST) switches inside. As a result, only one side of the line is isolated.

When setting up your controls, remember to allow enough time for your particular heating system to respond to heat-up commands. Hang a small thermometer near, but not on, your thermostat to see how much setback you're getting, since the thermostat's own indicator will not show the actual temperature.

It works like a charm, to the point where I forget that it's even running, and it's much more flexible (and cheaper) than the store-bought kinds. Maybe the XYL will let me use some of the heating-bill savings for—well, I can think of several things! Build one yourself, and I'll bet you can think of a use for your savings, too! ■

Chris Brown N1AUI

One Man's Magazine: Twenty Years of 73

The author, first licensed in 1962 as KN1UOJ, is a member of the 73 staff.

This month marks an important anniversary for one of amateur radio's best-known (and occasionally best-loved) publications. Twenty years usually means an engraved watch and a thank you, or a platinum memento. In the magazine business, twenty years is a milestone and a definitive statement of success. Many magazines never grow that old. *73 Magazine* is twenty years old this month.

In the summer of 1960, Wayne Green W2NSD sold almost everything he owned, rented a tiny office above a candy store in the Flatbush section of Brooklyn, and began his magazine publishing career by launching a monthly for amateur radio operators. Two publications, *QST* and *CQ*, already served this narrow field, but Green sensed the need for another viewpoint, another voice, in the ham community. Today, Wayne Green, Inc., produces three monthly magazines, two industry newsletters, and many technical and reference books. *73 Magazine* remains the backbone of the corporation and, in many ways, the source of its identity.

From the beginning, a sense of whimsy has pervaded the pages of *73*. Early issues were 73 pages in length (a printer's nightmare) and cost "a cheap" 37 cents each (two for 73 cents). Times and prices have changed, but *73 Magazine* has always retained a sense of humor, a unique achievement for a periodical in a highly technical field.

73 Magazine was intended to be a journal of contemporary construction projects for hams with a yen for home brew and, through the years, the magazine has fulfilled this intention. One thing not foreseen by Green in those early days was the role *73* would play as the "loyal opposition" in relation to the American Radio Relay League, the FCC, and other establishment organizations. This role resulted directly from publisher Green's individualist inclinations with regard to the ham-radio hobby. His outspoken editorials and the vitriolic letters to the editor that appeared every month served as a forum in which issues of the day could be discussed, often more openly and honestly than they were on the ham bands.

By 1962, *73 Magazine* was 96 pages long, and, despite the publisher's claims to the contrary, financially solvent. Manufacturers were quick to sense a winner, and all the major names of the era advertised with *73*. Clegg, National, Hallicrafters, Polycomm, Hammarlund, and Drake were regulars.

The sixties were a time of turmoil in both the microcosm of American life called amateur radio and in the larger landscape of America itself. As the country became increasingly involved in the war in Southeast Asia, amateur radio had its own polarizing issue, called incentive licensing.

This restructuring of the ham licensing procedure divided the amateur community along well-defined lines. Those in favor found a willing leader in the ARRL. Those against rallied behind *73 Magazine* and the organization it sponsored, called the IoAR (Institute of Amateur Radio). The IoAR was created as an alternative to the ARRL, and disillusioned hams opposed to incentive licensing were encouraged to join.

The core of the issue was the disenfranchisement of those who were then General and Advanced operators. As the docket was written, these operators would, over a period of time, lose many of their choice phone and CW privileges on the popular HF bands. Since no grandfather clause was included in the docket, the incentive licensing proposal was a threat to many active hams. It was the FCC's hope that eventually most hams would feel compelled to upgrade their licenses by taking more comprehensive technical exams, thereby increasing the overall technical expertise of the ham community.

In the meantime, other new developments confounded many veteran operators. A strange and more efficient mode of communication called single sideband was making inroads in what traditionally had been AM sections of the 80-, 40-, and 20-meter phone bands. Impossible to tune with many AM receivers, this new mode was a source of frustration for many hams. In addition, American electronic technology was becoming transistorized. Advances wrought by solid-state physics left many hams confused and alienated. No longer able to feel comfortable with obsolete, tube-type rigs, hams in the early sixties had to choose between reeducation or retreat. *73 Magazine* actively

pushed for the switch to SSB and transistors by running a large number of construction articles for hams who were starting from square one.

During this period, *73*'s editorial pages were filled with the incentive licensing debate, but its publisher's differences with the ARRL and FCC lay deeper. He was diametrically opposed to both these organizations on a philosophical level. Green distrusted bureaucracies, and he perceived the leadership of both these organizations as inept, if not downright corrupt. His mood reflected that of much of the country in the anti-establishment atmosphere of the mid-sixties.

In the April, 1963, issue of *73*, he unmercifully spoofed the League's publication, *QST*. His *QST*-like cover and inside layout closely resembled the League's official journal, and the entire issue was "Devoted Wholeheartedly To Amateur Radio." The issue has become a collector's item. The April fool tradition was continued for several years and included put-ons of *Playboy* (April, 1964) and *MAD Magazine* (April, 1965). Even Little Anny Hammy and Ham vs. Ham comic strips were included in these issues.

In 1962, *73 Magazine* left Brooklyn for Peterborough, "New Ham Shire." Editorials of the time extolled the virtues of clean air, country living, and spartan life styles. *73*'s content continued to reflect the changing trends in amateur radio and, as ATV, activity on 432 and 1296 MHz, OSCAR 6, and VHF FM developed, along with freedom rides and zip codes, *73* kept up a constant stream of "how to" articles.

New repeaters were appearing daily all over the country but no standards were in effect regarding their design, frequency allocations, or input/output spacing. *73*'s self-imposed mission during this period was to pull all repeater groups together in an effort to work out universally-acceptable standards. This grand design soon put *73 Magazine* and Wayne Green in conflict with the federal government.

The FCC was struggling to control the explosion in popularity of CB radio. Its Personal Radio Division had as its head, in the person of Prose Walker, a hard-line doctrinairian in favor of heavy regulation. Standards were proposed by Walker's division which made it impossible for repeater groups to get new machines on the air without considerable expense and paper work. The net result was that repeater development came to a halt.

At this point, *73 Magazine* decided to take on the federal government. In a hard-hitting series of editorials, publisher Green debunked the commission's position on repeaters and cast doubt on the competency of Prose Walker. Hams nationwide rallied behind *73*, and eventually the demands for a new hearing on the repeater issue became loud enough to be heard in Washington. A hearing was held in 1974, and much of the architecture of today's repeater system was determined at that time.

In April of 1967, Jim Fisk was named managing editor. Jim stayed with *73* for less than a year, and then left to start his own amateur publication. The rift between Green and Fisk was never closed after Jim's departure in 1967, and a cross-town rivalry soon developed between *73* and the new magazine in the field, *Ham Radio*.

Fisk was one of many notables to grace the *73* masthead over the years. Others included Ken Sessions, Don Miller, Bill Hoisington, Peter Stark, and Gus Browning.

As the Vietnam war escalated in the late sixties, and college campuses plunged into chaos over the bombing of Cambodia, *73 Magazine* remained preoccupied with the problems of amateur radio. The October, 1969, editorial however, offered Wayne Green's solution to the problems in Southeast Asia. His prescription for peace in that troubled land was founded on a faith in the ability of grass-roots capitalism to pacify the multitudes. Thailand today seems a case in point.

While men walked on the moon in 1969, ham operators headed for 2 meters in increasing numbers. The popularity of VHF FM was growing and the proliferation of repeaters on six and two was facilitating that growth. *73* ran scores of articles on FM conversions and repeater construction, while the editorial pages hammered away at the problems of repeater use.

During these years, publisher Green was possessed by wanderlust. His frequent European forays to pick up Porsche sports cars, ski the Alps, explore the night life of West Berlin, or meet foreign hams, were well documented in the pages of *73* and form an ongoing travelog of $5-a-day adventures. Green also made trips to Jordan during the early 70s, helped to write that country's amateur regulations, and eventually installed a 2-meter repeater in Amman for use by Jordan's King Hussein and the growing number of young hams in that country. A DXpedition to Navassa Island in the Caribbean occupied the summer of 1972 —and provided Green some calm before a gathering storm.

Early in 1973, the IRS wanted to talk to the publisher about tax deductions he had claimed during the previous years. Month after month, the editorial pages of *73 Magazine* told about the plight of citizen Green vs. Big Government. Was he really victimized by the IRS because of the pressure *73 Magazine* had applied to the FCC over the repeater issue? Or was he merely another businessman with a fool for an accountant? The details were murky, but the resulting tax-evasion case was well covered in *73* and competing amateur publications.

73 Magazine continued to grow with the hobby. Its coverage of satellite operations grew in relation to its page count (now close to 200) and the entire July, 1975, issue was devoted to OSCAR. Slow-scan TV also was becoming popular and received lots of attention in *73*. The magazine ran a slow-scan contest and devoted an issue to this new ham activity, also.

Computers became a force in ham radio in the seventies, and *73*'s pioneering efforts to disseminate information about this esoteric subject shifted into high gear. The I/O (input/output) section of *73*, devoted exclusively to the technology of bits and bytes, was rapidly becoming so large that it was a magazine in its own right. In 1975, therefore, *Byte Magazine* was spun off from *73* to service the computer-hungry public.

In January, 1976, *73 Magazine* reluctantly abandoned its six-by-nine format. *QST* and *CQ* already had announced that a change to a larger format was coming, but *73* was the first to implement it.

The days of skeleton crews peopled by jacks-of-all-trades were over. No more communal living and working in a rambling New Hampshire farmhouse, raising horses and vegetables in

off hours, or DXing from the mountaintop QTH. The magazine had become a demanding taskmaster that ate up time and energy voraciously.

Controversy was still a friend, though. A series of articles in 1975, entitled "Inside Ma Bell," resulted in a lawsuit of large proportions. Mrs. Bell, never to be accused of having a sense of humor, took offense at the publication of its toll-call billing secrets for all the world to read. Later, an ersatz 5″×7″ $100 bill printed as part of a subscription promotion also provoked the ire of the establishment. Warned by the Treasury Department not to circulate any of the monster bogus bills, *73 Magazine* once again found itself in the role of the *enfant terrible* of the ham publishing industry.

In August of 1979, the magazine ran an article on MDS (Multipoint Distribution System) TV equipment. For detailing construction specifics of antennas and downconverters for this metropolitan pay-TV system, *73 Magazine* again was taken to task. A lawsuit involving everyone but the cleaning lady is in litigation at present, this time brought by the MDS industry.

As one looks back over the past twenty years, the role that *73 Magazine* has played as loyal opposition, technical innovator, hell-raiser, and self-consciously fallible friend of ham radio is easy to see.

In essence, the magazine has always been the man: Wayne Green. From the earliest beginnings in Flatbush, the magazine and the man have been inseparable. *73*'s style, tone, editorial viewpoint, and appearance have reflected its publisher's personality. Green's dislike of excessive white space on magazine pages (born of Yankee frugality) and his adversary position in relation to the ARRL (a mistruster of bureaucracies) are reflected in the look and feel of *73*. More than any other publication in the field, *73 Magazine* represents one man's vision of the world and of the ham radio hobby, what they are, and what they should be.

Over the past twenty years, many adjectives have been used to describe Green and his magazine: zany, annoying, insightful, foolish, rabble-rousing, visionary, short-sighted. At one time or another, all have been applicable. Through it all, a sense of humor and self-deprecation has prevailed in *73*, and that is the attraction the magazine holds for many of its readers.

Whether railing against the League's position on incentive licensing in 1963 or detailing specifics of the Multipoint Distribution System in 1979, *73 Magazine* has always been lively and ready to poke fun at the sacred cows of amateur radio and the electronics industry. This seems extraordinary for a magazine devoted to technology, but it is quite understandable as a print extension of one man's personality.

What the next twenty years hold in store for us as ham operators and citizens is subject to conjecture: satellite communications systems, computerized station operation, energy shortages, war in the Middle East.

As history unfolds, it should be hoped that publications willing to take stands, air issues, and operate close to the edge continue to exist. A hobby and a democracy need that kind of journalism to thrive. ■

John W. Campbell W2ZCU

How To Be An Amateur

The Good Amateur—that is, the amateur who is useful in causing progress in the field he's in—has certain basic characteristics that are the same, no matter what that field may be. He may be an amateur in radio, electronics, chemistry, painting, or anything else; to be useful he must have a certain basic code—the Code of the Amateur.

A Good Amateur is...

1. Ignorant.
2. Egocentric.
3. Impractical.
4. Disrespectful of authority.
5. Materialistic, or pragmatic—not idealistic/theoretical.
6. Inconsistent.
7. Illogical.
8. Discontented.
9. Aggressive.
10. Unfair.

Every one of those characteristics, you no doubt noticed, is generally considered antisocial. The Good Amateur *is* antisocial; he's egocentric, and enjoys his own company, his own work, more than the best chitchat of the cocktail-party group that is, of course, the highest ideal of the extrovert-social type. The Amateur is antisocial in that he *likes*—actually *enjoys!*—thinking! He actually prefers using his brains to flapping his jaw; he normally thinks *before* opening his mouth. This is, of course, antisocial, because it imposes the necessity of thinking on those around him—which naturally makes them very uncomfortable. They're not used to it.

The Amateur is Ignorant; this is necessary, because he wants to learn—and you can't learn something you already know. The thing that makes an amateur's ignorance so useful, however, is that you can't learn if you already *think* you know, either. The old line about "It ain't so." The Amateur is Ignorant and escapes that trouble. Throughout history, amateurs have been lousing things up for professionals by doing what everyone who knew anything about the business knew was impossible.. until the amateur, who didn't know any better, did it.

Like Mad Anthony Wayne during the Revolution—the amateur soldier. He attacked a perfectly impregnable British position. Anyone with military knowledge knew it was impregnable because there were sheer, 300-foot cliffs protecting it on three sides, making attack from those directions impossible. Mad Anthony, not knowing any better, led his men up the Pallisades at night and cleaned out the British.

The Amateur has to be Egocentric. That is, nobody's going to pay him for all the hard work he does, so he'd better enjoy what he's doing because it pleases *him*. All his work will, 99.99% of the time, yield nothing but discarded materials and passed time. In the course of ten years, an Amateur may spend $10,000 on his hobby and wind up with $2 worth of junk and nothing else... except the self-satisfying fun he had doing it.

That, by the way, is one of the ways in which the Amateur is Impractical and Unfair. Amateurs happily tackle a research project that has one chance in 10,000 of succeeding, and spend ten years and $10,000 on it. Obviously, this is economically unsound; no professional research organization would consider so risky a venture; it would be economic suicide. For one thing, the Amateur in question may be a $100,000-a-year executive in a major corporation; he's worth that to his company because of the extremely high level of judgment he has. That high ability to judge, to select between alternatives, is being applied in his hobby—the $10,000 worth of material he invests in his hobby is nothing compared to the $1,000,000 worth of highly trained judgment he's also investing!

But the Amateur can, of course, charge off all those expenses, all the investment of time, effort, energy, and money to "Entertainment." It's a heads-I-win-tails-you-lose setup; if his research does not yield the desired result—it still yields ten years of fine entertainment.

This is very unfair competition from the viewpoint of the professional, who has to charge all the time, effort, and money invested to "expenses"—he can't call it "entertainment." The Amateur's research project, in other words, can never wind up bankrupt—in the red—a net loss. The fun of doing it, not the result, is the main product; any workable result is, then, pure gravy—a bonus over and above the call of entertainment.

Time and time again in the history of Science, the great breakthroughs have been made by amateurs; the great breakthroughs always will, for all time to come, be made by amateurs. The reason's simple: A true Amateur can tackle a

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problem with no reasonable hope of success and not suffer any loss. No professional can do so.

The essence of a breakthrough discovery, however, is that *it could not have been predicted* on the basis of previously known facts. Pasteur, a chemist, not a biologist or doctor, achieved the great breakthrough in medical-biological science—the discovery of germ disease. It could not have been predicted beforehand. No one could have, a year previously, reasoned that investigation of microscopic life-forms would be the way to solve the problem of disease.

Put it this way: Today, in the race for space, we need something a darned sight better than rockets. Rockets can never be developed to an economically practical method of commercial use of space; chemical-fueled rockets must consume tons of starting fuel for every pound of payload put into space. Nuclear or photon rockets can never be used to take off from Earth—the exhaust from such a rocket motor necessarily has an apalling energy intensity. It would slag down half a county behind it as it thrust itself up into space.

We *must* develop either an antigravity device, or a true space-drive—some kind of a device that can sink its claws into the structure of empty space and climb like a squirrel going up a tree.

No professional will ever achieve such a breakthrough invention; if Dr. Quiddius Q. Quidnunk of the Research & Development division of the Brontosauric Manufacturing Company does turn up as the discoverer—you can bet he did it as a hobby-amateur project, not in his official capacity as an R & D man for Brontosauric.

The reason's easy to see. Given: We want an antigravity device. It's worth $500,000,000 to the company that gets it. With a prize that size dangling, surely it pays to do research on it!

It would indeed . . . if someone could suggest someplace to start!

In 1935, Dr. Robert A. Millikan, one of the world's top atomic physicists, said it would be "250 years, at least" before we could release atomic energy. He was wrong by 243 years. What he meant was that as of 1935, no one had the slightest idea where to start looking for the answer! In 1940, they did know where to start; uranium-235 was the starting point. It took only two years to get an engineering device, once that was known.

The Amateur, because it's "entertainment," can start looking for the place-to-start; he doesn't have to wait for it to be discovered before launching his research.

The great Bell Laboratories had, of course, been looking for some way of amplifying electrical signals for years before that kid, Lee De Forest, came up with the triode vacuum tube. The transcontinental telephone line was impossible until an amplifier was invented. Bell needed one, knew they needed one, and couldn't imagine where to start looking for one, of course.

There's a lot of government-sponsored research being done today; Commissions, Authorities, Departments, and Divisions of the government set up boards, committees, and Agencies to assign research projects.

Let's imagine that government-sponsored research had been common throughout the history of the United States, and consider the probability that a government agency would have made the actually-correct assignment. The boards must, of course, act logically, with careful consideration of the opinions of the authorities in the field. Project assignments must be allotted fairly, logically, on the basis of the best available theoretical knowledge.

Would they, then, have assigned:

1) Development of a rapid, long-distance communication technique to a second-rank portrait painter by the name of Sam Morse?

2) Development of a technique for voice communication to an obscure teacher of the deaf in the Boston area, Alex Bell?

3) Development of a heavier-than-air flying machine to a two-man bicycle shop in Ohio?

Other projects would not have been assigned at all, by a committee which, not being amateur, was logical, had respect for authorities in the field, and acted on theoretical grounds. They would never, for instance, have assigned the project of developing an electric lighting system to anybody; it was proven mathematically by top physicists of the time that such things could never be practical.

The reason is one any radio ham can understand: It was "known" that the maximum energy transfer in an electrical circuit was achieved when the resistance of the generator equaled the resistance of the load. Therefore, in an electric lighting system, one-half of the energy would be dissipated in the generator and only half would be available for lighting. This made the maximum possible efficiency 50%—but worse, it meant that for any sizable electric system a tremendous amount of heat would be generated in the dynamo. Large machines would be impossible because they

would simply melt themselves into scrap.

It's most certainly true that if modern generators weren't 99% efficient, they *would* melt themselves into scrap. It's hard enough to get rid of 1% of ten megawatts, or 100 kilowatts of heat; if the Learned Authorities had been properly respected by Edison, he'd have recognized the futility of inventing incandescent lights.

The Amateur can, of course, expect all kinds of trouble when he *does* achieve something. The Learned Authorities assure him he's a crackpot; not infrequently the said Learned Authorities have the police arrest him to protect the public from his phoney racket. Alexander Graham Bell was arrested for trying to sell stock in his telephone company, I understand. Louis Pasteur threw his future into jeopardy when he first used his antirabies treatment on some Russians who had been bitten by rabid wolves. No MD would give them the treatment; Pasteur was not an MD and risked trial for murder if one of his patients died. (Things are different now; under modern laws, Pasteur would have been jailed for curing the dying patients. Now it's illegal to try to cure someone, successfully or not, unless you're a licensed MD.)

It's interesting to realize that three of the most famous criminals in history were, technically, amateurs. Jesus, Galileo, and George Washington were all, technically, criminals and amateurs. (Jesus defied the theocratic laws of the Jewish government; Galileo taught, without being properly accredited by the orthodoxy of his time, and Washington was, of course, defying the British Crown, as an amateur statesman-general. Meanwhile, Ben Franklin, amateur diplomat, was doing a bang-up job in France, to England's most acute annoyance.)

A considerable amount of Aggressive determination is, therefore, a *sine qua non* requirement for the Good Amateur. He can expect a battle when he does achieve his goal.

Obviously, he's achieved it illogically. If it could be achieved logically, from the accepted facts, professionals would have beaten him to it. The criminal-amateur must have achieved the goal by some illogical, unfair step. ("Unfair," when looked at closely, means "You did it by a method I didn't consider proper!" Obviously, if the professional had considered the method proper and had tried it, he'd have beaten the amateur to the punch.)

Go back and check over the ten points that make for the Good Amateur, and you'll see why they are necessary. If he weren't Discontented, of course, he wouldn't be trying to do something that "can't be done," or trying to do better a thing that can be done.

But the Good Amateur must be practical in one respect; he must not seek to compete with the professional on any fair, even-steven basis. He must always seek some underhanded, unfair trick. The amateur must not waste his time-effort-money on trying to do what the professional lab can do a thousand times better, faster, and easier. Don't build your own voltmeter. . . unless you want to learn, by actual building, what a voltmeter really is. Then, of course, you're really building your own knowledge-understanding, not a voltmeter.

You simply can't wind as perfect a moving coil, or make as precise and perfectly aligned bearings as a huge production machine-complex can; it's inefficient to try. Don't try to make your own transistors. Don't try to solve any problem that the professional research labs are working on *in the way the pro labs are trying*.

The pro labs are now, just as an example, trying to find a better method of long-distance communication. They've sent up that Echo sateloon reflector; they've investigated troposphere scatter, they've explored single sideband, pulse-code modulation, pulse-time modulation, a thousand variations. Don't compete; you'd be "fighting fair," and would be sure to lose.

Be Unfair; try finding out how telepathy works. Solve that one, and you'll junk all the multi-megabuck projects the pros have invested in. No pro researcher can tackle the problem because, of course, it's one of those things that you can't tell where to start working.

Legend has it that Alexander cracked the Gordian Knot problem by slashing through the Knot with his sword. Now there's an interesting thing about this; any amateur knows that it's a damn sight easier to untangle a snarl of wire that has only two ends than one that's been cut in two and has about 50 ends. With the two-ended knot you can, at least, start *here*, and know that, by simply keeping at it, you'll necessarily come out *there*.

Any pro lab can beat you six ways from zero on that sort of problem; they've got electronic computers, large staffs, and megabucks to grind away at the starting end, and follow it through.

The one that stops the pros, though, is the Gordian Knot after Alexander slashed through. It's got 100 ends, none of which can lead to "the" end.

The real fundamental-research scientist is a Good Amateur; that's why government research programs simply can't do a decent job of supporting true basic research. To be truly basic research, the project must *not* know where it's going to wind up, it must *not* know how it's going to get there, and must *not* be logically deductible from known factors.

The tunnel diode was the result of a Good-Amateur-type experiment; the result obtained not only could not have been predicted by previous knowledge—previous knowledge specifically predicted that it couldn't happen! Since it is theoretically impossible for electrons to travel at the speed of light, it could be shown that, theoretically, no electronic mechanism can have signal-transit times as short as light speed would make possible.

Happily thumbing its miniscule nose at theory, the tunnel diode is an electronic device with signal-transit velocity equal to light speed.

It also violates all proper transistor solid-state semiconductor theoretical approaches. To be any good, a solid-state semi-conductor must have very, *very*, VERY little impurity—"doping"—in it. The tunnel diode results from doping the germanium or silicon like crazy. Do the wrong thing—that's what works!

In the early days, the hams got shortwave radio going by doing wrong things like taking the carefully manufactured tubes right out of their carefully cemented-on bases, and soldering the leads directly into their circuits.

The real motto of the amateur must be, "Never give a pro an even break! Be unfair!"

To be a Good Amateur, don't compete with the pros—do what no pro would ever think of doing. And be Egocentric—whatever project you pick, pick it because you like it, not be-

cause somebody says it is your duty. That way, you're playing the heads-I-win-tails-you-lose game; no matter whether your project succeeds or not, you'll have had a hell of a lot of fun! Tackle the absolutely impractical projects—the ones where you'll have no pro competition. And always disregard Authorities; of course they're sure it's impossible. If they weren't, they'd have gone after it themselves. A thing can be economically impossible for professional research—and be completely practical for the happy little amateur. Lord knows climbing Mt. Everest is economically impossible in any profit-and-loss sense. What possible financial profit can be made up there?

And the amateur doesn't have to explain *why* his gadget works; to hell with theory! Be pragmatic; simply use it. Show *that* it works, and let the red-hot theoreticians worry about *why* if they want to.

Also, be ready and willing to be completely Inconsistent at any moment. If, one day, while working on a new idea for a two-meter half-kilowatt rig that you've told everybody is going to be a two-meter transmitter, said unit should suddenly start rising off the bench and floating up toward the ceiling—be inconsistent! Say, "I'm building an antigravity machine," and if somebody protests that you said it was a radio transmitter—why, point out that it obviously *is* an antigravity machine, so, obviously, that's what you were actually building. That's common sense, isn't it? Why should you care that it consumes a full gallon, and peeps out with only 2 Watts on 2? It floats, doesn't it?

Always be willing to change your project if something better slugs you along the way. Like George Baekland; he was trying to synthesize some complex organic chemical when his chemicals in the apparatus clabbered, turned into goo, and finally set into a solid mess. Efforts to clean his apparatus of the stuff proved totally futile; he couldn't dissolve the mess in anything he could find; it just sat there sneering at all his high-power solvents.

Of course, other chemists had had similar sad accidents, and had had to throw away not only their chemicals, but their apparatus as well. Baekland was by no means the first to wind up with a mess that nothing known to chemistry would remove.

Baekland was simply the first to be a Good Amateur about it; he was Inconsistent. "I," he decided, "am *not* synthesizing 1, 2-alpha, betaomicron after all. I'm synthesizing something as useful as the fabled Universal Solvent—the Universal Insoluble! Since I can't get rid of the damn stuff... there must be somebody that wants a material that stubborn, so I'll sell it." With that inconsistency of approach, things were easy. It was a snap to remove the apparatus from the mass of bakelite—the glass would break, or dissolve in hydrofluoric acid.

Remember, too, that Bell was working to invent the "musical telegraph"—what we now know as carrier-frequency telegraphy—when he got the wrong result. He was a Good Amateur, and immediately decided he was inventing a telephone instead of a musical telegraph.

There are lots of patents to be gained by seeing how *bad* a job you can do. The body-capacitance burglar-alarm, for instance, is the worst possible approach to a stable vfo, exaggerated and patented. Almost anything that is *extremely* one thing or another has some useful application. *Vide* Bakelite.

Transistors tend to be very temperature-sensitive; they make wonderful high-sensitivity thermometers because of that. The RC oscillators such as the multivibrator are horribly unstable... which makes them wonderfully useful as frequency multipliers and/or dividers. Being inherently unstable, they'll happily lock in with the frequency of any nearby oscillator.

Each of the characteristics I've listed as necessary to the Good Amateur is considered anti-social. Each of them is... in the wrong place, or wrong degree. But be inconsistent about that, too; in the right place, and right degree, each of them is tremendously useful.

I do not, for instance, recommend Disrespect of Authorities when they say "The human organism does not normally operate well after being connected to a 2000-volt power supply."

It is also necessary to respect authorities in another sense; they should be respected just as you should respect rattlesnakes, mules' heels, and dynamite. They frequently have power, and should be treated accordingly.

The crackpot is the bird who not only fails to respect authority, but also fails to respect good judgment.

The Good Amateur, of course, fulfills the only useable definition of a Genius: "A Genius is a crackpot who makes money at it."

Naturally... because "makes money at it" is simply another way of saying "has an idea which is economically sound and workable."

Remember that almost any crackpot can get a patent; it takes a Genius to get one *and sell it!* ■

Jean Shepherd K2ORS

Some Guys Make It

—and then there's us

You know, when you really step off a cliff, you know you've done it. It's just like looking out from the observation tower at the Empire State Building, and suddenly you're in midair and you know that there's no going back. I mean, it's a great flight while it lasts.

It's maddening. You notice that up and down the street the guys in the big Cadillacs never get tickets? Have you ever seen a ticket on a fat Mercedes? Let me tell you, I used to come back with my motor scooter decorated like a Christmas tree. You know, all those little green tags hanging like tinsel all over it. And in front of me would be a tagless Cadillac, and behind me a tagless Mercedes. Both parked there since last Easter. My scooter. . . I'd slow down, and the fuzz would be running alongside me, tying 'em on.

Well, that goes in all directions. There are guys who always get it you-know-where, and there are guys who don't. It's just that way. Now I don't know how it's set. I don't know whether it's predestination. I don't know whether it's preordained, but some guys from the very minute they're born—and they can be born in a rotten neighborhood—but from the very minute they're born, they are preordained or something to Make It. And there are other guys who are born to be Sunk. I mean just born to it. Your ship is leaking. From the very minute you start to walk. Your shoes squeak. And you're phonying it up, and hoking it up from the time you're six. Other guys *win* the sack races. You know, legitimately. They can run faster.

Well, let me tell you what happened one time. I'm on the air, you see. I'm a ham, and this is when I began to discover this principle. I'm a kid, and I got this paper route—rout. It was both a route and a rout. It's terrible to have to admit that even when I was a paperboy, I was a paperboy for a paper that was about to go out of business.

Every week you'd come around and you'd try to collect, and they'd tell you they want to drop the subscription, it's a rotten paper. It's awful. I had a paper called the *Herald-Examiner*. Did you ever hear of it, the *Chicago Herald-Examiner*? And you know, it was such a bad paper that they didn't even read it in my house, and we had a free subscription.

I used to go running around the neighborhood at four o'clock in the morning, delivering this rotten paper. It was a losing battle. And on Saturdays, every morning, I would go up and I'd knock on every third door, trying to collect the dough, and they'd say:

"Here's forty cents for last week. Please don't deliver the paper any more."

Well, then I'd have to go back and tell George The Paper Man that they quit down there, on Cleveland Street, those people down there, and he'd say:

"Ah, they're rotten people."

George was fighting a losing battle too, because he had the *Herald-Examiner* franchise in the neighborhood and he was going down with the ship. And all these poor little kids who were 12 years old and who were getting knobby knees from running around with this paper, they were going down, too. Whereas right across the street from us there were a bunch of wiseguy kids who had the *Tribune*. And this big fat guy who had the franchise for the *Trib*. And they all got fat. All those kids are Republicans today. And Cub fans. All of the rest of us kids that had the *Herald-Examiner*, look at us. Ha! Democrats, following the White Sox till the day we die.

So anyway, I'm a kid and I get my ticket, and I figure I'm licensed, like all the rest of the guys. Except, of

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course, the Cadillac has the same kind of license on it that you've got, you know. It's the same piece of metal on the back, but Boy, what a difference.

So I get my ticket. I'm really gonna swing. I'm on 40 CW for about six to eight months, when I get on 'phone. Now I'll tell you what I was doing as far as 'phone is concerned. I figure I'm gonna try and make it in the big leagues. And I have a single 2A5. Final driven by a 56 tri-tet oscillator. Do you know anything about the 2A5? Well, it was a pentode, a power pentode. Receiving type. I got ahold of this 2A5, and I was using a Majestic B Eliminator, which I had found in the basement of somebody's house, to power this thing. And it put out 135 volts. I can tell you exactly what was running, it was 135 volts on the plate at 10 mils. So you can figure out what my input was. Into an RCA mismatched receiving doublet SWL antenna. A special design they had to mismatch on everything. Didn't match anything. I could have done better with the bedsprings.

And so I've got this thing tuned up, and I'm running a cool 135 volts at 10 mils on the plate. I built a modulator. Oh, when I think of it. . . how sad.

The modulator was another 2A5, and I am grid-modulating the final. Well, you can realize the kind of output I have. I'm probably running about 7/10ths of a Watt, and you will never guess what band I'm running it on. I'm on 160 meters. Where a low-power guy was running 200 Watts and the high-power guys ran all the way up to, well, I would say WNBC standards.

I had this poor little receiver. I don't know whether you ever heard 160 meters when it really was wild. You know what you could do on 160? You could tune into the band, and when you hit the band it was one heterodyne from one end to the other. One *solid* heterodyne, without a break. And the heterodyne was of such magnitude that your S-meter was on the pin all the way across the band. It never fell off.

So one night I'm on there. I throw my 7/10ths of a Watt right into the middle of it all. I have a very vocal special sound, the bored sound of a high-power man, calling CQ. Nonchalantly:

"Hello CQ, CQ, 160. Hello CQ, hello CQ, hello CQ." Then there's a little silence while I'm tuning. Sound of arc being drawn by pencil from final plate.

"Hello. One Two Three. . . hello. Hello CQ, hello CQ, hello CQ."

Where you really sound like a big leaguer is when you turn the radio in the next room all the way up, so you sound like you've got so much power and so much gain, so much preamp gain that you can't cut down the background noise in your house. It sounds real great.

I've got the the cans on. I'm wearing cans monitoring myself on my receiver. I am the only guy who can hear me, the only guy who could hear my signal.

"Hello CQ, hello CQ, hello CQ, hello CQ."

It's 9 o'clock at night, and everybody in the country is on. Believe me, that band was so insane and my rig so weak that with my signal on and my receiver on, I could hear the heterodynes through my carrier. If you know what I mean.

"Hello CQ, hello CQ, hello CQ, hello CQ 160, hello CQ."

I am calling CQ from 9 o'clock at night till 4 o'clock the next morning. All I am raising is our light bill. That's all that's happening. So the next night I come on again. I get on the air again, and it's great, you know, just to throw on all the switches. The one thing I had that was heartwarming was that my BH tube was leaky. I had a gassy BH. Did you ever hear of the BH cold-cathode rectifier? Well, it was leaky. It was gassy. It made a beautiful blue light like an 866 when I talked. Made me feel like I had real power.

"Hello CQ, hello CQ, hello CQ, hello CQ, hello CQ." And I'd see that blue light flickering. It was just great.

"Hello CQ, hello CQ, hello CQ, hello CQ."

Well, this goes on for one solid week. They can't even hear me in the next room. I haven't raised even a BCL.

"Hello CQ, hello CQ, hello CQ."

Finally Friday night comes along. Friday night comes along. And my friend Chuck, down the street, is W9AHS. He has not worked anybody on 20 since the preceding spring, when he worked a guy who was mobile and who drove right past his house. So the two of us are in the same leaky rowboat.

Chuck comes home from school, and he says:

"You're on 160, huh? How're you doing?"

And I say:

"Ah, pretty good, Chuck. How are you doing on 20?"

Twenty is a real big league band. He says:

"Oh, not bad. Not bad."

We both made Class A, you see, but I didn't have the guts to go on 20 yet, because the band scared me.

Chuck says:

"What do you say we work a little crossband tonight?"

Chuck lived 10 blocks away from me. So I say:

"Okay, Chuck."

So Chuck has got his receiver tuned to 160 and I'm listening on 20 and sure enough, between all the heterodynes I hear Chuck come in:

"Hello, hello W9QWN, hello W9QWN, W9QWN. W9AHS calling W9QWN."

So I throw on my transmitter. I'm on 160:

"Hello W9AHS, W9AHS."

And Chuck comes back to me! Fantastic! He could hear me. Right in between all the heterodynes he says he could hear this little squeak, this little thing. He says:

"You're coming in. You're about an S-2. About an S-2. Readability is very low. About an R-3, I'd say, about every 3rd or 4th syllable."

So, without thinking about it, we slip into crossband work, into duplex. And I leave my transmitter on, Chuck leaves his on, and I'm talking to Chuck. We worked crossband, *duplex*, for not more than 30 seconds.

Illegal.

And I'm talking to Chuck, Chuck's talking to me, back and forth. It was great. Finally:

"73, Chuck."

"Okay, Dad."

"Hello CQ, hello CQ, hello CQ, 160 phone—hello CQ, hello CQ."

Six or eight weeks go by. When suddenly, in the mail, would you believe it? I get a card from the FCC. They got a listening station in San Diego. And they have ticketed me for crossband illegal operation. I am coming in there 599 XXXX. A ton of bricks! On 160!

Well, I figured, you know, there's some guys get ticketed and then there's others that don't. About that time I realized that there are born losers and there are born winners.

Oh well, it doesn't matter. It only gets worse. But the thing you got to keep saying to yourself is that it gets worse for everybody, simultaneously, all of the time. Maybe. ■

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The 40-Meter Band Blaster

—this antenna works, but why?

I don't own an isotropic dipole. In fact, I don't even own a conventional reference dipole.

So purists can just flip these pages and go on to something a bit more comprehensible.

But I can tell you that the antenna about to be described develops more real gain than anything I've ever used on the HF ham bands—and that covers a lot of years, a lot of antennas, and a lot of hamming.

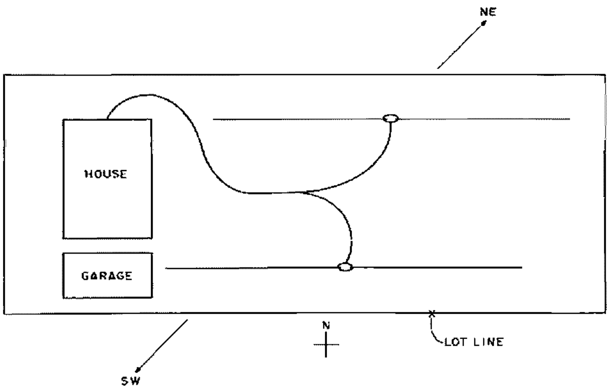

Fig. 1. Bird's-eye view of the original antenna system, set up as a dual-dipole for 75 meters. The offset between the two dipole centers was designed to reorient the firing pattern of the array so that contacts with St. Louis (southwest) could be maintained reliably. This antenna was the origin of the 40-meter array described in this article.

Here's what gain this antenna is providing, as best as I can do (no isotropics here):

- Gain over 4-element wire beam—5 dB.
- Gain over 2 dipoles, driven together—6 dB.
- Gain over double-extended zepp—6 dB.
- Gain over a pair of phased verticals—12 dB.
- Gain over roof-mounted ground plane—15 dB.

Admittedly, not all the above antennas are installed under optimum conditions. However, these gain differences are quite accurate at this QTH. If these figures interest you, read on.

Actually, I've been somewhat reluctant to write this article. First, it has been rather fun having nearly the strongest signal on the 40-meter General phone band all to myself! Second, I don't really understand much about why this antenna develops so much gain! (Theoretically, it shouldn't produce more than 3-4 dB.)

Yet people keep calling and writing me for details on this antenna. One night, I got a call out of the blue at 1:00 am from a chap 100 miles away who simply couldn't contain himself any longer and had to have the lowdown. However, after the number of requests for data on this antenna topped 100 (out of 300 QSOs), I decided that the best thing to do would be to write a report.

I had hoped to be able to explain this thing a bit better than I am prepared to do right now. But suffice it to say that this antenna has been in nearly constant operation every night I can

manage on 40-meter phone for the last month, and it is producing outstanding results.

How It Happened

Three years ago, I constructed a matched pair of 75-meter dipoles, driven from a common feedline, in order to be able to talk regularly to my father, WØPRQ, in the St. Louis, Missouri, area. For a number of reasons, we never made much use of this array, and my activity gravitated toward 40 meters. We found that we could get through okay up there most of the time. Then about a month ago, it occurred to me that rather than have that thing sit there dormant, why not cut it down for 40 meters and see what would happen?

I should mention that the antenna was originally set up in an offset condition so as to "beam" whatever rf was possible to the St. Louis area. This offset was required because it was necessary to direct the rf southwest, although my lot runs east and west, and supporting tree branches were available in just so many locations, so the offset was almost a necessity just to be able to mechanically hold up the array. Refer to Fig. 1 to understand this setup.

This system, on 75 meters, did work as planned and satisfactory performance was enjoyed on that band. (This was somewhat surprising, as the antenna was only about 15 feet above the ground, although I've been told by antenna buffs that because the two antennas are operated together, height is not as important as it normally is. I don't fully understand this phenomenon, but it has proved true, as you will see shortly.) The spacing between these two dipoles was as close to the lot line edges as I could get—probably about 65 feet center-to-center between the dipoles.

The 40-Meter Conversion

It was a relatively simple procedure to cut the 75-meter dipole system down to 40 meters. It took all of a few moments to do. Immediately after returning to the ham shack, however, it was apparent that something very important had happened.

Signals across 40 meters were considerably stronger than before. At the time, I'd been using a roof-mounted ground plane. Signals on receive were over two S-units stronger! My first contacts were amazing. People said I was extremely strong and immediately wanted to know what I was running. I was getting reports of 20-30 dB over S9, something quite unusual for me.

Getting It Higher

Within a couple of days I was thinking that if this thing was working so well at 15 feet, imagine what it would do if higher in the air. So I spent one entire Saturday out in the backyard raising the antenna.

Due to trees, which I must use as supports, raising the antenna considerably altered the spacing between the elements and dipole centers. Once this was completed, the antenna took on the rather unusual shape it is now in, although the offset between dipole centers remained. In all, it was brought up to the point where one dipole was over 25 feet and the other 30, at the centers. The elements stretched downward somewhat, not enough perhaps to qualify as inverted Vs, but enough so that they were no longer straight dipoles. The spacing between the dipole centers

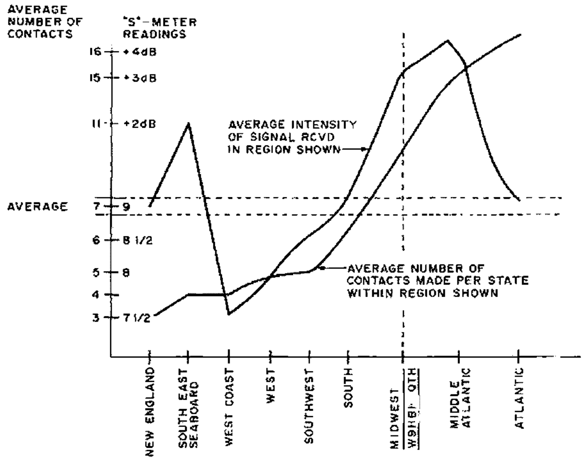

Fig. 2. This chart combines the signal report analysis and the number of contacts made per state. (Base is 285 contacts with stations running barefoot into dipoles or inverted Vs: 41 states, 9 regions.)

closed in considerably to the point where it now stands, at about 38 feet.

Well, as indicated earlier, results after all this work were relatively disappointing. No perceptible increase in gain was achieved by raising the height of the array. However, interestingly enough, no corresponding decrease in gain was noted either, which says something for the workability of the array regardless of the actual center-to-center spacing between the driven dipoles.

On-the-Air Results

Thus resigned to the fact that height increases would not really improve things much further, I decided just to operate this thing a while and see what kind of consistent results it would provide. After all, the 2-S-unit gain was indeed startling and needed to be checked out further.

Well, what I have done in my operating since that day has been startling for sure. While you may be skeptical of what you are about to read, I invite anyone who finds this incredible to stop by this QTH and see for himself—or, better yet, look for me on 40 phone. (You'll find me there in the evenings between 7250 and 7300 kHz.) Just listen for a while. You'll be as amazed as I am.

First, this antenna produces a pileup. And I mean a major pileup. All it takes is one CQ and then I simply have to sit back and wait it out. Due to the inevitable QRM that results on a frequency when normal QSOs are taking place, I have elected to follow this procedure when operating with this antenna:

- Call only one CQ for the entire evening. (It is all that is required to start up the action.)
- Pick out one caller from the pileup to respond to, but before doing so, announce that there are a number of stations calling, so QSOs will be short so as to be able to talk with as many as possible of those who have been kind enough to call.
- Then I announce the call letters of the station I wish to respond to, again repeating that this will have to be short, as others are standing by.
- Then we have a short QSO, after which I announce that W9HBF is QRZ on the frequency and standing by.

Then the pileup starts all

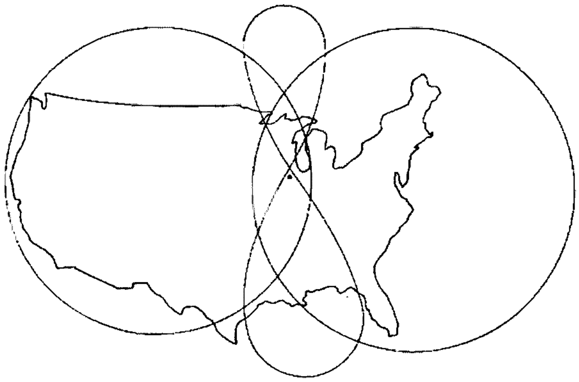

Fig. 3. Basic pattern developed from all QSOs made. While the pattern shows clear east/west orientation, the antenna is physically located running in the same direction, suggesting end-fire performance.

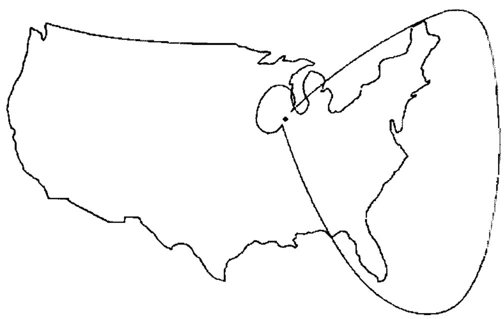

Fig. 4. A close-up look within the basic pattern (Fig. 3) showing the shape and path of most extraordinary results.

over again.

This has the decided advantage of clearing the frequency coast-to-coast because it doesn't take long for people to realize that I am serious about responding to everyone who calls, and they realize they will not have long to wait.

Can you imagine how much fun 40-meter General phone nighttime hamming can be under this kind of clear-frequency condition? Well, it is downright nifty. For example, it is entirely possible to pick out stations which would not ordinarily be heard because of QRM. Seldom does an evening go by when I'm not hearing from a remote Canadian way up there many hundreds of miles distant, from the Canal Zone or other Central American region, or from Bermuda (VP9). But the most fun is simply seeing how many people are hearing me and can be worked stateside. A typical evening will produce dozens of contacts from all over the US. And they all tell me about the same thing.

What People Say About the Signal

The plaudits this antenna produces in QSOs are fascinating:

- "You're absolutely the strongest signal I've heard on the band this evening."
- "I've been listening to you for the last hour and just had to give you a call to tell you how well I'm copying you here."
- "You are without a doubt the strongest signal we've ever heard from the Chicago area."
- "You are literally the strongest signal ever copied on this receiver. The S-meter is running between 35 and 40 dB over 9; previously, it's never gone higher than 20 over."
- "What are you running for an antenna? You are plowing in here way above the foreign broadcast QRM, strong and steady. Hardly any QSB at all."

The average S-meter reading I get is 20 dB over S9. While I fully realize that S-meter readings can be somewhat meaningless, the point is that people call me because I am Q5 copy and way above the signal strength of most other signals they are hearing.

Often, I will switch antennas over to see the differences on transmit. The three I usually switch between are (a) this array, (b) the double-extended zepp, and (c) the roof-mounted ground plane. In all cases, the reports I get directly corroborate the gain findings cited earlier in this article: 15 dB over the ground plane and 6 dB over the zepp. In some cases, I get a 10-dB gain reading over the zepp, but that is probably due to the rather directive characteristics of that antenna. Which brings up an interesting point: What about the pattern this array generates?

Pattern Observations

This thing at first appearance seems to generate a somewhat omnidirectional pattern. In no way does it produce the northeast/southwest major lobes that it did when functioning originally as a 75-meter array.

So uncharacteristic is this antenna's performance that I thought an interesting way to track its lobes would be simply to make log notations of signal strength from stations contacted and see what this produced. I recorded the signal strengths of stations worked and then tabulated them. For charting purposes, I drew up a scale running from 1 through 19. Each point represented a signal strength reading recorded in the log. Number 1 represented S6, 2 was S6½, 3 was S7, and so on up to 19 which was 22 dB over S9.

On the other axis of the chart were states organized into nine regions: New England, Atlantic, Southeastern seaboard coastal, South, Mid-Atlantic, Midwest, Southwest, West, and West Coast. (See Fig. 2.)

Only contacts made at the same time of the evening were charted. Also, only those identifying station line-up and antenna were recorded, and only those using barefoot rigs and either an inverted V or conventional dipole were included in the charting effort. Charting was done on 285 contacts in 41 states, an average of 7 contacts per state. As shown in Fig. 2, most contacts were in the Atlantic region, and the fewest were in New England.

Evaluation of Signal Reports

A much more telling finding can be deduced from an examination of the signal reports. These were done state-by-state within regions, averaged, and then shown as a state average. They then were averaged for the region as a whole. The results are shown in Fig. 2.

These are stingy receive-only readings. The signal reports I was getting were generally 10-25 dB stronger than those given. This is probably due to Kenwood sticking with a 50 microvolts = S9 spec on the original TS-520. But in any case, this data shows a clear pattern of maximum operation, and it definitely is not to the west.

Fig. 2 shows that the peculiar lobes producing the most gain vs frequency-

of-contact are three: New England, Southeastern seaboard, and Atlantic. The other regions track pretty much as they should, considering that close-by regions would naturally see higher signal reports and more QSOs than distant ones.

Look at Fig. 3. This shows the basic pattern as developed from QSOs made. Its shape is just the opposite of what one would expect from a dipole array mechanically positioned east and west (where one would expect it to fire north/south). Instead, it appears to be operating as an end-fire array.

A Close-up Look at Beam Shape

Fig. 4, however, is more telling. This is a look within the basic Fig. 3 pattern that shows where the most extraordinary performance is going, based on the signal report analysis made earlier, transposed to a map of the US.

This much more approximates what one would expect from a yagi beam of several elements. It is quite sharp in pattern, and extraordinary indeed for an array of this design. However, it also explains somewhat why this array out-performed by an S-unit a 4-element wire beam facing east that it was tested against. Apparently, this antenna simply develops more front-to-back, somehow.

Fig. 5 shows lobes configured into three classifications: (a) below average, (b) average, and (c) above average. This grouping was made possible by a recalculation of the S-meter data. A tabulation showed that the average for all stations worked was S9. Those below S9 are shown as below average; those above, as above average.

Remember that the gain developed is rather sensational from coast to coast, from reports I get here. So the totality of the overall omnidirectionality of the system must be kept in mind.

Fig. 6 is a final mapping which shows that signals are stronger in the southeast than they are along the way there. This is undoubtedly due to nighttime skip conditions that prevail late in the evening. It substantiates that this skip (or whatever) is happening in one direction only, so it would lead one to believe that the earlier patterns are somewhat accurate overall.

Why the Beam Effect?

The offset positioning of the dipoles in this array is probably the reason for this unusual patterning. While the offset shift worked admirably while the antenna was configured originally for 75 meters, the ratio of the dimension of the offset, physically, to the wavelength at 40 meters is significant. Hence, the offset produced the desired result on 75, yet a somewhat unpredictable one on 40.

Physical Characteristics

A basic appeal of this antenna centers on its ease of assembly. For many people who do not have a lot of real estate to erect wire beams, this should be ideal.

Here are a few of the features:

- No baluns required.
- Height is not a major factor.
- Cost is nil: All you need are insulators, stranded copper dipole wire, and coax. (I use RG-58 because of its lightweight characteristics.)
- Spacing between dipoles appears not to be critical.
- The antenna is pretty much invisible once erected and in position.
- Directionality apparently can be controlled by the degree of offset shift used.

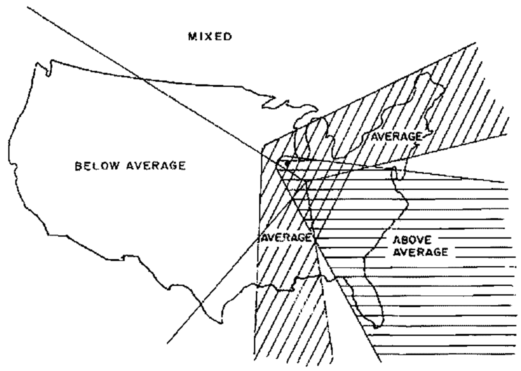

Fig. 5. An accurate visual projection of experiences at W9HBF, based on received (and contacted) station signals. Average is S9.

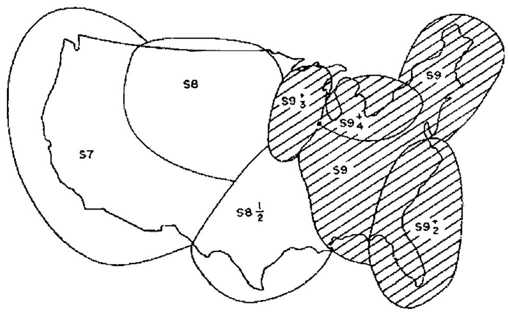

Fig. 6. Clustering of S-meter reports, based on received signal analysis over 41 states. Reports given to me were generally much higher. (These reports were accumulated on a rather stingy S-meter.)

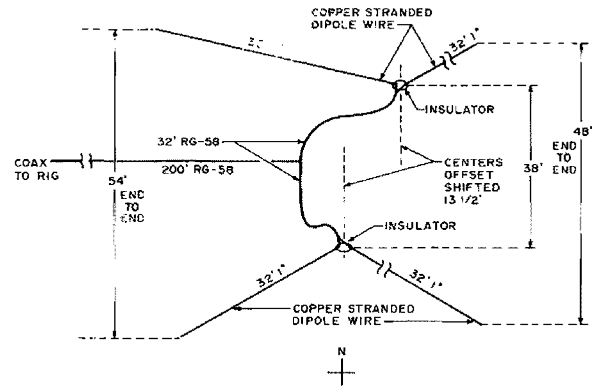

Fig. 7. Completed antenna design as installed at W9HBF. Dimensions shown as far as spacing is concerned do not seem to be critical.

There is no major part of the live element section of this array that is not touching leaves or branches. However, this one seems to have properties quite similar to a quad or closed loop in this respect: Trees and nearby structures do not appear to hamper or severely alter the performance of the array. My backyard is full of trees, most of which, one would think, are positioned all wrong. But they do the job for me, and they help to disguise the wires.

Construction

Fig. 7 shows the completed antenna design, as

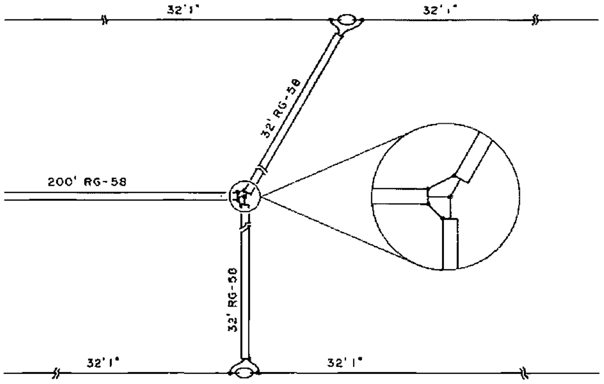

Fig. 8. Close-up of coaxial "T" interconnections. Actual coax length from this point to the dipoles is 32 feet each way. This section is elevated to a height mid-point between the heights of the two dipole centers.

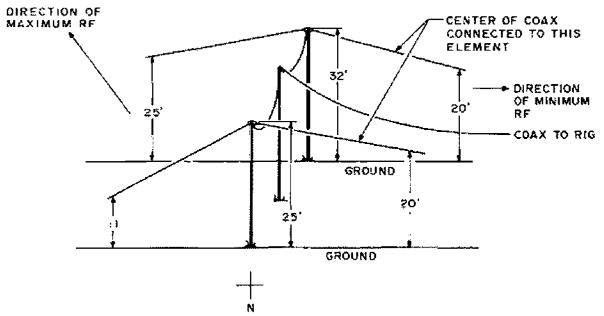

Fig. 9. W9HBF installation, looking south. (In reality, trees, not poles, are used as supports.) Note that maximum rf direction is almost opposite to that of the live dipole elements.

viewed from the top looking down toward the ground. Equal 32-foot lengths of RG-58 are used between the two dipole-type elements. This length was chosen not scientifically, but simply because it was the length required to reach between the two antennas when they were originally spaced when the array was cut for 75 meters. But many experts tell me that this coax spacing may have a great deal to do with why this antenna performs so well. I leave it up to you to decide what will work best overall.

The 13½-foot offset dipole centers also may help to explain a great number of things about this antenna, but I'm not sure just what at this point. I rather suspect that you could experiment with this shift considerably with interesting results.

Overall, 200 feet of RG-58 runs back to the operating position from the antenna. I often drive this with 2 kW in, and have yet to have a problem. The majority of the coax feeds back to the house at the elevated point where the two coax dipole feeds break off—so it is also possible that the effect of the coax adds something to the antenna itself. The coax runs through high tree branches much as the elements do.

Fig. 8 shows how the coaxial "T" is interconnected. I simply used black plastic electrical tape; the connections at W9HBF are not even soldered together—just twisted. You may want to experiment by reversing the center conductor feeds to the dipole elements, just to see the effect it might have on your pattern. I use a string to hoist up the "T" point into a tree so that the coax doesn't droop down into a play area where the youngsters often congregate.

Fig. 9 shows the installation from the north, looking south. (Poles, not trees, are shown here to simplify the diagram.) Note that the area of maximum radiation (gain) is quite opposite to where the center conductors of the coax feed. I have no way to explain this phenomenon.

Cutting/Pruning

I had to do no cutting/pruning whatever. The original 40-meter cut, to 7.250 MHz, is the only cut made, and that was by way of standard dipole formulae.

At W9HBF, due to extensive antenna experimentation conducted with wire arrays, all feedlines go into a switchbox and then into a DenTron Monitor Tuner. As a result, I've not had to be concerned over vswr problems, nor have I ever had any with this antenna.

I can report, however, that this antenna matches very closely to the settings used for the double-extended zepp. In fact, there is only 1.3:1 difference between the two. (In other words, if the transmatch is set for the zepp, which uses a balanced 300-Ohm line, switching in the unbalanced coax feed of the array through the DenTron "coax"/"balanced" panel switch produces only a 1.3:1 swr on the array. As a result, only a very minor adjustment is required to bring the array to a perfect 1:1.) This is quite advantageous, since it simplifies the problem of getting quick comparative antenna checks over the air.

TVI is one final aspect of this antenna that is worth mentioning. No TVI can be noted at all. This is not the case with the double-extended zepp or the roof-mounted ground plane.

This Array on Other Bands

Results on other bands are interesting. However, my comparison standard is a vertical Hy-Gain 14AVQ only. However, here's what I get:

- 20 meters: The vertical is better, by 6 dB.
- 15 meters: The array is better, by 12 dB.
- 10 meters: The array is better, by 24 dB.

Needless to say, this array sees a lot of 10-meter use at W9HBF. Contacts into Europe and Asia are especially good, and my signal frequently beats out all the boys with big beams, as the DX station invariably comes back to me first. Further, DX station contacts tend to be solid and reliable (no QSB), so half-hour-long rag chews on 10 meters with Europe are not uncommon.

Since my vertical does not function below 40 meters, I cannot use it as a comparison standard for 75 meters. But the double-extended zepp does work well there. A comparison here shows that the zepp has it over this array by 18 dB. This is probably because the zepp approximates a dipole at 75 meters. However, the array does function on 75, which surprised me.

Overall, though, the array seems to shine best on 10, 15, and 40. But because of the lack of effective gain-antenna competition at 7 MHz, it stands out more on this band than perhaps anywhere else.

I hope that others may experience equally satisfying results and that they will report refinements that further improve effectiveness. ■

Gilding the Lily

—FT-101 mod for crazed purists

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Smyrna GA 30080

While visiting K4QG, the subject of improvements to his rig came up (doesn't it always?). Jim wanted to be able to switch sidebands on his FT-101 without retuning the vfo. While he hunted up the schematic, WD4JOH (his XYL, Ruth) provided coffee and cake—food for thought, as great decisions were about to be made.

On close examination, the schematic yielded its secret—the varicap diode in the vfo, used for the clarifier, could be used to shift the vfo frequency when changing sidebands. (I know you use the other sideband only when checking someone's signal for suppression of that sideband, but remember the title of this article.) By shifting the frequency of the vfo up about 3 kHz when switching to LSB, the carrier frequency would be unchanged and retuning of the vfo would not be required. Raising the frequency of the vfo could be done easily by increasing the bias voltage on the varicap, which would decrease its capacitance and thereby raise the frequency.

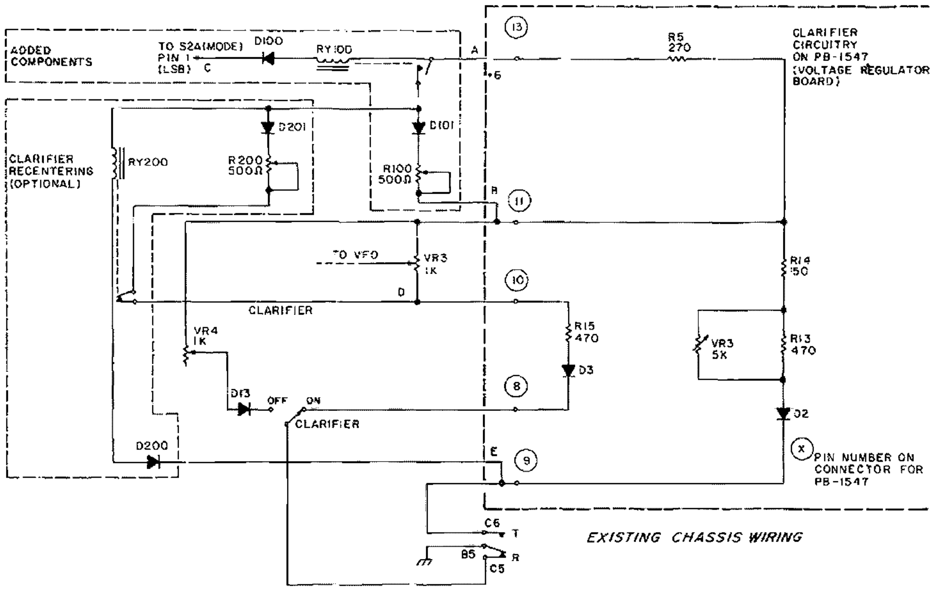

Fig. 1. FT-101 modifications.

A quick trip to Radio Shack netted the required parts: a small six-volt relay, a 500-Ohm pot, and a couple of diodes. Assembling the parts (see schematic, Fig. 1) and gluing the perfboard to the top of the vfo housing is the easy part. Now get another cup of coffee and start counting pins on the PC board connectors and switches in the FT-101. *Pull the plug before you*

open the covers!

The rest of the modification reads like an assembly manual, but maybe you won't go to sleep. Most of the wiring is done to the connector for PB-1547, the voltage regulator board, as this is where most of the clarifier circuitry is located. All the wiring is add-in; no removals. (It's easier this way and I'm basically lazy.) The pins on the connector start numbering with 1 at the rear of the transceiver and count up toward the front.

Point A on the schematic goes to pin 13 of the PB-1547 connector (red/white wire). Point B goes to pin 11 (yellow wire), and point C goes to pin 1 of the MODE switch (wafer closest to front panel, grey/white wire). If you remove the speaker mounting plate, the wire to the MODE switch can be threaded through the existing clips.

Adjustment is simple. Just turn the calibrator on and tune for zero beat in the USB position (clarifier off), then switch to LSB and adjust R100 for zero beat. That's it. Well, almost. This modification causes the clarifier control zero point to be offset about 90 degrees when on LSB with the clarifier on. If you don't use the clarifier or if the offset doesn't bother you, the rest of this article is just nice to know. If you want to re-center the clarifier tuning, read on.

Another addition (still the easy way) will re-center the clarifier control on LSB. The 200-series parts are used to change the vfo offset in receive with the clarifier on and then change it back when the T-R relay is operated. (This probably could be done with solid-state switches if you want to try it.)

The perfboard will have to be expanded to hold the additional parts, and the wiring goes as follows: point D to pin 10 of the PB-1547 connector (blue wire) and point E to pin 9 (you should be able to find this one).

Adjustment of this part of the circuit is easy also: MODE to LSB, clarifier off, tune in the calibrator for zero beat. Turn the clarifier on and set its tuning control to 0 offset (center of range). Adjust R200 for zero beat, and you are finished. Be sure to plug the rig back in before attempting to make any adjustments. (You *did* unplug it before you started, didn't you?)

If you have read this far, you deserve an explanation of how it works. R5 is part of a three-legged voltage divider, the legs being: (1) VR3, R15, D3 (receive frequency with clarifier on); (2) VR4, D13 (receive frequency with clarifier off); and (3) R14, R13, VR3, D2 (transmit frequency). By shunting R5 with R100, the voltage at the junction of R5, R14, VR3, and VR4 is increased in the LSB mode. This increases the voltage applied to the varicap in both transmit and receive, providing the desired vfo frequency change. R200 is shunted across the combination of R5, R100, and VR3 during receive to re-center the clarifier tuning range.

No, I don't know if it will work on your transceiver if it's other than the FT-101. Yes, I will answer your questions (if I can), but remember that I don't have a diagram of your transceiver and I can't even guess at connection points without one. And, please, send an SASE.■

Mike Mods for the KDK-2016A

—improved scanning

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For the price, the KDK-2016A is one of the finest two-meter rigs on the market today. I find it very easy to operate, and with the 4-channel, programmable memory scanner, it is unlikely that you will ever miss a call.

The only area that I felt needed improvement was the location of the scanner's Close-Hold-Open switch. Located on the front panel, upper-left corner, third from the left, this switch controls the scanner functions. The Close position locks the scanner on a frequency that is occupied. The Hold position holds that frequency so that you can QSO on it. The Open position locks on a vacant frequency.

The location of this switch next to the Tone/PL and RF ATT switch was such that when trying to put the scanner in Hold I would accidentally bump the PL to the OFF position, making it impossible to bring up the repeater. If nothing else, this modification might save you from having to take your eyes off the road, with consequent fender-repair and dentist bills.

The idea is to open the wire from P-12 and the middle pin on the scanner switch. This is done with a push/on and push/off switch located on the microphone. (*Caution:* The modification shown here is *only* for the CES-230A microphone, called the FMMC-1, when ordered with the KDK. This mike calls for +12 V dc to be applied to one of the microphone pins.) I have shown in Fig. 4 how a standard KDK mike is connected. I also caution you to remember Murphy when drilling the front panel!

See Figs. 1, 2, and 3 for the wiring of the CES-230A and the mating of the 6-conductor mike cord.

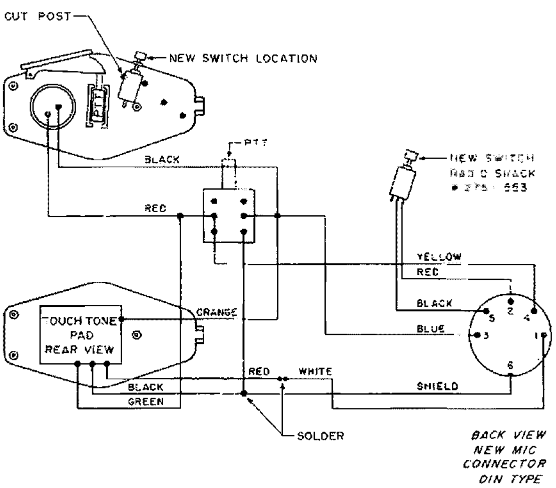

Fig. 1. Microphone wiring arrangement (CES-230A microphone only).

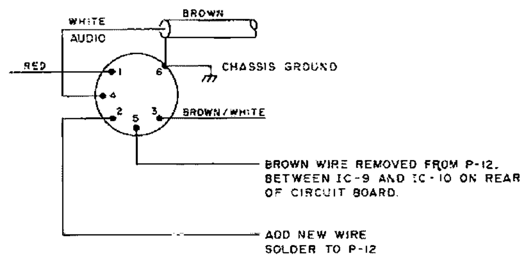

Fig. 2. Back view of new chassis socket (Radio Shack #274-1005).

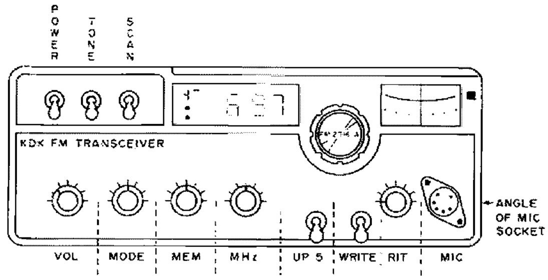

Fig. 3. Front view of KDK-2016A.

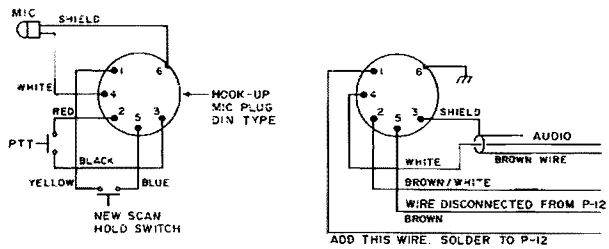

Fig. 4. Standard mike wiring arrangement.

Parts are from Radio Shack and are standard DIN type. Cost of the modification was on the order of $5.00, and it took me about 2 hours.

If you are a 2-meter RTTY fan, this is the rig for you. There is a DIN receptacle mounted on the back of the radio that is made for hooking up the rig to a TU. With this hooked to the TU-170, I can still operate on phone. There is no need to unhook the TU connections, as keying and audio are fed into the back of the rig and the mike can be left in the front jack.

I hope this article will help those of you who like to keep your eyes on the road. For you who have to look down at your rig to see what switch to throw, I would suggest that you make friends with someone in the auto repair business.

If you happen to be in the Michigan City area, please give me a shout on the .37/.97 machine, or 14.090 RTTY. 73 and good luck. ■

Clock Blocks

—a compendium of TTL and CMOS oscillators

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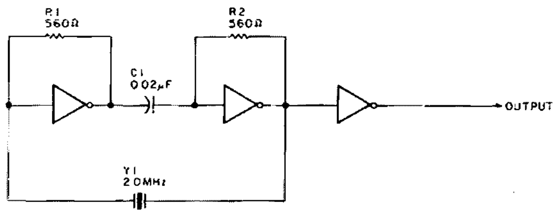

Fig. 1.

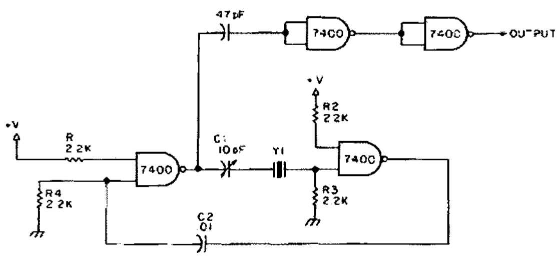

Fig. 2.

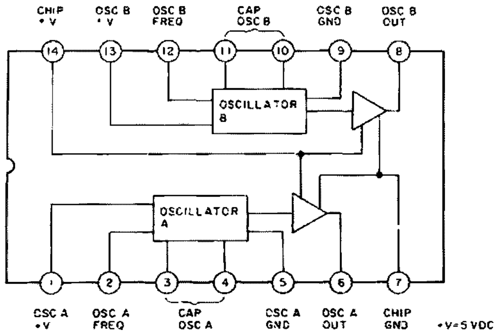

Fig. 3(a).

A lot of digital circuits require a clock, which is a square-wave oscillator running at some frequency. Some circuits might require only an RC square-wave oscillator of almost any output amplitude greater than a few volts. Other circuits require a more precisely controlled crystal-oscillator circuit (most UARTs require a crystal clock). In other cases, the output of the oscillator will have to be either TTL- or CMOS-compatible.

If you buy some type of digital kit or build a project from this magazine, then the clock oscillator circuit will be designed for you. But what do you do if you want to design or build your own digital circuit and a clock is needed? Say you want to interface a teletypewriter printer with your microcomputer and find that the UART you want to use needs a precisely controlled clock at a certain frequency. The circuits discussed below should help you out; they consist of both oscillator circuits and dividers.

TTL Clock Circuits

Many hobbyists who are confronted with the need for an oscillator circuit which generates square waves head for the nearest 555 IC. But the 555 output is not always TTL-compatible and that can cause problems. TTL devices want to see only other TTL devices at their inputs, so the non-TTL output of the 555 may be incorrect (especially if V+ is greater than +5 V dc!).

We can use either specialized TTL chips or ordinary TTL logic devices. The most common configuration is to use an inverter or a NAND (or NOR) gate connected as an inverter. Fig. 1 shows one popular form of TTL crystal oscillator consisting of two inverters. Keep in mind that a 7400 NAND gate connected with both inputs tied together will operate as an inverter, and, in fact, is the most commonly seen IC in this type of circuit. Resistors R1 and R2 bias the inverters, while capacitor C1 provides dc isolation between the two stages. In this case, we do *not* want direct-coupled connection. The resonant frequency is set by crystal Y1.

This circuit will work in the range of 100 kHz to 3 MHz, although it is known to be a little balky (i.e., critical starting) at the lower end of this range.

Sometimes we must juggle the ICs and crystals used when these low frequencies are desired. While it is well known that crystals vary from one unit to another, most people are not aware that "standard" TTL devices also vary from one to another, especially those from different manufacturers.

It is common practice in all crystal oscillators to provide an output buffer stage. This is done to prevent loading of the oscillator by changes in the external load circuit. To overcome this problem, we provide another inverter at the output of the oscillator. This is such a good practice that it is recommended for all clock oscillators.

The crystal is shown here in the feedback path between the output and the input. We must accept whatever frequency the crystal chooses to produce unless we connect a small (15-30-pF) trimmer capacitor in series with the crystal. We will then be able to make small adjustments in the oscillator frequency.

Another approach to building TTL clock oscillators from ordinary TTL gates or inverters is shown in Fig. 2. This circuit is slightly different from the version shown in Fig. 1, but it is essentially the same idea. This particular circuit places the crystal in series between the two gates. This is not too different from the other example; the important thing is that the crystal is in a series loop with the two stages. The 110-pF capacitor provides control of the operating frequency. Note the double buffering used. This is easy to implement because a 7400 TTL NAND gate IC has four independent NAND gates inside.

I am not terribly fond of TTL inverter/gate clock oscillator circuits. All of them can be a little sticky sometimes. They may fail to start or may quit at an inopportune time. When I first bought my microcomputer, the darn thing would not operate and the trouble was traced to a flaky clock-oscillator circuit. It seems that certain brands of 7400s would not operate unless a 220-pF capacitor was added to increase the feedback. Problems like that I don't need. Because of these experiences, I prefer to use a nice little Motorola chip as an oscillator. This IC is the MC4024 oscillator IC (not to be confused with the CMOS 4024 device!). It is readily available from most of the mail-order hobbyist electronics suppliers.

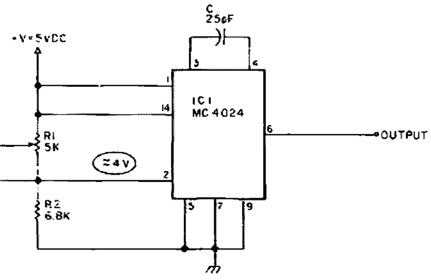

Fig. 3(b).

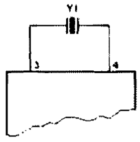

Fig. 3(c).

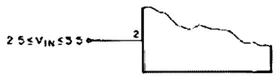

Fig. 3(d).

Fig. 3(a) shows the MC4024 pinouts and a block diagram of the internal circuitry. Note that the two oscillators, labeled A and B, are independent of each other in several ways. There are overall chip ground and chip V+ terminals, as well as separate V+ for oscillator A and oscillator B. Also, the grounds for the respective oscillators are separate.

In order to make one of these oscillators operate, we must ground both the chip ground terminal (pin 7) and the ground for the particular oscillator that we want to use (pins 5 or 9, for A or B, respectively). Similarly, we need to apply +5 volts dc to both the chip V+ terminal (pin 14) and the particular oscillator V+ terminal (pins 1 or 13, for A or B, respectively). Fig. 3(b) shows the standard configuration for using a single capacitor to control the frequency of one of the oscillators. In this circuit we are using oscillator A, but the same circuit is also used for oscillator B; only the pinouts are changed.

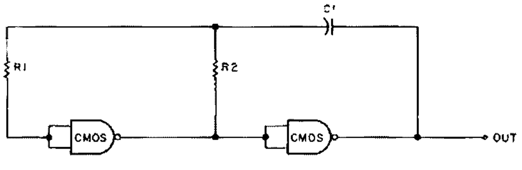

Fig. 4(a).

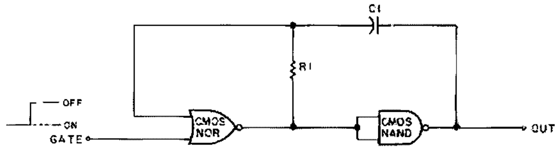

Fig. 4(b).

This circuit will operate over the range of 1 Hz to 25 MHz, with some units capable of operation to 30 MHz. The voltage divider consisting of R1 and R2 sets the control voltage at pin 2 of the MC4024 and that allows control of the output frequency. Control is possible over a 3.5:1 range. In some cases, simplicity tells us simply to delete R1/R2 and connect pin 2 directly to V+.

We can obtain only a rough formula for determining the operating frequency of this circuit. In general, we can claim that the operating frequency will be (approximately): $F=300/C1$, where F is the frequency in megahertz and C1 is in picofarads. This formula is valid only when the voltage on pin 2 is +5 volts dc. At lower voltages (down to +2.5 volts dc), the frequency will be lower—this is a general rule of thumb. Additional formulas for different operating conditions are given in the Motorola data sheet for the device.

We also can crystal-control the MC4024, but the frequency range is narrower. The frequency of the crystal must be between 1 MHz and 25 MHz. In practice, if the frequency is less than 2 MHz it is best to parallel a small capacitor with the crystal. Many crystals fail to oscillate in the 1-2-MHz range, but there is little trouble at higher frequencies. All we do to crystal-control the oscillator is to replace the capacitor with a crystal. If the adjustable circuit of Fig. 3(b) is used, it will be possible to pull the frequency of the crystal just a little bit, enough to "net" it on the correct frequency with potentiometer R1.

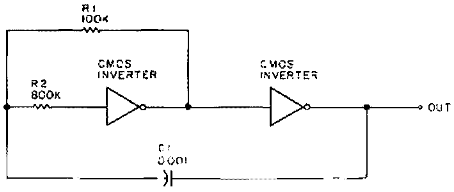

Fig. 5.

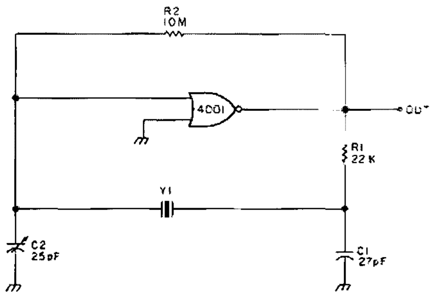

Fig. 6.

The MC4024 device can be used also, in either crystal or capacitor versions, as a voltage-controlled oscillator. In fact, it is as a vco that the device really earns its keep. We need only apply a control voltage to pin 2. In the case of a sweep generator, we would replace R1 and R2 of Fig. 3(b) with a sawtooth voltage. Just connect pin 2 to a low-impedance output voltage source—see Fig. 3(d).

CMOS Circuits

Those who fancy CMOS digital ICs can make oscillator circuits from ordinary gates as well. Also, they may select specialized IC devices from several manufacturers.

Fig. 4(a) shows an RC CMOS oscillator which uses a pair of NAND gates, or inverters, as the active elements. The operating frequency is given roughly by F = 1/1.4RC, where F is the frequency in Hertz, R is the resistance of R2 (in Ohms), and C is the capacitance of C1 in farads. Resistor R1 is used to limit the current and is given a value of R1 = (Vdd − Vss)/0.005. If Vdd, the positive supply voltage, is +5 volts dc and Vss is zero (i.e., grounded), then R1 will have a value of 1000 Ohms.

A related circuit, shown in Fig. 4(b), allows us to turn the oscillator on and off with an external logic level. This is very handy in many digital circuit applications. We do this neat trick by replacing one of the gates with a NOR gate. One input is used in a manner similar to that of Fig. 4(a), but the other input is used to gate the oscillator on and off. A high applied to this terminal turns off the oscillator, while a low turns it on.

Fig. 5 shows a variation on the circuit which makes it a little more free of frequency changes due to variations in power-supply voltages. Not all CMOS devices are used in a well-regulated power-supply environment, so this circuit may be necessary.

A CMOS crystal oscillator is shown in Fig. 6. This circuit uses the common CD4001 device as the active element—but notice the feedback network. It is a pi-network consisting of a crystal (Y1) and two capacitors, C1 and C2. This is relatively standard practice in CMOS circuits and is recommended by at least one major CMOS manufacturer as the circuit of choice. Feedback and slight frequency variations are possible using trimmer C2.

CMOS is a slow, or low-frequency, if you prefer, logic family. It will not operate at the frequencies that TTL will handle easily. But, on the other hand, it does operate nicely at under 100 kHz!

Dividers

We don't always have an oscillator operating on exactly the frequency that we need. Alternatively, we might need several frequencies which are harmonically related. An example is the crystal calibrator used by amateurs, CBers, and SWLs to spot the correct frequency on a communications receiver dial. To provide these, it is common practice to operate the oscillator at some higher frequency (e.g., 1 MHz in the example of the crystal calibrator) and then divide down. The TTL 7490 device is a nice example of a divide-by-10 IC. Its output frequency is 1/10 the input frequency. A cascade chain of 7490s will provide all of the needed output frequencies down to any point that you require.

If division ratios other than 10 are needed, then other ICs are available. In TTL, there are divide-by-8 and -16 devices that cost peanuts. There also are several examples in CMOS, including one binary counter (CD4024) and a really big divider (4020). If you really want to get slick, then try one of the higher-cost (and often harder to obtain) divide-by-N counters. These will divide by any ratio up to 256 or 1024. The exact division ratio is set by applying an N-bit binary word to the programming inputs. These are usually called programmable divide-by-N counters.■

Build a Better Battery Tester

—test 'em under load

Everyone knows that batteries should be tested while loaded. Or does everyone know this? Many amateurs test batteries simply by grabbing a VOM and checking the voltage across the battery terminals.

Often one can get away with this procedure, and things will work fine if the batteries tested are fresh. There are many situations where this procedure will not work, however, and the few seconds saved by not testing a battery properly will end up costing hours trying to understand why some circuit does not operate properly.

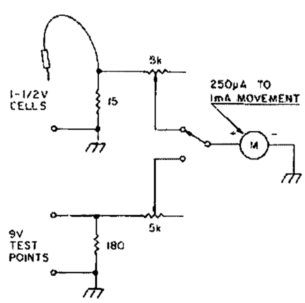

Fig. 1. Circuitry of the battery tester. It is designed for 9-volt batteries and AA/C/D-type cells only.

A good example of this happened when we were using a portable WWV receiver powered by a regular 9-volt transistor radio battery. The receiver exhibited low sensitivity. The battery was hastily checked (using the VOM method), and then a great deal of time was spent checking the rest of the circuit trying to find a fault. As it turned out, the battery was at fault. It would measure 9 volts using a VOM, but only around 5 volts when checked under a simulated load. A similar situation developed when a battery-powered electronic keyer started to perform erratically.

As the number of battery-powered pieces of equipment or accessory items grows in a shack, it pays, therefore, to get away from the simple VOM method of checking batteries. This is true, of course, regardless of the type of battery being used —carbon/zinc, alkaline, nicad, or whatever.

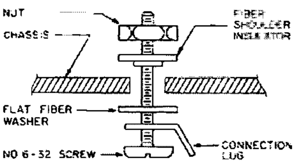

Fig. 2. Plain no. 6-32 hardware is used to form the necessary insulated test prods.

There are many battery testers available, and some are not expensive. There is very little to the circuitry of any battery tester for small cells, however, and one usually can build a tester from parts on hand. This battery tester was made up just to test 9-volt batteries and AA/C/D-type cells. The heart of the tester is an old-fashioned 0-1 milliampere meter rescued from a junk box.

Many other forms of surplus meters may be used, including some of the inexpensive tuning-types selling for a dollar or two. About the only requirement is that the meter have some combination of current deflection requirement and coil resistance so that it will indicate low voltages. This is easily met by many inexpensive meters which have current requirements below 1 milliampere and coil resistances of a few hundred Ohms, so that even a fraction of a volt will cause full-scale deflection.

The circuit of the tester is shown in Fig. 1. The 15-Ohm resistor provides about a 100-milliampere load to a 1.5-volt type battery, and the 180-Ohm resistor provides about a 50-milliampere load to a 9-volt battery. The two 5k variable resistors are used to set the full-scale deflection on the meter, using a known voltage source. For testing 1.5-volt batteries, the full-scale deflection is set for 2 volts, and for testing 9-volt batteries, the full-scale deflection is set for 10 volts. These were just convenient full-scale deflection values considering the scale on the 0-1 milliampere meter used. One could just as well set the deflection using batteries known to be good and let it go at that.

The test points for the battery are not complicated. They are made by simply using no. 6 hardware. The ¾"-long screws are filed to have a pointed end, and then they are mounted on the chassis using suitable fiber washers to provide insulation. The details

are shown in Fig. 2. The test points for 9-volt batteries are spaced ½" apart. There is only one test point for 1½-volt batteries, with connection to the positive terminal of the battery being made with a test lead. This arrangement has proven to be very handy in testing batteries, as opposed to using battery holders.

One could, of course, build a more elaborate battery tester by expansion of the idea shown. One also might wish to make provisions for testing each type of battery under different types of load conditions which approach the load placed on a battery in actual service. Obviously, some batteries which are approaching the end of their lives if fully loaded can still be useful for an extended time if only lightly loaded.

There is a problem, however, in approaching a more sophisticated method of checking batteries: obtaining accurate data on a battery's rated capacity. Nicads in the AA size usually have a 10-hour discharge rate of 45/50 mA. The discharge rate is 190 mA for C cells, and 400 mA for D cells. For these types of batteries, or for other types where some data is known, one can tailor the test load used to correspond to the performance the battery should deliver.

For the garden-variety forms and brands of batteries, however, the loading used in the battery tester as presented has worked very well.

A final note: When testing batteries, hold the battery on the tester for a few seconds. The true state of some batteries will not be revealed if they are loaded for only an instant.■

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Getting the SB-220 to Idle

—a final-saving mod for Heath's popular linear

Several articles have been written concerning modifications to the Heath SB-220 linear amplifier which will prevent current surges in the filament of the 3-500Z tubes. The surges can lead to grid/filament shorts and ultimate tube destruction.

This modification, while not eliminating the current surges, does much to cut down on the number of times that the amplifier is turned on and off and ultimately lessens the chance of tube destruction.

In checking over the specifications for the new Drake L7 linear amplifier, I noticed that a new feature had been incorporated that would allow you to have the L7 on, but in a standby condition. A quick check of the SB-220 diagram showed that relay RL-1 is made operative by bringing terminal #10 to ground via the RCA connector on the rear apron of the amplifier. My Drake T-4XC, as well as any modern transmitter or transceiver, has a terminal provided which will ground the relay and make the amplifier operative.

The trick, then, is to open the line from the transmitter to the linear and put in a switch so that you can control what the SB-220 will do. Where to put the switch seemed to be the big question. A good "no-holes" location turned out to be at the sensitivity control on the front panel. The original control is replaced with one with a switch. A push-pull switch would be ideal since you would not disturb the setting of the sensitivity when using the switch. Not being able to locate a push-pull at the local parts supply house (an ongoing problem), a regular switch was used.

The old control, R26, is removed from the front panel and the replacement is installed in its place. The wires are then connected as in the original installation. The blue wire coming from the RCA connector on the rear apron, marked "relay" and leading to terminal #10 of the relay, is removed. A new wire is run from the RCA connector to one of the terminals of the switch on the front panel. A second wire is run from the other terminal of the switch to terminal #10 of the relay. That's it!

To operate the SB-220, turn on the ac power switch and then the switch on the sensitivity control. Your amplifier will then run just as it did before. When you key the transmitter, the linear comes online and the relative-power meter functions. If you want to place the SB-220 in the bypass condition, just turn off the switch on the sensitivity control. The filament and the high voltage are still on, but the relay is inoperative.

The filament current surges have not been eliminated, but you have cut down on the number of times that the amplifier is turned on and off. The chances of tube failure have been reduced by a good factor and you have an operating convenience found on one of the latest linear amplifiers on the market.■

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Egad! An Easy-to-Build Synthesizer!

Have you ever been dissatisfied with having to buy a new crystal each time you wanted to change frequencies on that inexpensive receiver kit you bought?

This article will introduce you to an easily-built frequency synthesizer that can be adapted for two-meter ham band or weather satellite use.

If you are tired of being confined to the three or four channels in your crystal-controlled receiver, let me show you how you can have 299 channels for about twenty cents apiece. That's really not bad considering that crystals cost from five to six dollars each these days, and 299-position rotary switches are even more expensive!

By now, I am sure that you have asked yourself just why you need a 299-channel receiver, anyhow. Let me tell you how it all got started for me. A couple of years ago the Soviet Union started leaving some of their Meteor-series weather satellites operating over the United States. This stirred up my interest considerably, since up until 1976 I had used only United States satellites.

At that time, my receiver was all crystal controlled, and the Meteor spacecraft used different frequencies in the 136- to 138-MHz band. It took me two weeks to get a new crystal for the receiver; by that time the bird was programmed not to broadcast for a while, so I finally had the 137.3-MHz frequency available but no satellite. This really sounds like Murphy at work.

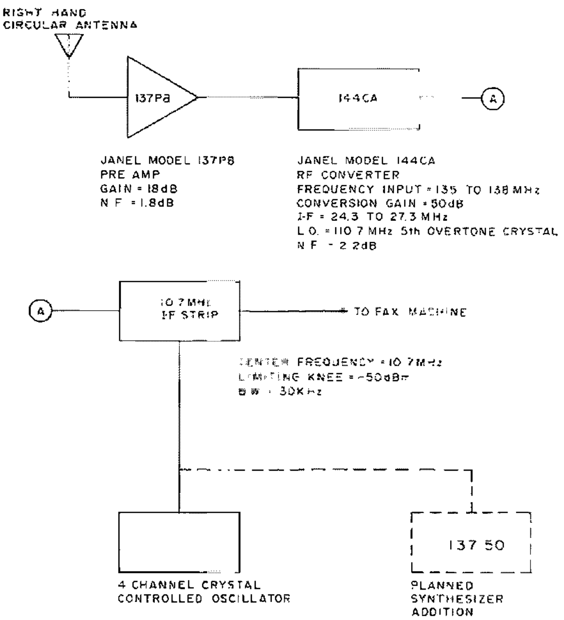


Fig. 1. Receiver block diagram.

It was not until 1978 that things got stirred up again. The Soviets now had a Meteor operating over the United States with high resolution—about one nautical mile resolution. This was discovered by Bill Watt in Conyngham, Pennsylvania, using a scanner/synthesizer arrangement. Naturally, I contacted Bill and found out the new frequency in use as well as the type of equipment he was using. This time, the frequency in use was 137.15 MHz, and again I was stuck without a crystal.

It now was becoming rapidly obvious that I had to do something to give the receiver some frequency agility. For all I knew, the next Soviet satellite would be on yet another frequency. The idea for a synthesizer for use in the satellite band seemed reasonable. The synthesizer would have the stability of a crystal with the agility of a variable-frequency oscillator.

First of all, I wrote down some specifications to shoot for in the design of the synthesizer addition.

1. The receiver will operate with inputs from 135 to 137.99 MHz.
2. Channel spacing will be 10 kHz to provide 299 channels. The 10-kHz spacing was deemed adequate since the receiver i-f is 30 kHz wide. This would give some desirable overlap.
3. Reference frequency feedthrough from the loop phase detector will be kept to a minimum since it would modulate the vco.
4. All spurious responses will be 50 dB below the carrier.
5. Vco output will be a minimum of 250-mV p-p in order to drive the SN76514 mixer located in the receiver.
6. The synthesizer lockup time between channels will be 0.5 seconds or better depending on final loop bandwidth and damping factor.
7. The loop damping will be between 0.707 and one.
8. Double power-supply regulation will be used on critical circuits.
9. Good rf construction practices will be used.

After this 1% of inspiration came the fun part!

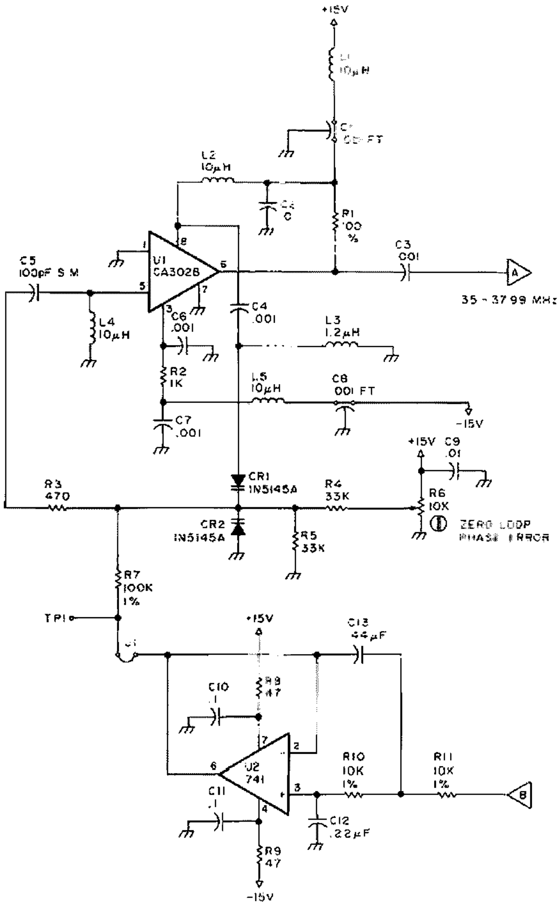


Fig. 2. Voltage-controlled oscillator and low-pass filter.

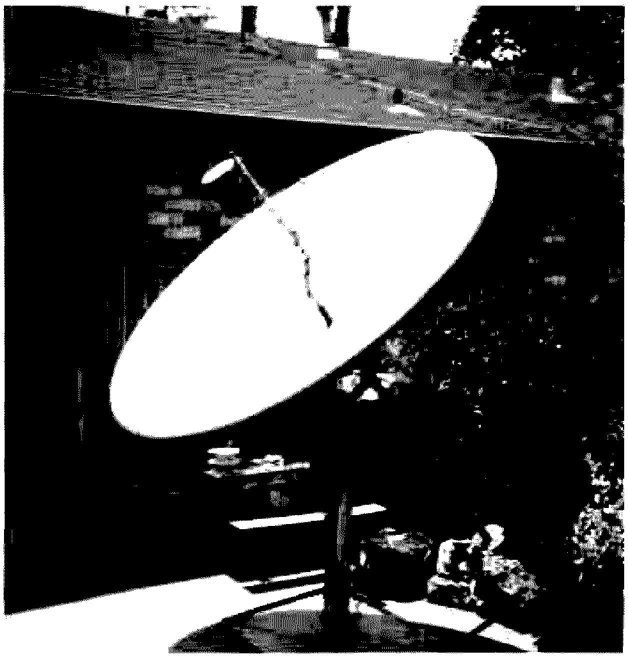


Photo A. A view of the dish antenna shows the usual tin-can feed. Three cast-iron barbell weights comprise the counterbalance. The S-band converter sits below the dish, shielded from the rain in its plastic trash bag. The dish diameter is six feet; the preamp is mounted at the feed.

The work lasted several months.

In discussing the synthesizer design, each section of the loop is reviewed separately. A short loop analysis is also given. I began the design by making a block diagram of the existing station receiver. This appears in Fig. 1. A Janel converter is used in this receiver due to the excellent construction techniques and circuit design by Janel Labs. This converter has worked flawlessly for several years now, and it seems as good as the day it arrived. Recently, the 137PB preamp was added. The 1.8-dB noise figure allowed me to hear the ATS satellites quite well on a simple dipole.

From the block diagram comes the first vital information needed in the design of the synthesizer. This information is the frequency range over which the device will operate. In my case, I changed the original 110-MHz crystal in the Janel to 110.7 MHz. This makes the synthesizer output frequency exactly 100 MHz below the receiver input and simplifies the number crunching for the divide-by-n counter interface. Now, simple subtraction says that the vco in the synthesizer phase-locked loop will run from 35 MHz, corresponding to a 135-MHz input, to 37.99 MHz, corresponding to 137.99 MHz.

The vco was designed around an RCA CA3028 differential amplifier IC, which appears in Fig. 2. One section of the IC is used in the oscillator circuit while the other side is used as an LO buffer. The circuit is useful up to 100 MHz or so by manipulating the tank circuit values. Also, it is quite linear over several MHz. In this case, the vco center frequency is 36.5

To divide by	Count loaded	Qa input	Qb input	Qc input	Qd input
9	0	L	L	L	L
8	1	H	L	L	L
7	2	L	H	L	L
6	3	H	H	L	L
5	4	L	L	H	L
4	5	H	L	H	L
3	6	L	H	H	L
2	7	H	H	H	L
1	8	L	L	L	H
0	9	H	L	L	H

Table 1.

	10 MHz section	1 MHz section	100 kHz section	10 kHz section	
	9	9	9	9	Terminal count
minus	6	4	9	9	Number counter sees to divide by 3500
equals	3	5	0	0	The number of counts to reach terminal count. The number the counter is dividing by.

Table 2.

Photo B. An overall view of the station. The receiver is at the left.

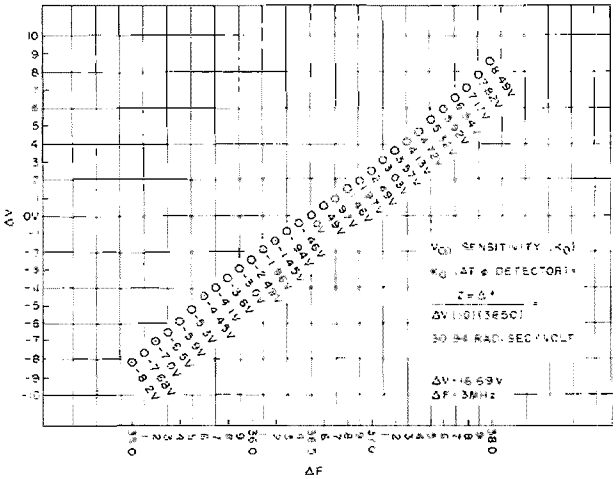


Fig. 3. Vco linearity curve.

MHz, which corresponds to 136.5 MHz, or the center of the satellite band.

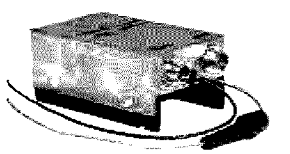
A graph of the vco linearity was plotted to determine its sensitivity, K_O, in radians/sec./volt. The graph was made by disconnecting J1 and applying a precision dc bias voltage through R7 into CR1 and CR2. With TP1 at zero volts, grounded, R6, the zero loop phase error pot, is adjusted to yield 36.5 MHz on point A.

The graph was then plotted in 100-kHz increments while noting the tuning voltage at TP1 required to produce the change. A plus voltage of 8.49 volts increased the frequency from 36.5 MHz to 38 MHz. In order to go down to the low end, 35 MHz, a negative voltage must be used. A voltage of −8.2 volts was needed to go from 36.5 MHz to 35 MHz. The final curve appears in Fig. 3. The linearity of the vco is obvious.

Please note that L3, the 1.2-uH inductor, is an optimum value. Using this value of inductance requires the zero loop phase error pot to place an optimum bias on the varactors. This bias gave the best linearity at this frequency range. The sensitivity of the vco was set by R7, the 100k-Ohm resistor. I decided on the 100k value and limited the vco tuning range to around eight volts either side of zero. This leaves a four-to-five-volt tuning margin on each side of the loop filter at bandedge. Finally, the vco sensitivity was calculated from the graph, as follows, and is used in the analysis of the phase-locked loop.

Vco sensitivity in radians/sec./volt) is equal to $2\pi\Delta F/\Delta V$. Delta F is equal to 3 MHz, and Delta V is 16.69 volts. K_O now works out to be 1.1293 times ten to the sixth power radians/sec./volt. This is the sensitivity of the vco alone. The vco sensitivity at the phase detector input must consider the divide-by-ten prescaler as well as the divide-by-n counter.

After completing the vco design, the high-frequency divide-by-ten prescaler and programmable 3500-to-3599 divider were thought out. These portions of the synthesizer appear in Figs. 4



and 5. The purpose of the divide-by-ten prescaler is to lower the vco frequency a bit so that the programmable counter can function reliably. The output of the prescaler is 3.5 to 3.799 MHz, and this feeds the programmable or divide-by-n counter. I used an MC12013P IC for the divide-by-ten circuit; however, almost any prescaler IC will work.

Looking at the circuit, transistor Q1 buffers and amplifies the vco output to a sufficient level to ensure proper counting by the prescaler. Transistor Q1 has a fixed gain of ten, and C15 couples the desired amount of rf into the MC12013P. About 0.8-volts p-p of rf is needed at pin 15 of the 12013P to ensure proper counting.

The programmable counter has the responsibility of dividing the vco output into 10-kHz increments over the 299-channel range when the loop is locked. To do this, the counter has to be designed to divide-by-3500-to-3799 in 299 steps. The following formula shows how the desired counter range was derived: n (number counter divides by) is equal to: (3.5 MHz − 3.799 MHz)/1000 Hz.

Dividing each frequency by the 1000-Hz reference yields the desired coverage of the counter. The 1000-Hz frequency is the phase detector sampling frequency or reference frequency. A 1000-Hz reference is needed at the phase detector to provide the 10-kHz step at the vco. This can be proven, as follows. For the moment, assume that the loop is locked and that the counter is set at divide-by-3500. The vco frequency now equals: F_{VCO} is equal to (prescaler)(divide-by-n number)(phase detector reference). This yields (10)(3500)(1000), or 35 MHz.

If the programmable counter is advanced to 3501, the vco frequency now becomes F_{VCO} is equal to (10)(3501)(1000) or 3501 MHz. The vco now has increased in frequency the desired 10 kHz, and it will increment 10 kHz each time the counter is advanced one step.

It should be apparent that the vco really is given

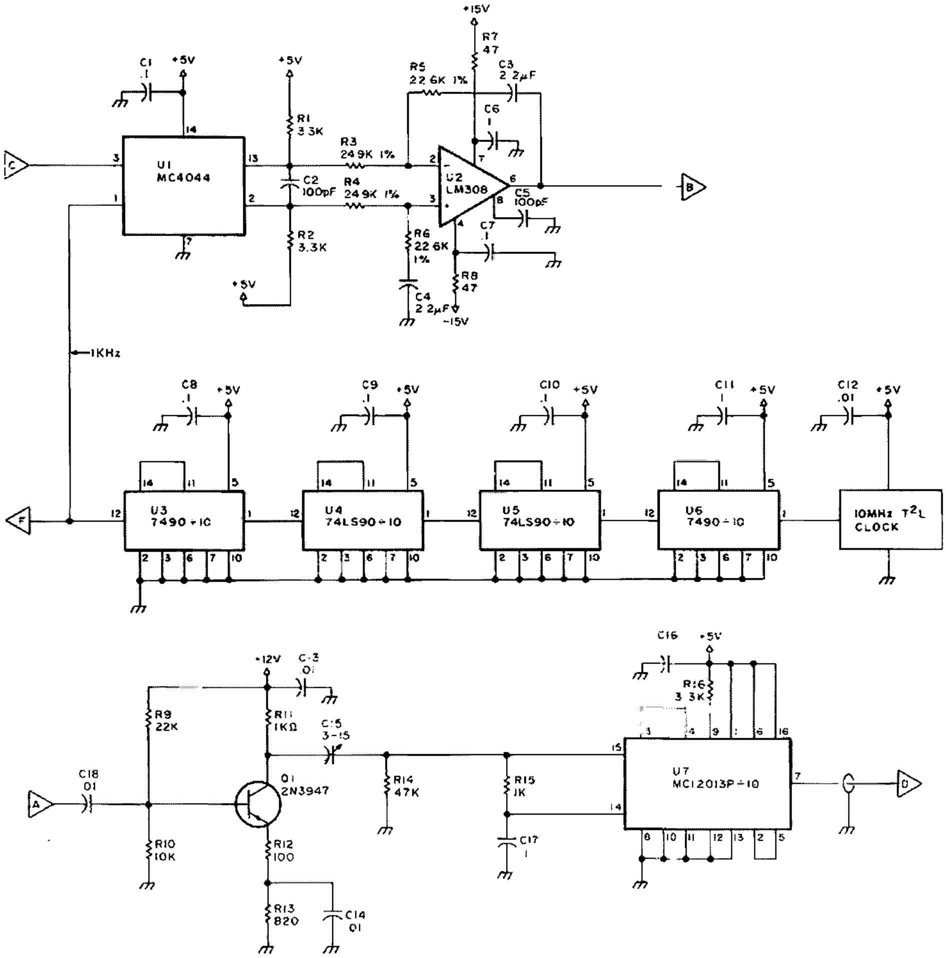


Fig. 4. Phase detector, loop filter, reference for phase detector, and vco prescaler.

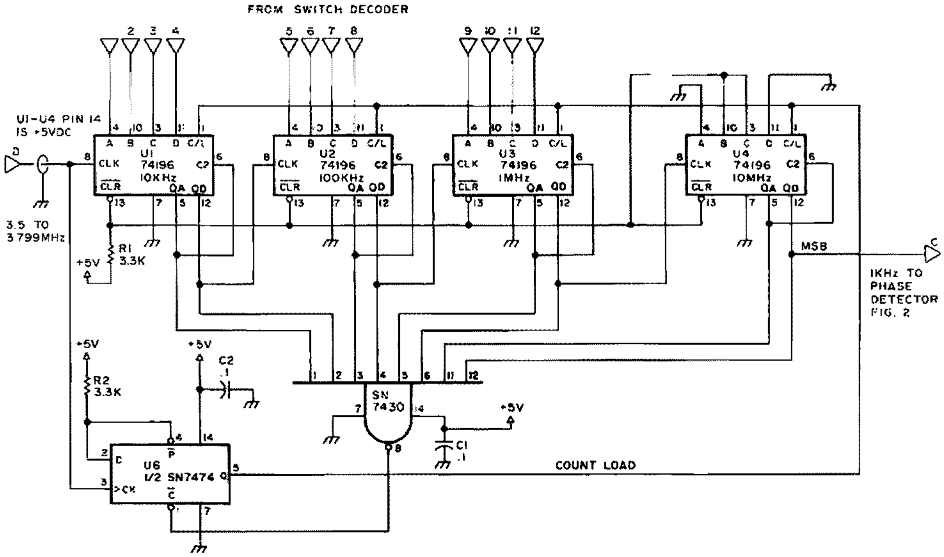


Fig. 5. 3500 to 3799 programmable divider.

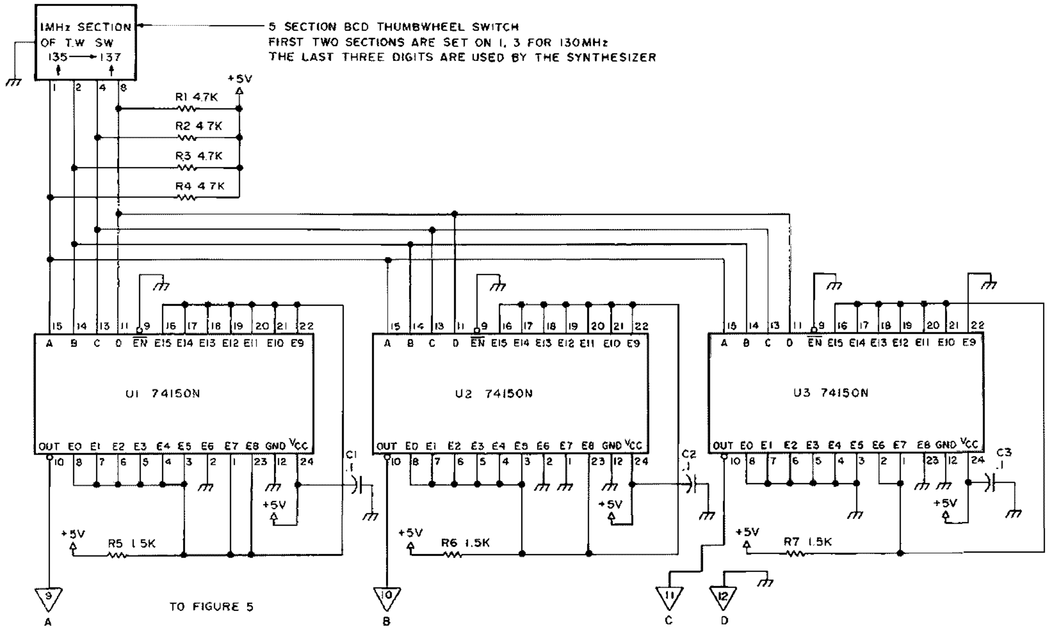


Fig. 6. 1-MHz thumbwheel switch decoder.

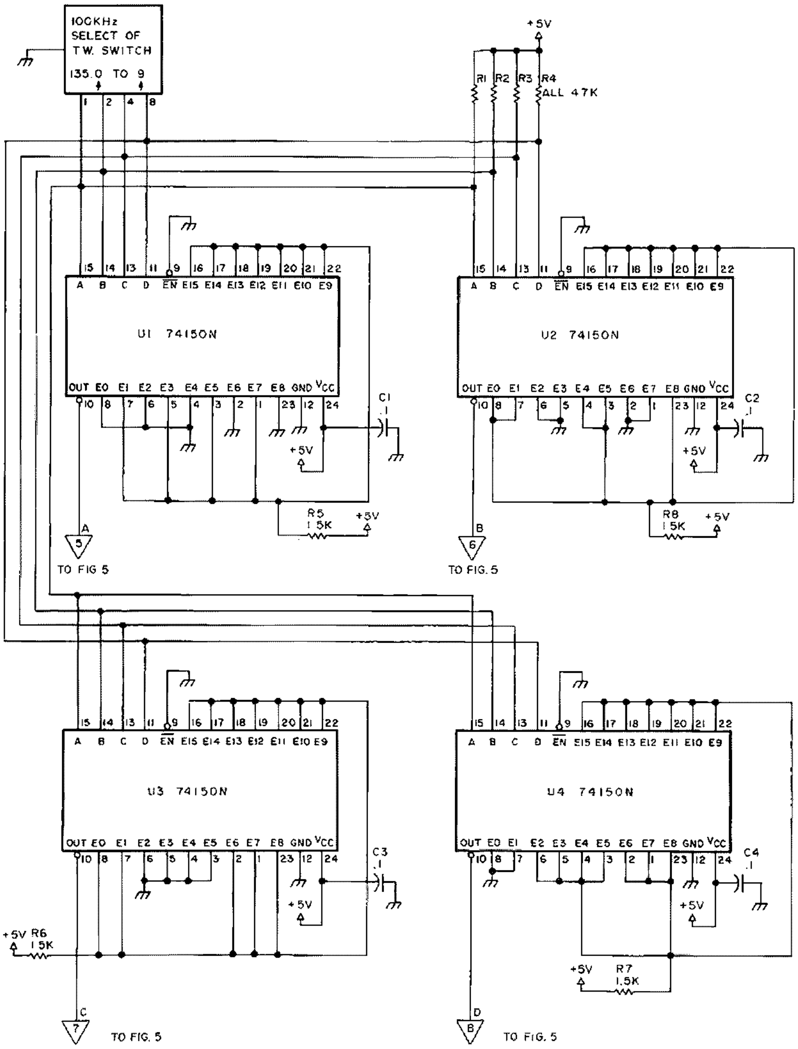


Fig. 7. 100-kHz and 10-kHz thumbwheel switch decoder. Two are required.

no choice about the frequency it takes when the loop is locked. When the loop is locked, the programmable counter output will be 1000 Hz and the 4044 phase detector will keep it and the reference in phase on the trailing edge of the two 1000-Hz waveforms. Any phase difference that occurs is used to steer the vco so that it remains locked to the reference. The nature of the loop is to reflect the stability of the low-frequency 1000-Hz reference to the high-frequency vco.

Next, I would like to give some insight into how the programmable counter functions. To begin, let me say that the counter actually counts between two numbers. One number is its maximum or terminal count while the other is a BCD start number. The terminal count is 9999 while the jam set inputs accept the BCD starting count. The BCD starting count comes from the thumbwheel switch decoder. This decoder converts the BCD data from the switches into the proper BCD number for the counters.

When the receiver is set to receive 135.00 MHz, the counter is doing division by

3500. To do this division by 3500, a count of 6499 is loaded into the jam set inputs. This 6499 becomes the counter's starting point. The count load line on the 74196 counters jams in the start count of 6499 and the ICs begin counting to terminal count. It will take 3500 counts to reach the terminal count of 9999. Therefore, the MSB on the last counter is a divide-by-3500 output.

To divide by larger numbers, the starting count is simply made smaller since more counts are needed. When the counter arrives at terminal count, the 7430 NAND gate senses the condition and clears flip-flop U6. This loads the starting number. Upon the next transition of the clock from zero to one, the Q output follows the D input and the counters count to terminal count once more. A sample truth table for one counter is given in Table 1.

This truth table is generated by the thumbwheel switch decoders (Figs. 6 and 7). The decoders drive the 10-kHz, 100-kHz, and the 1-MHz counters. The 10-MHz counter has a three hard-wired on its input since it does not change. An interesting feature of the 1-MHz decoder is that it has to change only from five to seven. Since the switch will rotate from zero to nine, the 74150 selectors are wired to insert a five into the counter if an illegal code is selected. If 0, 1, 2, 3, 4, 8, or 9 is selected, the synthesizer is operating in the 135 band.

Please remember that when I speak of numbers such as the above 5, 6, or 7, and the hard-wired three, these are numbers to divide by and not the actual counts to be loaded. In the 10-kHz and 100-kHz sections, the thumbwheel switch simply rotates zero to nine. The actual counts loaded here range from zero-loaded for nine to nine-loaded for zero. The examples in Table 2 help illustrate the counter function.

When the counter is at 3799, the 6499 is simply changed to 6200. I have used this counter that I designed, along with variations of it, in many designs. It can operate at quite high speeds as well as perform some strange divide functions.

The next important portion of the synthesizer is the phase detector. This design utilizes the MC4044 phase detector; however, the charge-pump portion is not used. The phase detector generates an error that is related to the phase difference between the 1-kHz reference frequency and the 1-kHz output from the programmable counter. The phase detector has a certain gain in volts/radian. This value is known as K_d and was found to be 0.7 volts/radian for the 4044 used here.

The phase detector reference or sampling frequency of 1000 Hz is derived from a stable source. I have used a 10-MHz crystal oscillator as the system standard. The output is simply divided down with simple divide-by-ten stages to the desired frequency of 1 kHz. It is a good idea to build all of the reference frequency generating circuits in a highly shielded enclosure. In my case, the 10 MHz was only 700 kHz away from the receiver i-f so that the shielding was very necessary.

The two outputs from the phase detector are summed together in the loop filter. I use a differential summing loop filter. The loop filter has about a 10-Hz bandwidth, or ω_n. To keep the vco quiet, a two-pole post filter was added. This filter breaks at 50 Hz. It was necessary to keep the loop narrow so that the vco remained fairly pure. Any AM

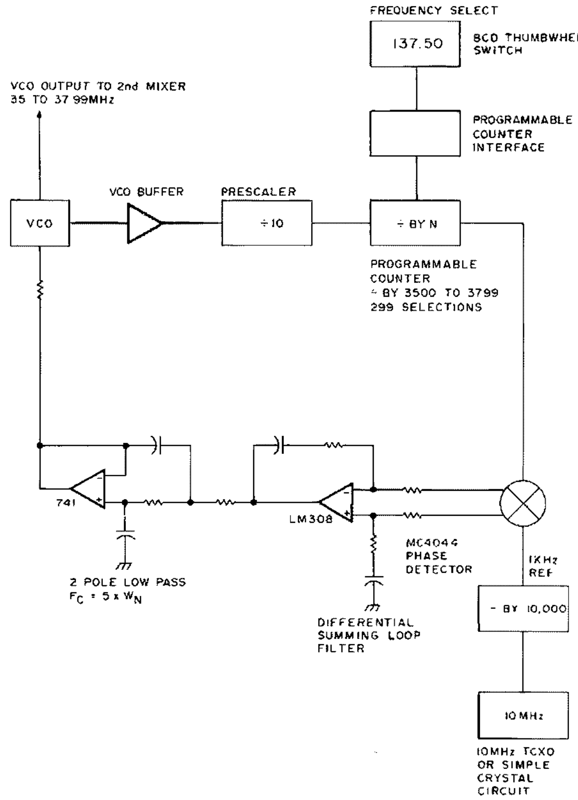


Fig. 8. Synthesizer block diagram.

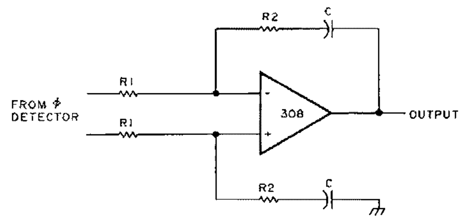


Fig. 9. Basic loop filter.

or FM modulation on the vco control line could render the synthesizer useless. I have not experienced any problems with 60- or 120-Hz modulation on the vco. If this were a problem, the loop bandwidth could be opened up a bit to track this out.

Finally, the output of the post filter connects back to the vco and closes the loop. The polarity of the tuning voltage is always such that the vco is driven until its counted-down output matches the 1-kHz reference. A block diagram of the synthesizer is shown in Fig. 8.

Next, I would like to show how I derived the values for the loop filter. The calculations used were simple and can be looked at in greater detail in references one and two. A good place to begin is by looking at what is given.

1. Phase detector sensitivity, 0.7 volts/radian.
2. Vco sensitivity, 1.129 times ten to the sixth power radians/sec./volt.
3. Damping factor, 0.707.
4. Lock-up time, 0.5 sec. between channels.
5. Vco sensitivity at phase detector input is equal to 1.129 times ten to the sixth divided by 3650(10). This yields 30.94 radians/sec./volt.

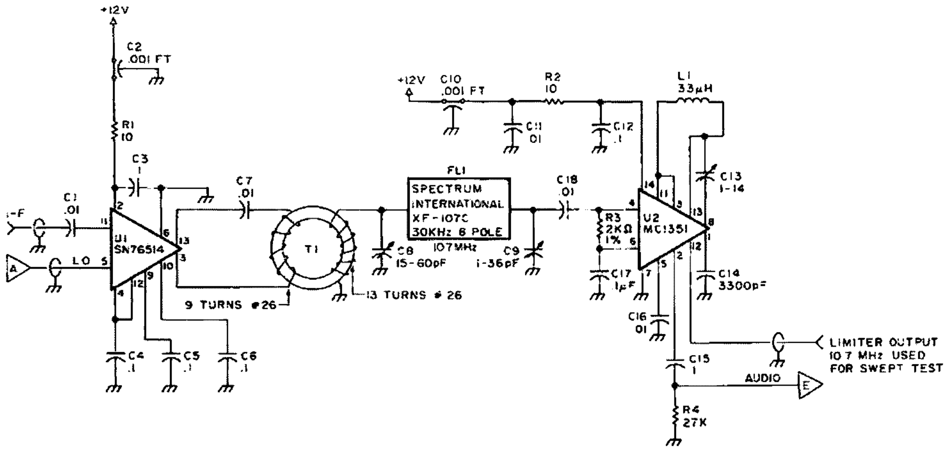


Fig. 10. 10.7-MHz FM i-f strip.

The sketch of the loop filter (Fig. 9) shows that a value is to be found for C plus R1 and R2.

The first thing I did was to determine the ω_n of the loop in rad/sec. First of all, it is necessary to consult a table of the second order loop step response. Knowing that the desired damping is 0.707, the time for the peak overshoot to settle out to 5% of its final value is at $\omega_n(t)$ is equal to 4.5. The value for t is .5 seconds or the desired lock time. To determine the ω_n of the loop, the formula is arranged as follows: ω_n is equal to 4.5/0.5 sec., which equals 9; 9(3.14) is equal to 28.2 rad/sec. To calculate the value for R1, the following formula can be used since ω_n is now known:

$$\omega_n = \sqrt{K_oK_dK_a/R1C}$$

The value for K_a is two, since a differential summing loop filter is used. In order to determine R1, the formula is rearranged to solve for R1. Also, a random value is picked for C. I chose to let C equal 2.2 uF so that the resistor values would remain reasonable.

$$\omega_n = \sqrt{K_oK_dK_a/R1C}$$

$$(\omega_n)^2 = (K_oK_dK_a/R1C)$$

$$R1C(\omega_n{}^2) = (K_o)(K_d)(K_a)$$

$$R1(1.749 \times 10^{-3}) = 30.94(.7)(2)$$

$$R1(1.749 \times 10^{-3}) = 43.316$$

$$R1 = 24.766k$$

Now that the value for R1 has been determined, R2 is calculated as follows:

$$R2C = 2(.707)/\omega_n$$

$$R2C = 1.414/28.2$$

$$R2C = .05014$$

Let C equal 2.2 uF

then R2 = 22.791k

Since it would be quite difficult to get exact values for R1 and R2, the closest value available is used. R1 is made the standard value of 24.9k, 1%, and R2 is made 22.6k, 1%. A point worth noting here is that the two-pole low-pass filter following the loop filter does add extra pole locations to the response. I have not had any instability problems from the fact that it is there. A more rigorous analysis for the loop could be done to include this filter for those who desire to do so. The

Parts List

Fig. 2	
C1	.001-μF feedthrough
C2	.01-μF monolithic
C3	.001-μF mono.
C4	.001-μF mono.
C5	100-pF silver mica
C6	.001-μF mono.
C7	.001-μF mono.
C8	.001-μF feedthrough
C9	.01-μF mono.
C10	0.1-μF mono.
C11	0.1-μF mono
C12	0.22-μF mylar™
C13	0.44-μF mylar
CR1	1N5145A
CR2	1N5145A
L1	10-uH)
L2	10-uH)
L3	1.2 uH) shielded
L4	10-uH)
L5	10-uH)
R1	100 Ohms, 1%
R2	1k, 10%
R3	470 Ohms, 10%
R4	33k, 10%
R5	33k, 10%
R6	10k, 20-turn PCB pot
R7	100k, 1%
R8, R9	47 Ohms, 10%
R10	10k, 1%
R11	10k, 1%
U1	CA3028
U2	741
Fig. 4	
C1	0.1-uF mono.
C2	100-pF silver mica
C3	2.2-μF mono.
C4	2.2-μF mono.
C5	100-pF silver mica
C6	0.1-μF mono.
C7	0.1-μF mono.
C8-C11	0.1-μF mono.
C12	.01-μF mono.
C13	.01-μF mono.
C14	.01-μF mono.
C15	3-15-pF variable
C16	0.1-μF mono.
C17	0.1-μF mono.
C18	.01-μF mono.
R1	3.3k, 10%
R2	3.3k, 10%
R3	24.9k, 1%
R4	24.9k, 1%
R5	22.6k, 1%
R6	22.6k, 1%
R7,R8	47 Ohms, 10%
R9	22k, 10%
R10	10k, 10%
R11	1k, 10%
R12	100 Ohms, 10%
R13	820 Ohms, 10%
R14	47k, 10%
R15	1k, 10%
R16	3.3k, 10%
Q1	2N3947
U1	MC4044
U2	LM308
U3	7490
U4,U5	74LS90
U6	7490
U7	MC12013P
Fig. 5	
C1,C2	0.1-μF mono.
R1,R2	3.3k, 10%
U1-U4	74196
U5	7430
U6	7474
Fig. 6	
R1-R4	4.7k, 10%
R5-R7	1.5k, 10%
C1-C3	0.1-μF mono.
U1-U3	74150
Fig. 7	
C1-C4	0.1-μF mono.
R1-R4	4.7k, 10%
R5-R8	1.5k, 10%
U1-U4	74150
Fig. 8.	
CR1	VH148 bridge rectifier
CR2	VH148 bridge rectifier
C1	1100 μF, 50 V
C2	1.0 μF, 50 V
C3	100 μF, 50 V
C4	1100 μF, 50 V
C5	1.0 μF, 50 V
C6	100 μF, 50 V
C7	1.0 μF, 50 V
C8	1.0 μF, 50 V
C9	1.0 μF, 50 V
C10	100 μF, 25 V
C11	100 μF, 25 V
C12	100 μF, 25 V
C13	100 μF, 25 V
C14	4800 μF, 50 V
C15	1.0 μF, 50 V
C16	100 μF, 15 V
S1	DPDT toggle switch
F1	2ASB fuse
T1	F-203U/F-93X transformer series
U1	7624CP +24-V regulator
U2	7924CP −24-V regulator
U3	7612CK +12-V regulator
U4	7815CK +15-V regulator
U5	7912CK −12-V regulator
U6	7915CK −15-V regulator
U7	78H05 +5-V, 5-A regulator
Fig. 10	
C1	.01-μF mono.
C2	.001-μF feedthrough
C3	0.1-μF mono.
C4-C6	0.1-μF mono.
C7	.01-μF mono.
C8	15-60-pF variable
C9	1-36-pF variable
C10	.001-μF feedthrough
C11	.01-μF mono.
C12	0.1-μF mono.
C13	1-14-pF variable
C14	3300-pF
C15	0.1-μF mono.
C16	.01-μF mono.
C17	0.1-μF mono.
C18	.01-μF mono.
L1	33-μH inductor, IR-2
T1	Yellow-dot toroid, 9 turns #26 primary; 13 turns #26 secondary
FL1	XF-107C Spectrum International
R1,R2	10 Ohms, 10%
R3	2.2k, 1%
R4	27k, 10%
U1	SN76514
U2	MC1351
Fig. 11	
C1	0.1-μF mono.
C2	0.1-μF mono.
C3	0.1-μF mono.
C4	1.0-μF mono.
C5	22-pF silver mica
C6	25-uF electrolytic
C7	100-μF electrolytic
C8	0.1-μF mono.
C9	1.0-μF mono.
C10-C11	0.1-μF mono.
C12	3900-pF silver mica
C13-C17	0.1-μF mono
CR1	1N914
CR2	1N914
CR3	1N2484
CR4	1.7-V, 20-mA LED
L1	10-mH inductor
Q1	2N3947
Q2	2N4093
Q3	2N3947
Q4	2N3947
Q5	2N2270
R1,R2,R11,R12	47 Ohms
R3	1k
R4	10k, 20-turn pot
R5,R6	10 Ohms
R7,R8,R20,R21, R29,R30,R32	10k
R9,R17	100k
R10	4.7k
R13	220 Ohms
R14	5k, 10-turn, panel mount
R15,R19	1 meg
R16	15k
R18	560k
R22,R24,R25,R26	4.7k
R23	3.3k
R27,R28	3.3k
R31	120 Ohms
R33	560 Ohms
U1	MC1458
U2	MC1454
U3	741
U4	7474
U5	4020
U6	4020
K1	24-V coil, 110-V ac DPDT contacts, 5 A
S1	SPST Push-button

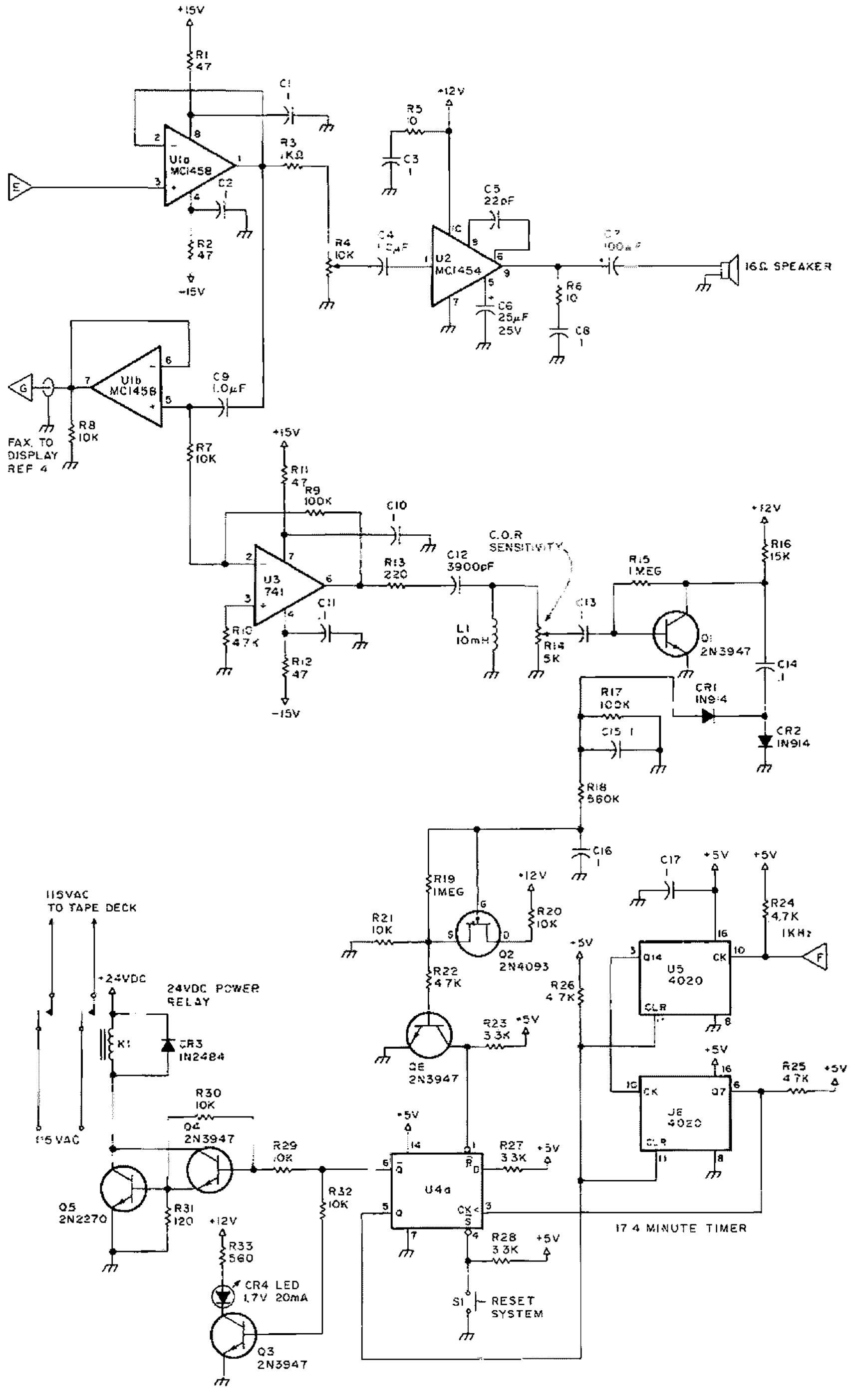


Fig. 11. Audio amp, carrier-operated relay, and pass timer.

synthesizer changes channels smoothly and settles out quite fast, so I feel that it works fine for me. It is most important to have this post filter in the circuit. This is where the majority of the undesirable components coming from the phase detector are finally removed.

When the loop was locked and checked out, the design goals were reviewed. The following results were obtained.

1. I have not found any spurious responses in the receiver from 135 to 137.99 MHz. The synthesizer is heavily shielded and plenty of bypassing is used on power rails.

2. The rf output level is around the desired 250-mV p-p range when the SN76514 mixer is driven.

3. The synthesizer output was looked at on a spectrum analyzer and the 1-kHz reference was not detectable above 50 dB below the carrier.

4. The loop lock time was around the 0.5-sec. value for total settling.

5. The programmable counter advances the vco in 10-kHz steps.

Finally, I have included the remainder of the schematics that complete the receiver package. First, a schematic of the 10.7-MHz i-f strip I use is given (Fig. 10). The SN76514 double-balanced mixer is used to convert the Janel converter i-f to the final i-f of 10.7 MHz. The toroidal transformer steps up the 1200-Ohm impedance of the mixer to about 2000 Ohms to drive the i-f filter. The i-f filter is an eight-pole 32-kHz model from Spectrum International. The filter feeds the limiter/discriminator IC. An MC1351 quadrature detector chip is used to demodulate the FM signal, and it drives the video processor through U1B. The MC1351 is a convenient IC to use since it has a special limiter output on pin twelve. This low-impedance test point is invaluable during alignment with the sweep generator. The sweeper detector is placed here to monitor the shape of the i-f filter as well as to check limiter performance.

The next circuit that is included is the carrier-operated relay and timer I use for automatic recording of passes (Fig. 11). This timing circuit was designed around the 4020 series counters. Since the clock for the counters is derived from the stable system reference, accurate timing is achieved. These counters will outperform the usual NE555-type circuit in this application. The problem with the NE555 is that an accurate timing period cannot be achieved over long durations. The capacitor values become too large and so does the associated timing resistor. It is possible to use the large-value timing capacitors in the NE555

circuits; however, large precision capacitors are hard to come by. Anyway, I feel the NE555 is long overdue a rest.

The way the entire circuit functions is as follows. A sample of the receiver audio is amplified by U3 and passed through a high-pass filter. When noise is present in the receiver, no signal, the high-frequency component is rectified by the 1N914 diodes and applied to the gate of an N-channel FET. The dc level is sufficient to bias the FET off. The gate is placed negative to turn off the device.

Now, as the receiver begins to quiet down upon receipt of a signal, this dc voltage on the FET gate begins to rise towards zero. As the voltage rises, the FET will finally conduct and reset the flip-flop, U4. Please note here that prior to using the timer, the system reset button is usually depressed. If this were not done, one would simply have to wait until the timer timed out.

At this time, reset is accomplished automatically. System reset is simply when the flip-flop is in the set condition. This de-energizes the carrier-operated relay, turns off LED CR4, and resets both 4020 counters. Once the receiver has acquired a live signal, the flip-flop is switched to its reset condition by the FET. This condition will energize the carrier-operated relay, turn on the LED, and allow the 4020 counters to begin counting.

It will take 17.4 minutes for the counters to produce a rising clock pulse to the flip-flop, U4. At this point in time, assuming the receiver is back to the noise condition, the flip-flop will be toggled back to the system-reset condition. The carrier-operated relay will turn off any equipment, such as a tape recorder, and wait until the next pass of the satellite (or transmission period, in the case of WEFAX). The 17.4-minute interval was chosen to allow the satellite to have time to complete its pass and get over the horizon.

Other time intervals can be set easily simply by selecting another output from the 4020 counter. I have used this timer and carrier-operated relay circuit to automatically record TIROS N passes as well as the Soviet birds when I can catch them on. It is necessary to have an omnidirectional, circular-polarized antenna connected to the receiver for unattended logging of passes.

The power supply (Fig. 12) deserves some mention only in that both the ±12- and ±15-volt supplies use dual regulation. The approximate 32 V dc is first regulated to ±24 volts and then to ±12 and ±15. The +5-volt supply has only one regulator.

In conclusion, I would like to say that the receiver has been a pleasure to operate. Combining all the circuits into a small compact unit makes the station much easier to live with. The synthesizer addition has not ceased to amaze me yet. Having 299 channels at your fingertips sure does beat swapping crystals.

If you address any questions to me, be sure to send me an SASE.■

References

1. *Theory of Phase Lock Techniques*, Floyd M. Gardner, Steven S. Kent, and Raymond D. Dasenbrock.
2. Motorola Application Notes, AN-532A, AN-535, AN-541, AN-553, and AN-564.
3. "Autophasing for WEFAX," Roy Cawthon, *73 Magazine*, December, 1978.
4. "Attention Weather Watchers," Roy Cawthon, *73 Magazine*, October, 1978.

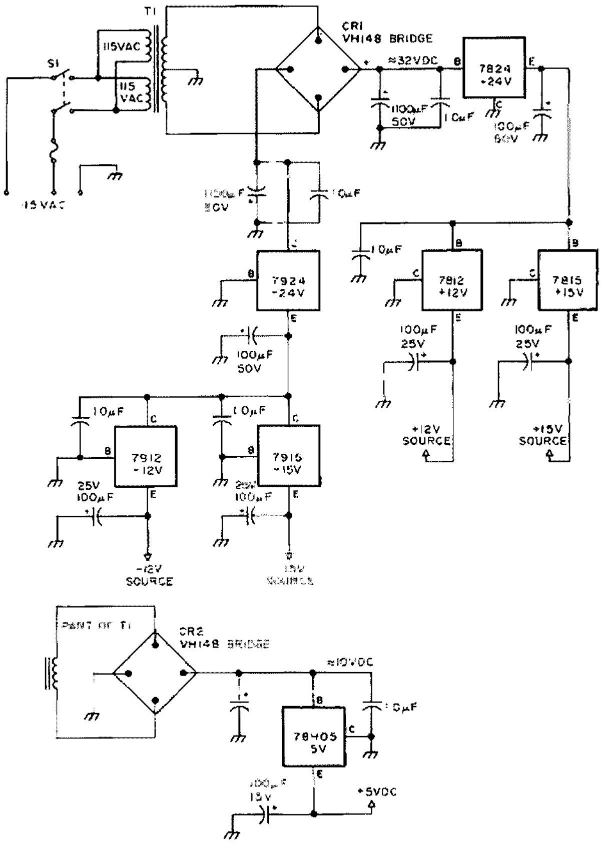


Fig. 12. Synthesizer power supply.

DX

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each callsign is followed by two numbers; the first is the credit for countries on the "active" list, and the second number is the total of active plus deleted countries credited to each Honor Roller.

Presently, 310 active countries out of a possible 319 are required to make DXCC Honor Roll. While you may have a 310 sticker on your DXCC certificate, you probably aren't on the Honor Roll, because just about everyone has had a few countries moved from active status to deleted, lowering our "real" total. On December 1, 1980, the active total will drop to 318, as Japan's Okino Torishima reef, 7J1, will be deleted. It has counted since 1978. Here's the story...

In preparation for the WARC 79 frequency conference in Geneva, the ARRL began consolidating its position as early as the late 1960s. Japan, with its very powerful Japan Amateur Radio League, was obviously going to be an important partner in the ARRL's efforts at WARC

RANK		COUNTRY	W1	W2	W3	W4	W5	W6	W7	W8	W9	WØ	VE	DX	TOTAL
		(# of respondents)	*63*	*54*	*40*	*113*	*81*	*109*	*55*	*58*	*74*	*60*	*12*	*103*	*822*
1	BY	China	55	48	38	95	72	83	45	53	68	53	11	92	713
2	VU	Kamarans	51	42	37	89	71	89	51	48	67	52	10	76	683
3	XZ	Burma	52	42	35	87	67	79	39	50	63	50	10	78	652
4	ZA	Albania	44	38	35	84	69	88	46	48	61	51	10	66	640
5	VU	Laccadives	46	41	34	80	71	85	41	50	58	44	11	66	627
6	VK	Heard	50	42	35	85	65	80	36	49	58	49	9	60	617
7	7O	PDR Yemen	43	34	36	73	56	89	41	46	57	45	10	62	592
8	XU	Khymer	50	45	35	85	61	65	30	44	58	42	11	41	567
9	FB8W	Crozet	46	42	35	82	63	73	35	43	51	39	10	41	560
10	VU	Andamans	43	38	36	76	63	68	30	43	49	45	9	39	539
11	CEØ	San Felix	36	35	29	70	53	66	37	39	50	38	10	68	531
12	3Y	Bouvet	31	35	27	70	60	73	42	37	50	40	10	50	525
13	3X	Guinea	36	29	29	65	57	70	36	38	46	44	10	58	518
14	FR	Juan de Nova	33	32	29	64	57	78	39	37	37	38	11	49	504
15	FR	Glorioso	30	36	31	67	62	77	36	38	38	31	9	26	481
16	9U	Burundi	33	21	29	59	48	66	32	32	44	40	9	52	465
17	XV	Viet Nam	32	36	29	70	53	59	23	34	45	36	10	32	459
18	HK	Malpelo	28	26	22	50	46	76	40	36	34	32	9	55	454
19	YA	Afghanistan	34	28	29	75	51	58	25	33	42	34	9	31	449
20	4W	N. Yemen	27	26	26	57	47	63	36	32	39	40	10	28	431
21	6O	Somalia	26	20	27	47	46	74	32	30	28	34	9	29	402
22	5A	Libya	22	17	21	48	39	65	23	27	35	31	9	36	373
23	5X	Uganda	24	21	17	50	41	60	28	30	31	32	8	28	370
24	HK	Bajo Nuevo	25	21	21	51	40	49	25	28	25	28	8	47	368
25	7J	Okino Torishima	41	37	31	53	34	30	14	31	30	32	4	23	360
26	XW	Laos	27	28	23	57	51	36	17	26	35	29	7	21	357
27	KS4	Serrana Bank	20	18	19	54	35	48	24	30	24	25	8	51	356
28	TN	Congo	24	19	21	39	43	65	29	19	30	34	5	22	350
29	ZM	Tokelau	43	31	20	51	32	40	15	33	28	22	5	37	348
30	A6	U.A.E.	26	23	23	42	40	54	27	29	30	26	6	16	342
31	5R	Malagasy	24	19	21	52	44	50	19	26	29	30	5	21	340
32	7Q	Malawi	24	20	22	48	33	46	24	27	28	27	7	19	325
33	TT	Chad	15	15	19	30	41	59	31	21	20	31	3	28	313
34	TY	Benin	20	13	17	38	44	50	26	18	24	27	5	30	312
35	ZD9	Tristan/Gough	20	13	16	41	42	49	19	22	27	31	7	23	310
36	PY	Peter and Paul	21	22	16	37	34	53	33	25	9	21	5	33	309
37	VK	Willis	29	25	23	37	36	38	16	27	21	26	4	16	298
38	FR	Tromelin	21	16	17	40	37	48	18	17	21	21	6	14	276
39	3CØ	Annobon	16	19	19	37	42	46	22	19	19	21	3	13	276
40	CEØ	Juan Fernandez	19	14	16	34	24	42	24	23	20	12	5	38	271
41	YI	Iraq	23	24	15	37	36	39	15	15	23	26	3	14	270
42	VP8	S. Sandwich	24	19	17	34	30	40	20	16	12	28	2	25	267
43	D6	Comoros	22	17	21	39	30	43	21	13	14	25	4	14	263
44	ZL	Kermadec	25	22	17	37	27	38	12	24	12	19	5	21	259
45	5V	Togo	15	14	12	30	30	48	26	16	14	25	4	22	256
46	SV	Mt. Athos	12	11	12	28	40	57	29	12	12	26	3	9	251
47		Abu Ail	20	15	13	26	36	49	24	15	16	21	2	9	246
48	VP8	S. Shetlands	14	11	16	29	25	41	22	16	13	22	4	26	239
49	S2	Bangladesh	18	23	19	42	30	39	12	17	15	12	2	8	237
50	VK	Mellish Reef	20	22	17	36	28	26	15	21	14	19	4	13	235

Table 1. 822 DXers responded to a survey conducted by The DX Bulletin; *listed are the top fifty countries needed overall, worldwide. The figures are raw numbers, not percentages, of respondents needing each country. Under each heading, in italics, is the total number of surveys returned from that area.*

79. Late in 1975, as the JARL looked toward its fiftieth anniversary the following year, the idea was hatched to make a new DXCC country which could be activated by the Japanese. From this idea came 7J1, which officially became a DXCC entity on May 31, 1976, and which was put on the air the following month by a massive JARL effort.

It was necessary to hire a very large ship for the trips to the reef; footings were made in the coral and a steel scaffold was constructed. The reef had turned out to be under water most of the time! One subsequent operation from Okino Torishima utilized the steel structure, but the demand continued and 7J1 still appears on many a DXer's "need list." Opposition to the creation of this DXCC entity by many DXers was based on the fact that Okino Torishima did not meet any of the DXCC country criteria; its status was purely political. Following the conclusion of WARC 79, as 7J1 had served its purpose, the matter came to a head, and in June, 1980, the ARRL's DX Advisory Committee of volunteers recommended deletion of 7J1. That was approved by League management and the deletion will become effective in a couple of months. Meanwhile, QSLs may continue to be submitted for credit for 7J1.

Other DXAC action in June concerned the African "homelands" of S8 Transkei, H5 Bophuthatswana, and T4 Venda; there have been operations from all three of these areas, using the special prefixes, and pressure has been building for a couple of years concerning their DXCC status. As these places are recognized by neither the United Nations nor the Organization of African Unity, and as only South Africa even has an embassy or consulate in them, DXAC recommended and ARRL concurred that country status at this time would be inappropriate. So continue working S8, H5, and T4, but the QSLs will count only for ZS South Africa. If and when country status is granted, credit for contacts prior to the status change will *not* be counted nor accepted for DXCC; there will be an official "starting date" for their DXCC status.

In April, *The DX Bulletin* (published in Vernon CT) surveyed its readers to determine the most-needed DXCC entities; over 800 readers responded. Naturally, in the middle of the survey, in April, an operation was conducted to one of the countries which would have otherwise appeared in the top ten: Glorioso Island. The survey showed BY China still topping the list, as it has for the past two decades. The basic survey results appear elsewhere in this column. Especially interesting is the breakdown by call area, showing that what is super rare from, say, the east coast of the USA may be only so-so rare from the west coast, and vice versa. Everyone suffers, maybe more or less equally!

PHONE BAND EXPANSION

Phone band expansion for U.S. amateurs is a hot topic, one affecting DXers dramatically. The Western Washington DX Club, among others, has circulated a letter requesting that the ARRL's Board of Directors consider the matter, and they did indeed, at their July 24 meeting in Seattle. The Board has now come out in favor of petitioning the FCC to consider the topic. While such may take several years and is still open to much discussion, at least two parts of the proposed changes are clear: The 20-meter phone band would be expanded, with the 14150-14175 segment for Extra class, 14175-14200 for Advanced, and 14200 and above for General class (plus Extra and Advanced, of course). The other area of discussion is the 40-meter band; when Canadians received permission last fall to operate 7075-7100, which is where most of the rest of the world does its 40-meter phone operating, U.S. amateurs, contesters and DXers in particular, felt left out. Expect any phone band expansion proposal to include this prime territory for U.S. amateurs, probably Extra class only.

With those bands at 10, 18, and 24 MHz from WARC of a year ago still just a dream for amateurs worldwide, don't expect action on phone band expansion to happen soon. Discussions are still underway to decide if the new frequencies from WARC are to be wide open, mode restricted, class restricted, etc. Let's just hope we get those new bands by the time the sunspots recede in a couple of years!

ARRL DX CONTEST

Last fall, in this column, we carried on about new rules for the ARRL International DX Competition, rules which were to take effect in March, 1980, rules which were rammed down contesters' throats without proper discussion and without allowing time for due consideration of their impact.

What the action amounted to was a total change in the basis for the contest, an activity with a 40-year history. The contest was run last March under the new rules, comments were then digested by the ARRL and by their Contest Advisory Committee, and the CAC voted in June to recommend that the major change in the rules, allowing DX-to-DX contacts, be rescinded. So, next year, the activity will be the same as in 1980, except that it will be "the world working the U.S. and Canada" only. That was the original intent in the 1930s and apparently contesters felt it was a valid basis for an operating activity. Single-band competition, another change for 1980, will be retained.

JULY DX HAPPENINGS

Guiseppe De Gasperin I2YDX operated three weeks from Somalia, signing 6OØDX, when time from his agricultural consultant duties permitted. Using low power, a vertical, and fighting poor band conditions, he worked 20 and 15 meters on both SSB and CW. With 6OØDX still active as this is written, those west of the Mississippi River were doing their best, but many will probably go away without Somalia's arrow in their DXCC quivers, due primarily to the lousy band conditions. Those lucky enough to have made the contact QSL to I2YAE,

1	2	3	4	5
BY 87 (1)	BY 89 (1)	BY 95 (1)	BY 84 (1)	BY 89 (1)
XZ 83 (3)	XU 83 (8)	VS9K 93 (2)	VS9K 79 (2)	VS9K 88 (2)
VS9K 80 (2)	XZ 78 (3)	7O 90 (7)	XZ 78 (3)	VU-L 88 (5)
VK9H 79 (6)	VK9H 78 (6)	VU-A 90 (10)	VK9H 75 (6)	ZA 85 (4)
XU 79 (8)	VS9K 79 (2)	XZ 88 (3)	XU 75 (8)	XZ 82 (3)
VU-L 73 (5)	FB8W 78 (9)	ZA 88 (4)	ZA 74 (4)	VK9H 80 (6)
FB8W 73 (9)	VU-L 76 (5)	VK9H 88 (6)	FB8W 73 (9)	FB8W 78 (9)
ZA 70 (4)	ZA 70 (4)	XU 88 (8)	VU-L 71 (5)	VU-A 78 (10)
7O 68 (7)	VU-A 70 (10)	FB8W 88 (9)	VU-A 67 (10)	FR-G 77 (15)
VU-A 68 (10)	7J 69 (25)	VU-L 85 (5)	7O 65 (7)	XU 75 (8)

6	7	8	9	Ø
VS9K 82 (2)	VS9K 98 (2)	BY 91 (1)	BY 92 (1)	BY 88 (1)
7O 82 (7)	ZA 84 (4)	XZ 86 (3)	VS9K 91 (2)	VS9K 87 (2)
ZA 81 (4)	BY 82 (1)	VU-L 86 (5)	XZ 85 (3)	ZA 85 (4)
VU-L 78 (5)	VU-L 75 (5)	VK9H 84 (6)	ZA 82 (4)	XZ 83 (3)
BY 76 (1)	7O 75 (7)	VS9K 83 (2)	VU-L 78 (5)	VK9H 82 (6)
VK9H 73 (6)	3Y 76 (12)	ZA 83 (4)	VK9H 78 (6)	7O 75 (7)
XZ 72 (3)	HK-M 73 (18)	7O 79 (7)	XU 78 (8)	VU-A 75 (10)
FR/E 72 (14)	XZ 71 (3)	XU 76 (8)	7O 77 (7)	VU-L 73 (5)
FR/G 71 (15)	FR/E 71 (14)	FB8W 74 (9)	FB8W 69 (9)	3X 73 (13)
HK-M 70 (18)	CEØX 67 (11)	VU-A 74 (10)	CEØX 68 (11)	XU 70 (8)

Table 2. This breakdown of the survey results, for the ten U.S. call areas only, shows the difference in needs on a geographical basis. The first number is the percentage of survey respondents needing each country; in parentheses is the rank that country had in the overall survey.

G. C. Broggini, Via Roma 1, Ispra Va 21017, Italy.

Several operators at Australia's Willis Island continued active, signing VK9ZG on 20 meters only. They will continue through 1980, after which the island's weather station will be automated and technicians from Australia will seldom be needed. That will increase Willis's rarity dramatically. QSL to VK3OT, Stephen Gregory, Box 622, Hamilton 3300, Australia.

San Hutson K5YY operated from ZK2 Niue, A35 Tonga, and KS6 American Samoa during July; it was his eighth expedition since 1969. Concentrating on 160, 80, 40, and 10 meters, San made nearly 12,000 contacts from the three spots, about one-third of them on CW. His only complaints were the constant requests for QSL information and for times when he might be found on certain bands. As this information was published in the various DX bulletins, San needlessly had to spend time answering questions. Otherwise, all went well and the demand for several countries, especially on the low bands, was reduced. QSL to San Hutson K5YY, Box 5299, Little Rock AR 72215 USA.

Dick Grantham VE1AI put Canada's Sable Island on the air for about 48 hours the last weekend of June; a longer stay was precluded by the authorities. About 1300 contacts were made, including a fairly high percentage of Europeans and Japanese. Conditions for working Canadian and U.S. DXers were not so hot on the higher bands. Sable Island, by the way, is six square miles, has six permanent inhabitants operating a weather station, and is a difficult landing by boat.

Erik Sjolund SM0AGD has retired after eight years of traveling for the Swedish government and putting a number of rare countries on the air. His last operation was from Africa in the spring, including Guinea Bissau J5AG, Swaziland SM0AGD/3D6, Botswana A22GD, and Rwanda 9X5LE. Erik was in another half-dozen countries but could not secure operating permission. From the four above-mentioned spots he made 9500 contacts, 95 percent on CW. QSLs for all Erik's operations go to Joergen Svensson SM3CXS, Berghemsvagen 11, S-86021 Sundsburk, Sweden.

Another CW goodie in July was AI3E/KX6 on Kwajalein, Marshall Islands. Dwight Sipler was there about a week, used equipment already in place for the KX6DC club station, and made 1700 contacts...650 in the States, 550 in Japan, and the rest around the world. His previous operation in March from Kwaj netted 1900 contacts, also all on CW. SASE to Dwight Sipler, 1879 Shaw Ave., Pittsburgh PA 15217 USA.

QSLs are stil eagerly sought by many DXers for contacts with YI1BGD Iraq and LU3ZY South Sandwich. Both take several months and probably more than one request. The previously published routes for these two are valid, but slow.

There is talk of an upcoming operation from Iraq, by Jordanian amateurs along with the Iraqis, to happen in September. If it happens, the call will be YI1JY and QSLs will be handled by WA3HUP. Nothing has been forthcoming on Heard Island, but expectations are for a December or January operation to last about two weeks. And there is talk of a possible operation from 7O South Yemen, also around December or January.

MAILBAG

Hugh Vandegrift WA4WME, a member of the 1978 Clipperton expedition team, responded to our suggestion back in August that DXCC credit might be granted to someone who puts a very rare spot on the air. Hugh says "the real thrill of being a DXpeditioner is *not* getting a 'freebie,' but hearing your own station (regardless of the operator) and knowing that you are hearing something that you put together yourself." Pretty hard to argue with that, Hugh. WA4WME has worked his own station from 128 countries while abroad! His letter concludes with our quotation of the month: "There are only 19 countries that are DXpeditions...all the rest are vacations."

Comments on how easy it is to make DXCC these days brought a letter from another old-timer, W9ITV in Chicago. Joe has just completed working a hundred countries with his five-Watt Argonaut and nothing more than a vertical on 20, 15, and 10 meters. His list of the hundred is about half CW and half SSB, about two-thirds on 10 meters, one-third on 15, and a handful on 20. In conjunction with our work on *The DX Bulletin*, we get regular reports from WA2JOC, who uses an Argonaut and beam, and works really rare stuff, right through pileups and all.

Bob Beach W8LCZ penned a letter from 33,000 feet, on his way to Ascension Island. Bob travels on miltary transports to various worldwide assignments, but never knows enough in advance to publicize his upcoming operations. He has been on from Thule, Greenland, Guam, Hawaii, Peru, and as ZD8RB Ascension Island. He carries a transceiver and a collapsible whip antenna, getting on the air whenever possible.

Next month is QSL manager list time again. Until then, keep the letters and photos coming. Thanks!

CONTESTS

from page 16

lowing details noted in the log: date/time, callsign of the VK/ZL station heard, callsign of the station he is working, RS(T) of the VK/ZL station heard, serial number sent by the VK/ZL station, band. Scoring is on the same basis as for the transmitting section and the summary sheet should be the same. Phone and CW is combined for the SWL section!

MONTANA QSO PARTY
Starts: 1800 GMT October 11
Ends: 2300 GMT October 12

Sponsored by the Butte Amateur Radio Club and the Gallatin Ham Radio Club, the contest is open to all. Use all bands, CW and Phone. There will be a rest period from 0500 GMT to 1400 GMT on October 12th. The same station may be worked on each band and mode.

EXCHANGE:

RS(T) and state, province, country, or Montana county.

FREQUENCIES:

Phone—1820, 3935, 7235, 14280, 21380, 28575. CW—1810, 3555, 7055, 14055, 21055, 28055. Novice—3730, 7130, 21130, 28130.

SCORING:

Complete QSOs count 3 points. Out-of-state stations multiply the total number of QSO points by the number of Montana counties worked (56 maximum). Montana stations multiply the total number of QSO points by the sum of Montana counties, states, provinces, and countries.

ENTRIES & AWARDS:

Certificates will be awarded for the top score from each area. A plaque will be awarded to the highest-scoring Montana station and to the highest-scoring out-of-state station. Logs should show date and time in GMT, band, and emission. Logs, summary sheets, and an SASE for results should be sent by November 15th to: Gene P. Shea KB7Q, Gallatin Ham Radio Club, 417 Staudaher Street, Bozeman MT 59715.

JAMBOREE ON THE AIR
Starts: 0001 GMT October 18
Ends: 2400 GMT October 19

The World Scout Bureau sponsors this 23rd Jamboree on the Air. It is not a contest, just an opportunity for Scouts, former Scouts, or anyone interested in Scouting and kids to talk about Scouting. Hams invite members of Scout units, individually or as units, to visit, see, and hear ham radio. No score, no specific exchange, no logs required, but participation certificates are available from the USA/BSA JOTA Coordinator, H.A. Harchar W2GND, 216 Maxwell Avenue, Hightstown NJ 08520. Send an SASE!

FREQUENCIES:

3940, 7290, 14290, 21360, 28990, 50.5, 3590, 7030, 14070, 21040, 28190, 50.05, 3750, 7125, 21140. Also, all SSTV and RTTY frequencies!

QRP ARCI ANNUAL OCTOBER QSO PARTY

Starts: 2000 GMT October 18
Ends: 0200 GMT October 20

The contest is open to all amateurs and all are eligible for the awards. Stations may be worked once per band for QSO and multiplier credits.

EXCHANGE:

Members—RST, state/province/country, and QRP number.

Non-members—RST, state/province/country, power input.

SCORING:

Each member QSO counts 3 points. Non-member QSOs are 2 points, and stations other than W/VE count 4 points each. Multipliers are as follows: more than 100 Watts input— ×1; 30.1-100 Watts input— ×1.5; 10.1-30 Watts input— ×2; 3.1-10 Watts input— ×4; 1.1-3 Watts input— ×6; less than 1 Watt input— ×10.

Stations are eligible for the following bonus points: +300 for solar or wind power (100% solar or wind power source), +100 for battery power (100% battery power), for duration of party. Use only one bonus, not both!

Final score is total QSO points times total number of states/provinces/countries per band times the power multiplier. Any bonus points are added last.

FREQUENCIES:

Novice—3710, 7110, 21110, 28110. SSB—1810, 3985, 7285, 14285, 21385, 28885, 50385. CW—1810, 3560, 7060, 14060, 21060, 28060, 50360.

Note: VHF/UHF contacts must be direct—no repeater contacts are allowed.

Try SSB on even hours and don't forget the Novice frequencies.

AWARDS:

Certificates to the highest-scoring station in each state, province, or country with 2 or more entries. Other places will be given depending on activity. One certificate to highest-scoring Novice/Technician overall. One certificate for the station showing three skip contacts using the lowest power.

LOGS & ENTRIES:

Send full log data, including full name, address, and bands used, plus equipment, antennas, and power used. Include details on how bonus points were determined. Please indicate if you are a Novice or Technician station. Entrants desiring results sheet and scores, please enclose a business-size envelope with return postage. Logs must be received by November 20th to qualify. Send all logs and data to: QRP ARCI Contest Chairman, Edwin R. Lappi WD4LOO, 203 Lynn Drive, Carrboro NC 27510.

AWARDS

from page 20

DX AWARD FROM PUERTO RICO

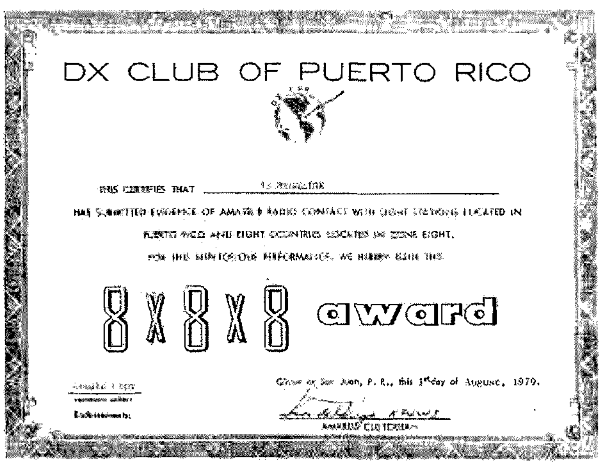
I'm sure everyone recognizes the callsign KP4AM/D as the call used this past year for the great Desecheo Island DXpedition. Well, Dave KP4AM, President of the DX Club of Puerto Rico, just dropped me a line and advised me of the award being offered amateurs by this respectable Caribbean group.

8 × 8 × 8 Award

This award made available by the DX Club of Puerto Rico now has found a home with 350 recipients. Requirements are to work 8 stations in the Commonwealth of Puerto Rico and 8 other DXCC countries in *CQ* Zone 8 (CO, HI, HH, 6Y5, KP2, KP1, VP2, etc.) for a total of 16 QSOs. There is no time limit and special endorsements will be given for single mode or band accomplishments.

A list of calls, countries, modes, and bands certified by a club's officers or 2 amateurs (GCR) should be sent with US $1.00 or 4 IRCs to: Awards Manager, DX Club of Puerto Rico, PO Box 1061, San Juan, Puerto Rico 00902.

The club reserves the right to request any or all cards be sent the Manager before the award is issued. Note that KP4, NP4, and WP4 prefixes are issued in Puerto Rico and that KP4AM/D counts for Desecheo Island, not for Puerto Rico.



DX AWARDS FROM MEXICO

The Mexico DX Club has two very attractive awards being offered to amateurs worldwide and I'd like to take this opportunity to share them with you.

100 X Award

This award is issued by the Mexico DX Club to licensed amateurs and SWL stations who confirm QSOs with stations that have in their callsign one or more "X" letters (XE1OW, W4LXX, W7UMX, EA3AX, K6AXC, KH6XX, etc.).

To apply for the award, you must accumulate 100 points as follows: 1 point is earned for stations (with X in their call) outside Mexico; 2 points for contacting stations in Mexico (with an X in their call). In addition, should you have a QSO with a member of the Mexico DX Club, 3 points will be earned. Should you QSO with the club station of the Mexico DX Club, XE1MDX, this will count 10 points credit.

Only contacts after January 1, 1973, will be valid. Award fee is 15 IRCs or $3.00 US.

Mexico DX Club Award

This is issued to licensed amateurs and SWL stations who confirm QSOs with Mexican DX Club members' stations, located in Mexico. XE applicants need 10 QSOs with 10 different Mexico DX Club members. Zones 1 to 13 (North, Central, South America, and Caribbean), except Zone 6, need 5 QSOs. All others need 3 different DX Club member QSOs. Award fee is 10 IRCs or $2 US.

Applications and QSL cards must be sent to Awards Manager, Mexico DX Club, PO Box 21-167, Mexico City 21, Mexico.

DX AWARD FROM PORTUGAL

Attention County Hunters! From the national amateur radio society in Portugal comes word about the Portuguese "Counties" Award. Known as the DCP, this award is available in 4 levels of achievement, each dependent upon the type of station being used in making contacts: Class A–HF fixed; Class B–HF mobile; Class C–VHF fixed; Class D–VHF mobile. Depending on the number of Portuguese counties claimed, 7 different grades may be earned: Grade I–75 counties; Grade II–125 counties; Grade III–175 counties; Grade IV–200 counties; Grade V–225 counties; Grade VI–250 counties; Grade VII–274 counties.

DCP is available to licensed amateurs and club stations throughout the world and is issued to them for all contacts claimed, regardless of calls held or date of contact. The only stipulation is all contacts must be made from the same DXCC country. Counties worked under 2 or more classes may not be combined. QSL cards must be in the applicant's possession at the time application is made.

Unless otherwise indicated on QSL cards, the QTH printed will determine the county identity. When in doubt, the "Lista Do Codigo Postal" issued by the

Post Office will become the official guide. This booklet is available from Amateur Radio Club of Portugal at a cost of US $2.00.

A special award booklet is available for $1.00 US from either the sponsoring society or from WB9RCY. GCR apply in all instances. Mail your award application along with an awards fee of US $2.50 to ARP. Their formal address is Associacao de Radioamadores Portugueses, PO Box 2145, 4021 Porto Codex, Portugal.

INTERNATIONAL ISLAND DX AWARD

The Whidbey Island DX Club takes special pleasure in announcing its Island DX Award program. Recognized throughout the world, this award has realized recipients from almost every major country on the globe.

Known as the IDX Award, this program recognizes those amateurs who can work a minimum of fifty (50) DX Islands of the World. Endorsements are also given for 100, 150, and the maximum islands possible.

All DXCC countries which are designated "islands" are the only qualifying contacts. A list of these islands is included here. Reprints of the IDX listing are available by sending an SASE to the club's address.

All contacts must be made after October 1, 1977, on either CW, SSB, SSTV, RTTY, OSCAR, or any mixed mode. Single-band accomplishments are also recognized on the award issued.

To apply, prepare a list of contacts in prefix order. Applications received in any other order will be returned to the applicant unprocessed. Indicate the station worked, IDX island, band, mode, date, and GMT.

Do not send QSL cards! Have your list verified by two amateurs, a local radio club secretary, or a notary public. Enclose your application with the award fee of US $2.00 and a large SASE or 5 IRCs to: Whidbey Island DX Club, 2665 No. 1250 East, Oak Harbor WA 98277.

Rules governing this award are reviewed annually in the month of September.

To assist IDX Award seekers, during the month of January each year, rare DX stations appear for the International Island DX Contest.

A3	HKØ (Bajo)	S9,CR5	VS6
A9X	HKØ (Malp)	SV (Crete)	VS9 (See 8Q)
BV	HKØ (San An)	SV (Dodecanese)	VS9K
C2	IS	T2,VR8	VU7 (Andaman)
C6	J3,VP2G	TF	VU7 (Laccadive)
CEØA	JA-JR-KA	TI9	XF4
CEØX	JD,KA1 (Mina)	UA1,UK1 (Franz Jo)	XP
CEØZ	JD,KA1 (Ogasa)	VE1 (Sable)	YB,YC,YD
CO,CM,KG4	JD,7J1 (Okino)	VE1 (St. Paul)	YJ
CT2	JW	VK (Lord Howe)	YVØ
CT3	JX	VK9 (Willis)	ZD7
D4	KG4 (See CO)	VK9 (Christmas)	ZD8
D6	KH1,KB (Baker)	VK9 (Cocos)	ZD9
DU	KH2,KG6 (Guam)	VK9 (Mellish)	ZF
EA6	KH3,KJ	VK9 (Norfolk)	ZK1 (North)
EA8	KH4,KM	VK9 (Heard)	ZK1 (South)
EI, GI	KH5K,KP6 (King)	VK9 (Macquarie)	ZK2
FB8W	KH5,KP6 (Palmy)	VP2A	ZL
FB8X	KH6,WH6,AH6,NH6	VP2D	ZL (Auck-Camp)
FB8Z	KH6,KH7 (Kure)	VP2E	ZL (Chatham)
FC	KH8,KS6	VP2G (See J3)	ZL (Kermadec)
FG (Gaud)	KH9,KW	VP2K	ZM7
FG,FS	KHØ,KH2,KG6 (Mari)	VP2L	ZS2 (Marion)
FH8	KC6 (West)	VP2M	1S
FK	KC6 (East)	VP2S	3B6,3B7
FM	KP (Desoth)	VP2V	3B8
FO (Clip)	KP1 (Navassa)	VP5	3B9
FO	KP2,KV	VP8 (Falkland)	3CØ
FP	KP3,KS4,HKØ (Ran-Ser)	VP8,LU (Ork)	3D2
FR (Glor)	KP4,NP4	VP8,LU (Geo)	3Y
FR (Juan)	KX	VP8,LU (Shet)	4S
FR (Reun)	OHØ	VP8,LU (Sand)	5B,ZC
FR (Trom)	OJØ	VP9	5R
FW	OX,XP	VQ9	5W
G,GM,GW	OY	VR1 (Br. Phoenix)	6Y
GC,GU	P29	VR1 (Gilbert)	8P
GC,GJ	PJ (Neth Ant)	VR3	8Q,VS9
GD	PJ (St. Martin)	VR4 (See H4)	9H
GI,EI	PYØ (Fernando)	VR6	9M6,9M8 (See VS5)
H4,VR4	PYØ (Peter & Paul)	VR7	9V
HC8	PYØ (Trinidade)	VR8 (See T2)	9Y
HH,HI	S7	VS5,9M6,9M8	

Island DX Listing. The IDX Award program depicts DXCC countries which are bona-fide "islands" as recognized by the National Geographic Society. First criterion, however: They must be a DXCC country as stated on the ARRL DX Countries List. Any qualifying DXCC countries either omitted from this list by error or those which have been recognized for DXCC after the release of this listing will be added to the IDX List when it is printed next.

HAM HELP

I need a schematic and/or user's manual for a Dumont type 350 oscilloscope. I will pay for copy or copy and return original promptly.

Elbert Drazy
6 Amherst Rd.
Andover MA 01810

I have a VHF AM receiver that I would like to put on 121.5 for an ELT receiver. It is currently on 127.400. It is a military receiver model RC-3A. It was made by Dorsett Electronics and purchased from Fair Radio. It is a solid-state receiver and appears to be of late production. Any help as far as a schematic, crystal frequencies, or any modifications anyone has done to this unit would be appreciated. The receiver is to be used for search and rescue applications.

Stan Gantz WB5TGL
PO Box 2802
Silver City NM 88061
(505)-538-5091

Due to a seemingly overwhelming demand for instruction/service manuals for various types equipment, rather than write to the other hams individually, I thought I'd just send a couple of addresses in as sources of such manuals.

For surplus equipment, contact: Fair Radio Sales, PO Box 1105, 1016 E. Eureka St., Lima OH 45802.

For commercial/amateur gear manuals, contact: HI, Inc., PO Box 864, 1601 Ave "D," Council Bluffs IA 51501.

I was once in the same position—I dang near would've killed for certain manuals!

D.L. Hildebrand N6BHU
Hollywood CA

FUN!

from page 28

5) The "Zepp" antenna is a type of halfwave dipole. How did it get its name?

1) It was named after its inventor, the Italian wireless pioneer, Prof. Hugo Zeppolini.
2) They were first used on zeppelins.
3) It's an acronym for Zero Efficiency Parallel Plane antenna.
4) The guy who invented it thought "Zepp" was a cute name.

ELEMENT 4—MATCH THE PREFIX

Instructions: Mate the country in Column A with the appropriate prefix in Column B.

Column A	Column B
1) United States	A) AH9
2) Montserrat	B) XE
3) Wake Isl.	C) KA5
4) Kingman Reef	D) AP
5) East Germany	E) NH5
6) Pakistan	F) DU
7) Bahama Isl.	G) G
8) England	H) EA
9) United Arab Emirates	I) PY
10) France	J) HH
11) Mexico	K) LU
12) Argentina	L) Y2
13) Philippine Isl.	M) EA6
14) Spain	N) 4W
15) Balearic Isl.	O) HB
16) Brazil	P) F
17) Switzerland	Q) C6
18) Haiti	R) 4X
19) Israel	S) A6
20) Denmark	T) VP2M
	U) OZ

ELEMENT 5—HAM ACROSTIC

Instructions: Guess the words defined and write them over the numbered dashes. Then place each letter in the correct square in the puzzle. The black squares show word endings. The completed puzzle will form a statement about amateur radio. (Illustration 2)

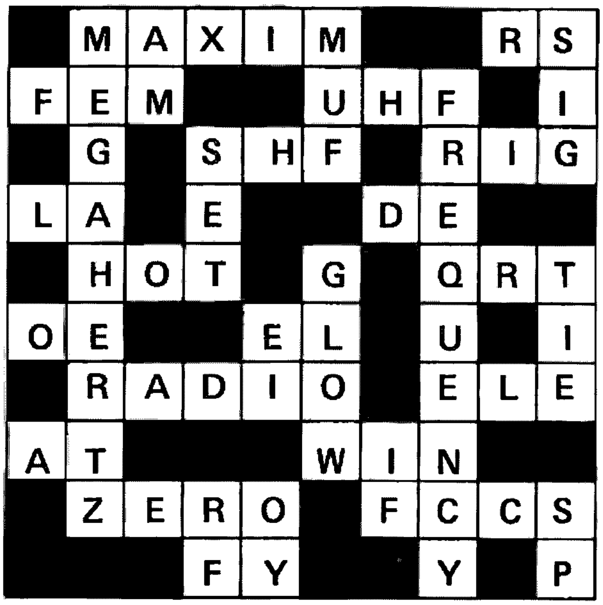
A) To pass a message............. 72 69 86 35 88
B) Beam................................. 118 52 56 12
C) License............................... 7 1 24 53 9 110
D) Bad season for skyhooks.... 111 112 28 75 37 109
E) Antenna structure............... 76 18 61 50 47
F) "Mr. Code"......................... 51 42 95 11 108
G) Coaxial line......................... 113 115 104 49 6
H) Type of business................ 22 39 107 102
I) Amplitude............................ 81 45 30 48 101 98 60 41 32 10
J) Ham time............................. 26 34 74 68 8 27 96 87 64
K) Gassy bulb.......................... 106 114 62 3
L) Contest sheet...................... 65 63 85 91
M) Repeater (abbr.)................. 46 97 38
N) RTTY gadget (abbr.)............ 93 78
O) "Push to"-talk (abbr.)........... 36 14
P) Field Day (abbr.).................. 44 31
Q) Field Day shelter................. 25 71 99 40
R) Small 2-meter rig (abbr.)....... 90 16
S) "One land" state (abbr.)....... 5 66
T) Getting "knack of it" code... 79 59 55 100
U) . . . and cheese.................... 20 80 73
V) Incentive licensing decade.. 92 4 13 57 54 29 82
W) Power................................ 33 117 83 19
X) Record a QSO...................... 89 94 70 21
Y) Early morn contest reflex.... 15 67 17 43
Z) The Morse........................... 23 84 116 77
AA) You send with your........... 58 105 2 103

■	■	1 C	2 AA	■	3 K	4 V	5 S	6 G	7 C	8 J	9 C	10 I	■	11 F	12 B	13 V	14 O	15 Y	■	16 R
17 Y	18 E	■	19 W	20 U	21 X	■	22 H	23 Z	24 C	■	25 Q	26 J	27 J	28 D	29 V	30 I	■	31 P	32 I	33 W
34 J	■	35 A	■	36 O	37 D	38 M	39 H	40 Q	41 I	42 F	43 Y	■	44 P	45 I	46 M	■	47 E	48 I	49 G	50 E
51 F	52 B	53 C	54 V	55 T	56 B	■	57 V	58 AA	59 T	60 I	■	61 E	62 K	63 L	64 J	65 L	■	66 S	67 Y	68 J
69 A	■	70 X	71 Q	72 A	73 U	74 J	75 D	76 E	77 Z	78 N	■	79 T	80 U	81 I	82 V	■	83 W	84 Z	■	85 L
86 A	87 J	88 A	■	89 X	90 R	91 L	■	92 V	93 N	94 X	95 F	■	96 J	97 M	98 I	99 Q	100 T	101 I	102 H	103 AA
■	104 G	105 AA	106 K	107 H	108 F	109 D	■	110 C	111 D	112 D	113 G	114 K	■	115 G	■	116 Z	117 W	118 B	■	■

Illustration 2.

THE ANSWERS

Unlike many other exams, we hope you actually enjoyed taking this one. Now for the answers. Here goes . . .



Element 1:
See diagram.
Element 2 (Reading from left to right):
AMATEUR, YAGI, RTTY, TUBE, DXCC, COAX, LID, COIL, ANTENNA, SSTV, DIPOLE, TVI, SSB, KEYER, SCOPE, VOX, DIODE, OSCAR, SOLDER, VTVM.
Element 3:
1-1 Yes, for the benefit of gangsters and spies everywhere, gentle old Hiram invented the gun silencer. However, like most inventors whose projects are put to ill use, Maxim felt his silencer got a bum rap. He originally invented it to help protect American soldiers.
2-3 According to international allocations, broadcasters aren't supposed to go below 7.100 MHz on our shared 40-meter band. But that hasn't stopped many of them from doing it. If you feel your few hundred Watts will overcome their megawatts, by all means feel free to transmit all over them.
3-2 Between 80-10 meters, RTTY is fair play on all CW frequencies—if you stay within your license's limits, that is. While transmitting F1 on a Novice band may be ethically questionable, it's quite legal. Novices, of course, are restricted to A1.
4-1 Yes, the harmonica. Sir Charles transformed the instrument from a device consisting of a series of water goblets one played with a moistened finger (invented, incidentally, by another "electrical" scientist, Benjamin Franklin) into the familiar mouth organ we all know today.
5-2 The "Zepp" skyhook did in fact get its name from Count Zeppelin's airships. "Prof. Zeppolini," "Zero Efficiency"—indeed!
Element 4:
1-C, 2-T, 3-A, 4-E, 5-L, 6-D, 7-Q, 8-G, 9-S, 10-P, 11-B, 12-K, 13-F, 14-H, 15-M, 16-I, 17-O, 18-J, 19-R, 20-U.
Element 5:
See diagram.

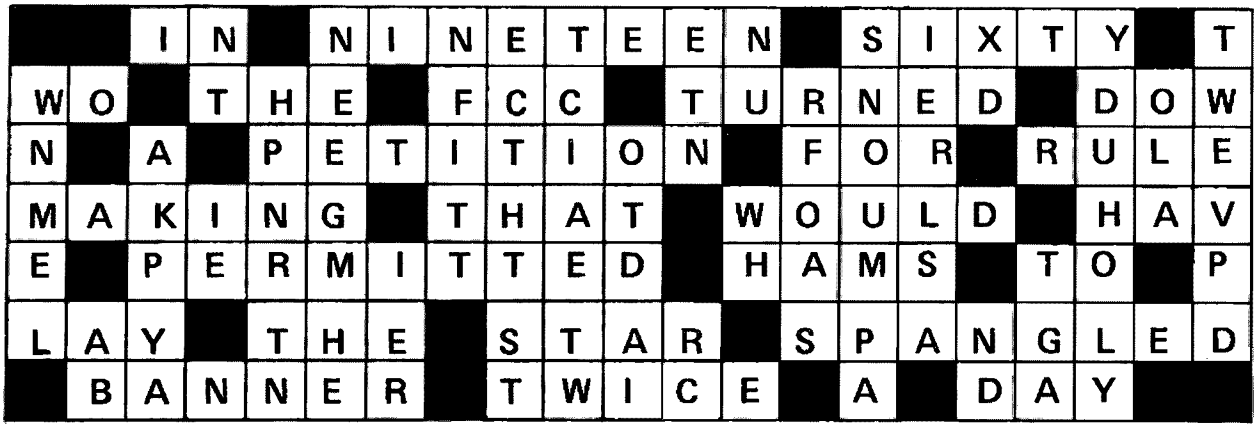
SCORING

Now, let's try to make some sense out of all this. Starting with Element 1, score 20 points if you successfully completed the crossword puzzle; or, if you didn't finish it, ½ point for each question you got. On Element 2, award yourself 1 point for each word you untangled. Moving to the multiple choice questions, Element 3, each correct answer here nets you 4 points. On Element 4, every prefix connected to the right country adds 1 point to your total. And, to wrap things up, if you completed the Ham Acrostic, you get 20 points. Subtract ¼ point for each unsolved definition if the puzzle stumped you. But a bonus 10 points to the experts who deciphered the message: "IN NINETEEN SIXTY-TWO THE FCC TURNED DOWN A PETITION FOR RULEMAKING THAT WOULD HAVE PERMITTED HAMS TO PLAY THE STAR SPANGLED BANNER TWICE A DAY." Incidentally, we'll leave anonymous the name and call of the patriotic ham who made that request. Perhaps he got a job playing the anthem on some broadcast station. Must listen for him on 40 meters someday.

So, how did you do? Let's see...

0-20 points = Novice material
21-40 points = Technician material
41-60 points = General material
61-80 points = Advanced material
80-110 points = Extra material

If you scored below your actual license class, don't feel too bad—maybe you're just hooked on the FCC's type of tests.



REVIEW

The Linear Amplifier Planbook II

While searching through a box of junque purchased at a hamfest flea market, I found a handful of Motorola engineering bulletins and application notes. The people at Motorola had taken the time and trouble to write short articles about the amplifiers they designed around their transistors. Each bulletin contains a description of the design strategy, a schematic with parts values, and circuit board templates. Those amateurs not interested in the mathematics can skip over the theoretical parts of the text and concentrate on duplicating the design in their own workshop.

Now you don't have to rely on flea-market scrounging, nor do

you need a friend who works for Motorola to obtain these technical gems. A. P. Systems recently introduced *The Linear Amplifier Planbook II*. It contains a dozen application notes and bulletins that cover amplifiers for the amateur frequencies between 1.6 MHz and 450 MHz. Most of the designs are for amplifiers running under 100 Watts using 12-volt supplies. One section covers a state-of-the-art, one-kW, solid-state amplifier, a perfect mate for your new HF rig.

The A. P. Systems handbook is a 100% reproduction of the Motorola information, with addenda included where applicable. It costs $11.95. Hams interested in home-brewing their next amplifier should write to A.P. Systems, PO Box 488, Milford PA 18337.

Tim Daniel N8RK
***73 Magazine* Staff**

Single Sideband Engineering Practice
Edition II, published by American Crystal Supply

Rarely is there a week when *73* doesn't get several letters inquiring about CB-to-10-meter conversions. Hams everywhere are moving up to the action band.

Unfortunately, for every CB conversion that has been published, there are at least two radios with no conversion information available. Now a guide to the basics of CB-to-10 modifications can help the would-be 10-meter fan make the move. The staff of American Crystal Supply has put the experience gained in converting more than 2000 rigs into their new book, *Single Sideband Engineering Practice* Edition II.

While this book emphasizes the conversion of popular SSB units, it also contains information useful to AMers. First, the basics of crystal and phase-locked loop (PLL) frequency generating schemes are covered. Next, individual chips are discussed with modification details given in many cases. Tips for boosting power output and enhanced clarifier operation can also be found.

As the CB fad diminishes, amateurs are going to find themselves sitting on a goldmine of potential ham gear. Many of the late model CBs were intended for crowded bands and offer selectivity and sensitivity that puts the more expensive multiband transceivers to shame. Don't be discouraged by the lack of detailed information on the inner workings of CB gear. Once you develop a basic understanding of the theory involved, you'll know which rigs are easily converted and those you should avoid. Conversion nuts, *Single Sideband Engineering Practice* Edition II is for you. This 96-page book is available from American Crystal Supply, PO Box 638, W. Yarmouth MA 02673, for $14.95.

Tim Daniel N8RK
***73 Magazine* Staff**

HAM HELP

I need schematics and/or owner's manuals (I will copy and return with postage) on the following:

1) Digitab™ TA 300 panel meter, model TA 305-02-A5.

2) Time Systems Corp. model 704 micro/mA meter.

3) Electronic Research Co. model 2316-01-02-04 up/down counter.

4) Honeywell modem-telegraph MD-700 (P)/G TM 11-5805-423-15/TO 31W2-2G-1. I need help with this one on best way(s) to convert to ham use, both Baudot and ASCII.

Thanks.

N. M. Callaghan, Jr. N2AUN
RD#3, Box 140
Rhinebeck NY 12572

I need a copy of the operations manual or other instructions for the Power Meter, TS-226A/AP, 115 V ac, 50-2400Ω. I will pay expenses.

Sidney L. Morgan KA9BAI
1048 Englewood Drive
Rantoul IL 61866

I badly need manuals/schematics for the following equipment: Hallicrafters model SX-140 ham band receiver; Heathkit HW-10 Shawnee, 6-meter transceiver; World Radio Labs Globe Scout model 65 A/160-10 meter transmitter. I'd like to borrow, copy, and return the manuals, or I will buy them separately. Can somebody please help out? Thanks.

Bill Coleman, Jr. KA4DAP
114 Circle Drive
Rocky Mount NC 27801

I would like information on a VHF portable transceiver I purchased at a ham auction. This unit would be very helpful in emergencies and it makes a good rig for bad weather because it is sealed against water. The model number is RT-209/PRC and the order number is 08709-Phila-55-93. I need the schematic of the unit, power requirements, and any crystal data such as load impedance and whether it is series or parallel operation. If anyone has a manual containing this unit, I would be glad to pay for a copy of this information. I am very much interested in getting some use out of this unit.

Rick Lucas WBØNQM
1922 Edgelea Road
Lawrence KS 66044

Does anyone have any information on a receiver that is very similar to, but not the same as, a Hammarlund HQ-129X? The circuitry and layout are almost identical to the 129X, but it has no S-meter circuit and the tube lineup is slightly different. The bandspread dial calibration is very different from that of the 129X, and it is designed for rack mounting, without a cabinet.

I would like to know if this was an earlier, lower priced, militarized or whatever version of the 129X, what it was called, and about when it was built. (The panel lettering on mine is faded beyond readability.) I do *not* need an HQ-129X manual, but if anyone has any documentation on this particular model, I would gladly pay for copying or copy it myself and return the original.

Fred Goldberg WA2BJZ
29 Clearview Road
E. Brunswick NJ 08816

I wish to express my very deep gratitude to all the people who supplied information pertaining to my Ham Help needs. Now that I am on the semi-mend and settled down at the old QTH, I have found a pile of information, *all* helpful; those who have not yet received a thank-you QSL card (*73* press, of course!) should be getting them now. The response was fantastic. My only regret is that the most detailed description of Link FM equipment I have ever seen or heard of came in an envelope with no return address, and it had been "eaten" by the express pony.

Special thanks, too, to the people who are responding to the request for equipment for the East Valley ARC; we already have two teleprinter systems on the line (not just two machines) and designs and modifications for improvements are pouring from the drawing boards—now if we receive more equipment . . . hope, hope.

Marc Leavey should be getting a RTTY Loop article I sent in April. It came back several times undelivered; this time things will work out—I found Murphy! Also, a couple of missed issues were double shipped so I am returning them under separate cover; my pleasure to help any publication related to amateur radio, especially the *best* one.

Finally, I am bewildered by the seemingly general amateur attitude that CBers are stealing the PR from services rendered especially in emergencies. Yes, we do well in hurricanes, tornadoes, quakes, etc. In checking my log, I find that in seven instances in the past six years I have been either first or second on the scene of an auto accident (no, I haven't been involved). I grabbed the amateur mics. Six times I got no answer, even on the repeaters, and one time the answerer joked about how silly I was to request police, ambulance, etc. In six instances I then switched to the eleven-meter channel nine mic and got through the QRN and M for emergency services—kind of makes you wonder, doesn't it? If we don't put out the effort, how can we expect any good PR?

Again thanks, and keep up the great projects and editorials.

John C. White WB6BLV
Porterville CA

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, *Pine Street, Peterborough NH 03458, Attn: Social Events.*

CORNWALL NY
OCT 4

The Orange County Amateur Radio Club will hold its annual auction on Saturday, October 4, 1980, at Munger Cottage, Cornwall NY. Admission is $1.00. The auction begins at 11:00 am. Talk-in on 146.52. For more information, contact William Lazzaro N2CF, 11 Jefferson Street, Highland Mills NY 10930.

SYRACUSE NY
OCT 4

The Radio Amateurs of Greater Syracuse will hold their annual hamfest on October 4, 1980, from 9:00 am to 6:00 pm at the Arts and Home Center, New York State Fairgrounds, Syracuse NY. Tickets are $2.00. Flea market vendors may bring their own table or rent one. A women's program will be offered as well as an indoor and outdoor flea market and exhibits. Talk-in on .31/.91 and .90/.30. For further information, write to Box 88, Liverpool NY 13088.

BILOXI MS
OCT 4-5

The Mississippi Coast Amateur Radio Association will hold its 4th annual Ham-SwapFest on Saturday and Sunday, October 4-5, 1980, at the International Plaza, Biloxi MS. Admission is free. Features will include a prize drawing Saturday afternoon, an old-time shrimp boil Saturday night, main prize drawings on Saturday afternoon, a flea market, commercial displays, forums, and prizes for YLs, XYLs, and harmonics. Talk-in on 146.13/.73 and .52. For further information, contact Bob Wyatt WB5VCI, Hamfest Chairman, Box 114, Whispering Pines Drive, Waveland MS 39576.

VIRGINIA BEACH VA
OCT 4-5

The ARRL Virginia State Convention and the fifth annual Tidewater Hamfest, Computer Show, and Flea Market will be held on October 4-5, 1980, in the Arts and Conference Center, Virginia Beach VA. Take Highway 64 to Highway 44, which passes right by the door and also into the beach resort area. Featured are ARRL, traffic, DX, and technical forums, as well as free bingo and a lounge for XYLs. Admission is $3.50 and flea market spaces are $3.00 per day. There will be an advance ticket drawing for a Kenwood FM transceiver. For tickets and more information, send an SASE to TRC, PO Box 7101, Portsmouth VA 23707.

WARRINGTON PA
OCT 4-5

The Pack Rats fourth annual Mid-Atlantic States VHF Conference will be held on October 4, 1980, from 9:00 am to 5:00 pm at the Warrington Motor Lodge, Rte. 611, Warrington PA. Registration is $3.00 in advance or $4.00 at the door. The price includes admission to the ninth annual Hamarama flea market on October 5, 1980, from 8:00 am to 4:00 pm, rain or shine, at the Bucks County Drive-In Theatre, also on Rte. 611. The Saturday conference will include a cocktail hour and get-together at 6:30 pm and a buffet dinner, at $9.00 each, at 7:30 pm. The cost for the flea market alone is $2.00 and tailgating is $2.00 per space (bring your own table). Featured will be amateur radio equipment, electronic parts, surplus, and door prizes. Talk-in on 146.52 (W3CCX). For information about both events, write Ron Whitsel WA3AXV, PO Box 353, Southampton PA 18966, or phone (215)-355-5730.

BENTON HARBOR MI
OCT 5

The 1980 Blossomland Blast will be held on Sunday, October 5, 1980, from 8:00 am to 3:30 pm EDT at the Lake Michigan College Convention Center, one mile off exit 30 on I-94 near Benton Harbor MI. Prepaid tickets are $2.00 each ($3.00 at the door). XYLs, YLs, and children under the age of 16 are free. Features will include a gigantic flea market, an ARRL movie, an audio/visual tour of a Heathkit factory, a Novice forum, an XYL program, and a CW contest. Talk-in on 146.22/.82. For tickets or an information package, send an SASE to Box 164, St. Joseph MI 49085.

NEW YORK NY
OCT 5

The Kings County Radio Club will hold its Hamfest 1980 on October 5, 1980 (rain date is October 12, 1980), at Manhattan Beach Park, Brooklyn NY. Take the Ocean Avenue exit from the belt parkway and follow the signs. Admission for sellers is $3.00, buyers' admission is $1.00, and spouses and children will be admitted free. There will be a large outdoor electronic flea market and plenty of parking. Sellers can bring their own tables or tailgate. Prizes will be awarded and a color TV will be raffled. Talk-in on .52.

ROCK HILL SC
OCT 5

The York County Amateur Radio Society will hold its 29th annual hamfest on October 5, 1980, at Joslin Park, Rock Hill SC. A barbecue dinner, a snack bar, and a drink stand will be available in the park. For registration and prize information, write YCARS, PO Box 4141 CRS, Rock Hill SC 29730.

YONKERS NY
OCT 5

The Yonkers Amateur Radio Club will hold Westchester's 4th annual flea market and hamfest on Sunday, October 5, 1980 (rain date: Sunday, October 12, 1980), from 9:00 am to 5:00 pm at Redmond Field, Yonkers NY. Admission is $1.50 per person with children under 12 admitted free. Sellers must bring their own tables. Parking space is $3.00 (which admits one person). Features will include an auction starting at 3:00 pm, a raffle and 50/50 drawings every two hours, door prizes given every two hours, and a final door prize awarded at 5:00 pm. There will be plenty of free parking, refreshments, picnic tables, ball fields, swings, and sanitary facilities available. Talk-in on 146.865 and .52 starting at 8:00 am. For advance registration or information, call (914)-969-1053 after 3:00 pm and ask for Otto.

KENNER LA
OCT 11-12

The Jefferson Amateur Radio Club will hold Amacom '80 on Saturday and Sunday, October 11-12, 1980, at the Airport Hilton Inn, across from the New Orleans International Airport, Kenner LA. Features will include forums, demonstrations, exhibits, and an outside flea market. Admission is $3.00 for head-of-household and $1.00 for each family member. Other tickets are six for $5.00. There will be entertainment on both days for wives and others that are interested. For more details and arrangements for interviews, phone Wayne Knabb, publicity co-chairman, at 943-5889 (home) or 586-3560 (work); Robert Dunn, publicity co-chairman, at 866-3036; W. D. "Bill" Bushnell, Amacom chairman, at 887-5022; or Leon Lessard, program advertising chairman, at 469-0106.

EL PASO TX
OCT 11-12

The El Paso Hamfest will be held on October 11-12, 1980, at the Missle Inn, 9487 Dyer Street (US 54), El Paso TX. Activities will include seminars, swap tables, a QCWA breakfast, contests, prizes, and more. Talk-in on 146.28/.88. For additional information, write El Paso Hamfest, PO Box 4573, El Paso TX 79914, or call Mary Ann or Roy Gould N5RG at (915)-751-7638.

WARNER ROBINS GA
OCT 11-12

The Central Georgia ARC's second annual hamfest will be held October 11-12, 1980, at the City Recreation Center, Watson Boulevard, Warner Robins GA. Dealer displays and a flea market will be indoors. The annual meetings of the Georgia Single Sideband Association and the Georgia Cracker Net will be

held, and the Georgia State CW Association will have a Sunday morning breakfast. Prizes include an Icom IC-720 HF transceiver, an Icom IC-255A 2-meter mobile transceiver, and an Icom IC-2AT synthesized 2-meter handie-talkie. Activities will be available for YLs and harmonics. Talk-in on 146.25/.85. For more information, call or write John Robuck N4AMJ, 117 Avalon Drive, Warner Robins GA 31093, or phone (912)-922-4527.

LANSING MI
OCT 12

The Central Michigan Amateur Radio Club and the Lansing CD Repeater Association will hold Hamfair '80 on Sunday, October 12, 1980, at Grand Ledge High School, 7 miles west of Lansing, off I-96, near M-43 and M-100, from 8:00 am to 3:00 pm. Donations are $2.50. Free parking and lunches will be available, as well as fun for the whole family. Talk-in on .34/.94 and .22/.82. For more information, call (517)-372-5462.

BALTIMORE MD
OCT 12

The Columbia Amateur Radio Association will hold its 4th annual hamfest at the Howard County Fairgrounds (15 miles west of Baltimore, just off I-70 on Rt. 144, 1 mile west of Rt. 32) on Sunday, October 12, 1980, at 8:00 am. Admission is $3.00 and tailgating and tables are $5.00. Food and prizes will be available. Talk-in on 147.735/.135 and 146.52/.52. For table reservations and information, write Dennis Parra, 6955 Spinning Seed, Columbia MD 21045.

LIMA OH
OCT 12

The Northwest Ohio Amateur Radio Club will hold its annual hamfest on October 12, 1980, beginning at 7:00 am at the Allen County Fairgrounds, Rte. 309E (1 mile off I-75), Lima OH. Dealer tables will be available. Talk-in on .52/.52 and .07/.67. For more details, write NOARC, PO Box 211, Lima OH 45802.

PLYMOUTH IN
OCT 12

The Plymouth, Indiana, Swap and Shop will be held on October 12, 1980, at the National Guard Armory in the west part of Plymouth IN. The doors will open at 7:00 am for this 5th annual gathering. Tickets are $2.00 in advance or $2.50 at the door. There will be inside floor space available, snacks, and electronic goodies for sale or trade. Talk-in on 146.07/.67 and 146.52, or follow the signs. For more information, contact the Marshall County Amateur Radio Club (MCARC), PO Box 151, Plymouth IN 46563.

CHICAGO IL
OCT 16-19

National Computer Shows (formerly Northeast Expositions) will hold the Midwest Personal and Business Computer Show from Thursday, October 16, through Sunday, October 19, 1980, at McCormack Place, Chicago IL. Show hours are: Thursday through Saturday, 11:00 am to 9:30 pm and Sunday, 11:00 am to 6:00 pm. General adult admission is $5.00. For further information, contact National Computer Shows, PO Box 678 Brookline Village MA 02147, or phone (617)-524-0000.

PENNSAUKEN NJ
OCT 19

The Moorestown Severe Weather Watch will sponsor the Greater Delaware Valley Hamfest on October 19, 1980, from 8:00 am to 5:00 pm at the Nashville East Cotillion Ballroom, Rte. 73, Pennsauken NJ. Advance tickets are $2.00 with an SASE, $2.50 at the gate, and ladies are free. There will be door prizes drawn hourly from 11:00 am until 3:00 pm; then, at 3:30 pm, the main door prizes will be drawn. Table spaces are $5.00 indoors and $3.00 for a 10' space outdoors. The outdoor flea market set-up will start at 2:00 am and will have space for over 300 vendors. The indoor exhibit space set-up will also start at 2:00 am and will have over 20,000 square feet available. RV parking and camping will be available Saturday night, as well as parking lot and exhibit area security from 6:00 pm Saturday to 6:00 pm Sunday. Features will include seminars on DX-P, MARS, ARPSC, ARRL, traffic, antennas, etc.; ladies' activities; and food and refreshments. Talk-in on 146.22/.82 and 146.52 simplex and monitoring Ecars, 146.19/.79 and 146.58 simplex. For advanced tickets, table reservations, or more information, contact Greater Delaware Valley Hamfest, 15 E. Camden Avenue, Moorestown NJ 08057, (609)-234-3926.

REVERE MA
OCT 19

The 19-79 Repeater Association of Malden MA will hold its first annual flea market on Sunday, October 19, 1980, from 11:00 am to 4:00 pm (sellers will be admitted at 10:00 am) at the Beachmont VFW Post, 150 Bennington Street, Revere MA. Admission is $1.00. Sellers' tables are $5.00 in advance and $7.50 at the door, if available. Talk-in on .19/.79 and .52. For table reservations, send a check to 19-79 Repeater Association, PO Box 221, Malden MA 02148.

KALAMAZOO MI
OCT 25

The 26th annual VHF Conference will be held on October 25, 1980, at Western Michigan University, Kalamazoo MI, from 2:00 pm through 9:00 pm. VHF topics will include Microprocessor Control of VHF Transceivers, Plotting Antenna Settings, and others. For more information, write Dr. Glade Wilcox, Professor of EE, Western Michigan University, Kalamazoo MI 49008.

CHATTANOOGA TN
OCT 25-26

Hamfest Chattanooga will be held on October 25-26, 1980, at Chattanooga State Technical Community College, Chattanooga TN. Events include dealer exhibits, a flea market, forums, contests, and ladies' programs. Flea market spaces are $2.00 per day or $3.00 for both days. Talk-in on .19/.79 and 3980. For inside dealer space information or for pre-registration with a prize ticket (send $1.00), write Hamfest Chattanooga, PO Box 3377, Chattanooga TN 37404.

LONDON ONT CAN
OCT 26

The London Amateur Radio Club will hold its 3rd annual Swap 'n Shop on Sunday, October 26, 1980, from 9:00 am to 4:00 pm at Lord Dorchester High School. Admission for buyers is $2.00, with children under 12 admitted free. Admission for vendors is $3.00, which includes one table. Doors open at 8:00 am for vendors only. Featured will be forums on current topics, hourly prize drawings, free parking, an expanded display area for both tables and commercial exhibits, and food, which will be available all day. The main prize will be a synthesized hand-held radio. Talk-in on .52 and .78/.18. For table reservations (until October 22nd) and/or further information, contact Dick Reiber, 417 Regal Drive, London, Ontario, Canada N5Y 1J8.

MARION OH
OCT 29

The 5th annual Heart of Ohio Ham Fiesta will be held on October 29, 1980, at the Marion County Fairgrounds Coliseum, Marion OH. Featured will be a flea market, prizes, and an XYL drawing. Dealer space is available. Talk-in on .90/.30 and .52. For more information, contact Paul Kilzer W8GAX, 393 Pole Lane Road, Marion OH 43302.

MORRISTOWN TN
NOV 1

The Lakeway Amateur Radio Club will operate from the David Crockett Tavern, Morristown TN, on Saturday, November 1, 1980, from 1300 UTC until 2200 UTC. SSB-only operation will be on the following frequencies, plus or minus QRM: 28.560, 21.360, 14.280, and 7.235 MHz. Amateurs and the general public are invited to visit the tavern and site, which is the boyhood home of Davy Crockett, during regular operating hours (weekdays, 9:00 am to 5:00 pm, and Sundays, 2:00 pm to 5:00 pm). For a certificate commemorating the event, send $1.00 plus a legal-size SASE or 3 IRCs and an SASE to Davy Crockett DXpedition, Rte. 11, Box 28, Morristown TN 37814. The callsign will be WD4PEQ for this expedition.

ST. PETERSBURG FL
NOV 1-2

The Florida Gulf Coast Amateur Radio Council, Inc., will hold the Suncoast Amateur Radio Convention on November 1-2, 1980, at the Bayfront Concourse Hotel, downtown St. Petersburg FL. Close by are the Albert Whitted Airport, the St. Petersburg Marina, bus depots, and many parking lots. Registration is $3.00 each and children under 12 are admitted free. Two award tickets are free with advance registration. Swap tables are $10.00 each for both days

(no one-day tables). Double booth space is available and all the swap area will be inside. Featured will be dealer displays, forums, a Saturday luncheon and banquet, and a Sunday luncheon and fashion show. FCC exams will be given. Send to the Tampa office for 610s. Talk-in on 147.96/.36, 147.66/.06, and 146.52. For more information, write FGCARC, PO Box 157, Clearwater FL 33517, or phone (813)-461-4267.

HICKSVILLE OH
NOV 2

The Defiance County Amateur Radio Club is sponsoring its 3rd annual hamfest on Sunday, November 2, 1980, from 8:00 am until 4:00 pm at the Defiance County Fairgrounds at Hicksville OH. Tickets are $1.50 in advance and $2.00 at the gate. Table space is free on a first-come-first-served basis, inside or outside. Hourly drawings will be held, with the main event at 3:00 pm. Talk-in on 147.69/.09 and .52. For more information, write Ed Ballard, Jr., RFD #1, Roland Road, Sherwood OH 43556.

SOUTH FALLSBURG NY
NOV 7-9

On November 7, 8, and 9, 1980, the Hudson Amateur Radio Council will sponsor the ARRL Hudson Division Convention to be held at the Pines Hotel, South Fallsburg NY. The theme is "Good Times at the Pines," with emphasis on a mini-vacation type convention for both families and solo attendees. A full range of forums is planned along with an exhibit hall and flea market. Contact Mike Troy WA2TYV, 70 Ridge St., Rye NY 10580, for advance tickets at $5.00 each through 10/27/80. Contact Mike Evans WB2RDD for flea market info at Box 143, White Sulphur Springs NY 12787, or call at night (914)-292-8630.

NEWMARKET
ONT CANADA
NOV 8

The York North Amateur Radio Club will hold its annual flea market on Saturday, November 8, 1980, at the Newmarket Community Centre, Newmarket, Ontario. General admission will be $1.50, which includes a door prize ticket. Admission for exhibitors will be $4, which includes a door prize ticket and *one* table. Additional tables will cost $2. The flea market will run from 0800 to 1400 EST, but doors will be open earlier for exhibitors. The talk-in frequency will be 146.52 MHz simplex; the club call is VE3YNA.

SO GREENSBURG PA
NOV 8

The Foothills ARC will hold its annual Swap & Shop on Saturday, November 8, 1980, at the St. Bruno's Church in South Greensburg PA. Doors will be open from 9:00 am until 5:00 pm. Dealers are welcome. The main prize is a complete HF antenna system, including a triband beam, a 40-foot tower, a rotor, thrust bearing, and cable. Second prize is an Icom IC-2A handheld. Talk-in on 146.07/.67 and .52. For advance table reservations, phone Jim Yex WB3CQA at (412)-256-3531. For more information, phone Chuck Hamman WB3HZM at (412)-837-9194.

FRAMINGHAM MA
NOV 9

The Framingham Amateur Radio Association will hold its annual fall flea market on Sunday, November 9, 1980, at the Framingham Police Station Drill Shed, Framingham MA. Admission is $1.00 and sellers' tables are $6.00. Sellers are advised to pre-register. Doors will open at 9:00 am. Talk-in on .75/.15 and .52. For more information or to register, contact Ron Egalka K1YHM, FARA, PO Box 3005, Saxonville MA 01701, or phone (617)-877-4520.

SELLERSVILLE PA
NOV 9

The RF Hill Amateur Radio Club will hold its fourth annual hamfest on November 9, 1980, in the Sellersville National Guard Armory, Sellersville PA. Doors will open to sellers at 7:00 am and a $2.00 donation will admit buyers after 8:00 am. Tickets are on sale for the grand prize, a complete low-band station from key to antenna. The radio is the new 9-band Ten-Tec Model 580 DELTA with a 110-volt power supply and filters. The antenna is a model AP-3 from W6TIK. Talk-in on 146.28/.88 and 146.52. For further information, contact the RF Hill ARC, PO Box 29, Colmar PA, or Robert Bentley WB3EWP, RF Hill Hamfest, 334 Railroad Avenue, Souderton PA 18964, or phone (215)-723-8303.

MASSILLON OH
NOV 16

The 23rd annual auction, Auctionfest '80, sponsored by the Massillon ARC will be held on Sunday, November 16, 1980, from 8:00 am until 5:00 pm at the Massillon Knights of Columbus Hall, Massillon OH. The flea market opens at 8:00 am with auction action to start at 11:00 am. Auctionfest '80 will feature three major prizes, plus a long list of door prizes to be given away hourly. Tickets are $2.50 in advance and $3.00 at the door. Extra prize tickets are available for $1.00 each. For further information, tickets, or table reservations, contact Steve Nevel WD8MIJ, 1864 Massachusetts SE, Massillon OH.

OAK PARK MI
NOV 30

The Oak Park High School Electronics Club will present its 11th annual Swap 'n Shop on Sunday, November 30, 1980, at the Oak Park High School, Oak Park MI, from 8:00 am to 4:00 pm. North and east doors will open at 6:00 am. Admission is $1.50 in advance and $2.00 at the door. Tables (8 feet long) are $5.00 in advance, $6.00 at the door, and $3.00 for a half table. There will be door prizes, refreshments, and parking available. For more information, send an SASE to Herman Gardner, Oak Park High School, 13701 Oak Park Boulevard, Oak Park MI 48237, or call Bruce at 1-(313)-543-8569.

FARIBAULT MN
DEC 6

The Handi-Ham System will hold its annual winter hamfest on Saturday, December 6, 1980, at the Eagles Club, Faribault MN. There will be a flea market, a dinner at noon, a program, and a prize drawing.

HAM HELP

I need conversion information on the T-20/ARC-5 command transmitter which covers 4 to 5.3 MHz. I would like to convert it to the 15-meter CW band, if possible, or to the 40-meter CW band.

Robert E. Bunn WA0LKE
Rt. 3, Box 565
West Plains MO 65775

I would like to thank *73 Magazine* and the numerous hams who responded to my request for a manual for my HQ-100 receiver in the August, 1980, issue of *73*. I have received letters, radiograms, and long-distance phone calls in answer to my request. Thanks again!

Marvin Rosen KA3EUY
20 W. Madison Street
Baltimore MD 21201

I need a schematic and/or manual for a Johnson Viking 6N2 transmitter. I will copy and return or pay for your copy. I would also like to hear from anyone who has converted this transmitter for use as a 2-meter amplifier.

John Barclay N8ARC
1115 Talley Avenue
Zanesville OH 43701

I am trying to find a PC board and parts kit or an already assembled unit for the MXV-200 SSTV Scanverter. I sent an SASE to W6MXV for prices and availability as suggested in the *SSTV Handbook* but had no response. Can anyone help me?

Bradley F. Hardin KB8OC
NRS, Box 92
Sugar Grove WV 26815

I would like to purchase a reasonably priced FV-101B external vfo for my Yaesu FT-101E.

Wayne F. Albert KB3KV
431 Greenlee Road
Pittsburgh PA 15227

I would like to find modifications that improve the performance of a Collins 75S-1 and Collins 32S-1.

John Gallivan III
9124 Ashmeade Drive
Fairfax VA 22030

I need a user's manual for a PAIA #2720 music synthesizer. I can copy and return it or I will buy a copy.

Jung Y. Lem KB6BO
5222 Coringa Drive
Los Angeles CA 90042

HAM HELP

I am in need of schematic and conversion info for an RCA "LD" Business Band radiotelephone, model CMCT-30B2-H, 159.60 MHz. Of course, I will pay any copying and postage costs. Thank you.

Roger Mason KA4JHC
4308 Faigle Road
Portsmouth VA 23703

I need a schematic and/or instruction manual for a Collins 310B-1 Exciter. I will pay for these or I can reproduce and return them. I also need a complete set of knobs for a Hallicrafters S76 receiver.

Herman F. Schnur K4CTG
115 Intercept Avenue
North Charleston SC 29405

I recently purchased a Kenwood R-1000 receiver and would like to correspond with anyone who has used this receiver in conjunction with a transceiver and/or separate transmitter.

Marvin Rosen KA3EUY
20 W. Madison St.
Baltimore MD 21201

I need a schematic drawing of a Hallicrafters model S-76-U. I also need one for a Gemtronics model V-258A. I wrote to Gemtronics about six months ago but I didn't receive an answer. Thank you.

David A. Carter WA4VHP
28 Alpine Drive
Savannah GA 31405

I would like to obtain a manual and schematic for a Midland model 13-505 2m transceiver. I will copy and return or pay a reasonable copy and mailing fee. Thank you.

Terry Jones KA6IYE
2945 Sequoia Avenue
Eureka CA 95501

FCC

Reprinted from the Federal Register

47 CFR Part 97

[Docket No. 19852; FCC 80-419]

Amendment of Rules To Provide for the Amateur-Satellite Service

AGENCY: Federal Communications Commission.

ACTION: Final rule.

SUMMARY: The Commission is adopting rules to govern stations operating in the Amateur-Satellite Service. These rules are needed to obviate requests for waivers of rules developed to regulate terrestrial radio communications. The effect of the adoption of these rules is to regularize amateur radio space operations which heretofore have been authorized on an *ad hoc* basis by rule waivers.

EFFECTIVE DATE: November 3, 1980.

ADDRESSES: Federal Communications Commission, Washington, DC 20554.

FOR FURTHER INFORMATION CONTACT: John B. Johnston or Maurice J. DePont, Private Radio Bureau, (202) 254-6884.

SUPPLEMENTARY INFORMATION:

Report and Order

Adopted: July 17, 1980.

Released: August 11, 1980.

In the matter of amendment of Part 97 of the Commission's rules to provide for the Amateur-Satellite Service, Docket No. 19852.

1. On February 14, 1973, the Commission adopted amendments to Part 2 of the Commission's rules in Docket No. 19547, published in the Federal Register on March 1, 1973 (38 F.R. 5562). These amendments incorporated into the rules the Amateur-Satellite Service (ASAT), as established by the World Administrative Radio Conference for Space Telecommunications, Geneva 1979. Certain frequencies already allocated to the Amateur Radio Service were also allocated to ASAT.

2. On October 25, 1973, the Commission adopted a Notice of Inquiry in Docket 19852, which was published in the Federal Register on November 6, 1973 (38 FR 30566). In our Notice of Inquiry, we indicated our desire to receive comments from interested parties concerning the structure for ASAT, technical standards, licensee qualifications, and other provisions that should be included in the rules.

3. On November 20, 1979, the Commission adopted a Notice of Proposed Rule Making in Docket 19852 which was published in the Federal Register on December 7, 1979 (44 FR 70499). The Notice discussed the comments filed in the Inquiry, the international regulations concerning ASAT, and the nature of the various waivers to Part 97 which have been necessary to make past and current space operations possible. Specific rules based upon these considerations were proposed for ASAT, and comments were solicited. They were due on February 5, 1980, with reply comments due on or before March 6, 1980.

Summary of Comments

4. Ten comments were filed in response to our Notice of Proposed Rule Making. All of them supported our objectives in developing rules for ASAT, and they agreed with our proposed rules in principle. They suggested helpful substantive improvements, and requested clarification of certain points in the proposed rules.

5. Both the American Radio Relay League (ARRL) and the Radio Amateur Satellite Corporation (AMSAT), pointed out that since the release of our Notice of Proposed Rule Making, the World Administrative Radio Conference (WARC), Geneva, 1979, was held. At that Conference, additional frequencies were allocated to ASAT, and a resolution was adopted which would exempt ASAT earth stations from international coordination procedures. Both organizations recommended the rules adopted in this proceeding incorporate these changes.

6. Several respondents addressed the issue of the notifications for space operation proposed in the Notice. No one questioned the need for notifications (which are required to satisfy international advance publication and coordination requirements). Their concern, rather, is the long lead time proposed for the first notification to the Commission (27 months). While there was an understanding of the basis of the proposal, they claim that such a long lead time is unrealistic for ASAT. AMSAT commented, "... Previous amateur radio satellites have been launched on 'missions of opportunity', and the actual missions available are often not identified until a much later date * * *". They recommended that the rules adopted for first notification of intended space operation include the phrase "if possible".

7. Other respondents forecast the possibility of future manned space flight where an amateur radio operator in the spacecraft may be able to operate the station from space by means of local control. ARRL supported their prediction with reference to amateur radio operator Owen Garriot, a member of the Skylab crew. They recommended that the rules adopted for ASAT include provision for such an eventuality.

8. ARRL and AMSAT recommended deleting the requirement that third party traffic be logged, in the case of space operation. ARRL claims such logging (required for all types of amateur radio operation by § 97.103(b)(2). "* * * is impossible in the context of an amateur satellite. Because the signal is not actually demodulated withio the satellite, it is not possible to place a recorder within the orbiting spacecraft, and it is not possible to monitor the entire passband of the satellite from a single or small number of points on earth * * *". AMSAT also recommended deleting third party logging requirements for stations in telecommand operation. Their comments included no rationale for their recommendation.

9. The Southern California Repeater and Remote Base Association (SCRRBA) requested the restrictions against repeater operation in the frequency bands 431–433 and 435–438 MHz be deleted. They said their understanding is that these restrictions were initially adopted by the Commission to protect satellite stations. They were concerned "* * * future petitioners may request that additional frequency spectrum be withdrawn from some or all ARS uses for AMSS-exclusive use * * *" and they "* * * believe that it is the amateur radio community itself which should determine the specific activities to be conducted on the amateur frequency bands * * *".

10. ARRL recommended a clarification for proposed § 97.413 (Space operation requirements). They wanted to verify that the proposed section, if adopted, would supersede the requirements of present § 97.79 (Control operator requirements), and § 97.88 (Operation of a station by remote control).

11. AMSAT requested that provisions be made in the ASAT Rules which would permit amateur radio operators to accept pay for conducting earth operation and telecommand operation for periods when they are using a station in space operation for experiments and educational demonstrations. They also requested the definition of telemetry (proposed § 97.403(d)), and the rule for telemetry (proposed § 97.419)), be expanded to include stored messages "* * * of an amateur radio nature * * *". Furthermore, they requested that proposed § 97.413, which requires the capability to effect a cessation of radio transmissions in case the Commission so orders, be modified to include the phrases "within a reasonable period of time" or "within 24 hours".

12. AMSAT commented on the provision in § 97.415 that stations in ASAT must not cause harmful interference to other stations between 435 and 438 MHz. They claimed this requirement should only apply in the case of interference to non-amateur services. AMSAT also suggested simpler wording for some of the technical parameters described in proposed § 97.427.

13. Mr. Frederick E. Wirth, Jr. commented that he found the definitions in proposed § 97.403 "confusing and not inclusive". He recommended the definitions also account for space-to-space operation.

Conclusions

14. Our objective in this proceeding is to develop rules for ASAT through the rulemaking process. A statement of ASAT requirements in the Commission's rules will relieve the licensee of an amateur radio station in space operation from the burden of applying to the Commission for a lengthy series of waivers to rules developed to regulate terrestrial amateur radio communications. All of the respondents agree with our objective. Therefore, we are adopting rules for ASAT substantially as we proposed. Individual paragraphs in those rules, in certain instances, are adopted with the improvements suggested in the comments.

15. It would be premature to include in this proceeding the results of the World Administrative Radio Conference (WARC) (Geneva, 1979). The final acts of the Conference are not scheduled to become effective until January 1982 and, in the United States, will not be binding until after Senate ratification. Moreover, additional public comment may be necessary through the rulemaking process before they can be incorporated into the rules. Therefore, we are not including the additional frequencies allocated to ASAT by the Conference, at this time.

16. Turning to the matter of international coordination of space operation, we are sympathetic to the problem a licensee could face in providing the necessary information over two years prior to operation. However, the international publication and coordination requirement does exist, and it is the responsibility of the Commission and its licensees to comply. Therefore, we are adopting the notifications requirements as proposed. Again, we point out that we could waive the first notification (at 27 months), where justified. Possibly the second notification (at 15 months) could be justified for a waiver. But in either case, the licensee would run a risk, although probably a small one, of later being directed to cease space operation in favor of a prior space operation, or for the purpose of avoiding interference with other radio services because of incomplete international coordination.

17. With a record of eight successful amateur radio space operations (under Commission authorizations), it is difficult to be skeptical over the predictions of future space operation where the control operator will also be aboard the spacecraft. Therefore, we are adopting proposed § 97.407 with wording to make it clearer that any amateur radio operator (with an FCC authorization) may be the control operator of a station in space operation. The same clarification is also added to § 97.409 to make it clearer that the same provision also applies to earth operation, a point suggested in the comments.

18. Because past and current amateur satellite designs have not provided for logging is insufficient reason, in itself, for deleting the requirement for logging third party traffic. However, we can see not useful purpose being served by requiring third party traffic passing through an amateur satellite to be logged. Therefore, the exception to § 97.103(b)(2) requested by ARRL and AMSAT is incorporated into § 97.417.

19. SCRRBA is partially correct in their understanding of the reasons for the prohibition against repeater operation in subbands 431–433 MHz and 435–438 MHz. The latter (435–438 MHz), was established to protect stations in space operation in Docket 18803 (Report and Order released September 8, 1972, and published in the Federal Register on September 13, 1972, (37 FR 18540)). The former (431–433 MHz) was established to protect weak signal experimentation in Docket 21033 (Memorandum Opinion and Order, released September 27, 1977, and published in the Federal Register on September 30, 1977, (42 FR 52418)). SCRRBA presented no new information in their comments over that which was considered by the Commission in those two proceedings. Inasmuch as weak signal experimentation is not a subject of this proceeding, their request to open 431–433 MHz to repeater operation is not being adopted. However, space operation is the subject, and their request to open 435–438 MHz to repeater operation is pertinent.

20. SCRRBA contends that frequencies allocated to both the Amateur Radio Service and ASAT should be jointly shared by all licensed operators, and should not be arbitrarily reserved for any particular sub-set. In principle, we concur with SCRRBA's contention. However, the 435–438 MHz ASAT/Amateur Radio Service frequency subband is unique. It is located within a relatively large band (420–450 MHz). It is a popular band, and is used for many diverse activities: Voice, television, experimentation, etc. Being an Ultra High Frequency band, a coordination organization such as SCRRBA can be very effective in achieving an orderly band plan for all of these varied activities, domestically. But ASAT is of international scope. There may be stations in space operation authorized by other governments. These stations may be used by amateur radio licensees of many countries. The characteristics of frequencies in this portion of the radio spectrum make them very useful for ASAT. To permit long term repeater operation in this subband could effectively remove them from space operation. Considering the remaining 25 MHz open to repeater operation, 3 MHz for space operation does not seem unreasonable. As far as SCRRBA's concern that future petitioners may be encouraged to request frequency spectrum be withdrawn from some or all amateur radio uses for ASAT-exclusive uses, those eventualities, if and when they occur, will be considered on their own merits. Therefore, SCRRBA's request to open 435–438 MHz to repeater operation is not being adopted.

21. Telecommand operation in ASAT is somewhat similar to radio remote

control of an amateur radio station. In both situations, the control operator of a distant station is using another station (telecommand or control) to transmit command signals to the distant station for the purpose of carrying out his/her responsibilities as control operator. The main difference is that the control operator of a remotely-controlled amateur radio station always has a functioning control link to the distant station while the control operator of a station in space operation may not. The position of the satellite with respect to the earth may not provide the telecommand station with a view of the satellite for much of the time. This is the case with low earth orbit amateur satellites. Thus, the control operator requirements (§ 97.79) and remote control requirments (§ 97.88) have not meaning to space operation. We are adopting proposed § 97.417 which will state that those two sections are not applicable. This will provide the clarification recommended by ARRL.

22. In considering the matter raised by AMSAT of permitting amateur radio operators to accept pay for conducting earth operations and telecommand operations, we must bear in mind that the present prohibition (§ 97.112; No remuneration for use of station) is based upon international agreement (Article 1, Radio Regulation No. 3044/78). Therein the Amateur Radio Service is defined as "A service of self-training, intercommunication and technical investigation carried on by amateurs, that is, by duly authorized persons interested in radio techniques solely with a personal aim and without pecuniary interest". This definition was the subject of proposed modifications at the WARC (Geneva 1979). These proposals were debated at length at the Working Group level and were in part considered again in full Committee. Although the definition was changed editorially to make clear that which was earlier implicit, namely, that the Amateur Radio Service is a radiocommunication service, the phrase " * * * solely with a personal aim and without pecuniary interest" was retained and thereby emphasized. Therefore, it is our obligation to help preserve this very distinctive characteristic of the service, which is at the root of the many and varied privileges afforded amateur radio operators worldwide. For this reason, we are most reluctant to make any further exceptions to the "no pay" policy over the singular exception listed in § 97.112(b). (Control operators of club stations transmitting telegraphy practices and bulletins may accept compensation in a very precisely defined situation. As far as we know, only a few employees of the ARRL have taken advantage of this provision). Having laid this foundation, we do not find the sketchy information provided by AMSAT, as justification for their request, sufficient to establish the need for amateur radio operators to accept payment for conducting earth operations and telecommand operations. For this reason, we are not adopting AMSAT's suggestion.

23. The American Radio Relay League requested, in its comments, a clarification of the matter of an amateur radio station retransmitting radio signals on frequencies reserved for higher operator classes. No amendments are necessary to make this clarification, which applies to repeater operation as well as space operation. As long as the control operator of the transmitting station is authorized (see § 97.7) for the frequency privileges being used, the fact that the station may retransmit from frequencies authorized to both higher and lower operator classes is of no consequence. For example, there is no prohibition, *per se*, for those types of operations where retransmission is permitted (repeater, auxiliary, and space) to retransmitting the signals from a station with a Technician Class control operator on frequencies not authorized for the Technician Class.

24. We take exception to the statement in AMSAT's comments that the non-interference provisions to protect stations using frequencies between 435 and 438 MHz should apply only to non-amateur services. The prohibition in the International Radio Regulations (RR MOD 3644/320A) against Amateur Satellite Service stations causing harmful interference does apply to the Amateur Radio Service (ARS) since ARS frequencies are in the International Table of Frequency Allocations. Further, the Amateur-Satellite Service definition (RR NOC 3108/84ATA) was not changed at WARC, 1979. That definition does not say that the Amateur-Satellite Service is part of the Amateur Radio Service. Moreover, Article 35 of the International Telecommunications Union Convention provides that all stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to other radio services.

25. As a result of the comments received, we are adopting some changes to the proposed rules. Specifically, we have provided for automatic control of stations in space operation; exemption from all logging requirements for space operation; and an improvement in the wording of § 97.405 suggested by R.P Haviland. Mr. Haviland pointed out in his comments that future problems could arise with the definition of space operation because no distinction is made between existing operations and future operations. The rewording suggested overcomes this potential problem.

26. Accordingly, *it is ordered*, that effective November 3, 1980, Part 97 of the Commission's rules is amended as shown in the Appendix, pursuant to the authority contained in Sections 4(i) and 303 of the Communications Act of 1934, as amended. The reporting requirement included herein is adopted subject to General Accounting Office clearance and, unless advised to the contrary, will be effective on the same date as these rules. *It is further ordered*, that this proceeding is terminated and the docket is closed. Further information on this matter may be obtained by contacting Maurice J. DePont, or John B. Johnston, Personal Radio Branch, at (202) 254-6884.

(Secs. 4, 303, 48 stat., as amended, 1066, 1082; (47 U.S.C. 154, 303))

Federal Communications Commission.

William J. Tricarico,

Secretary.

Appendix

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended, as follows:

§ 97.3 [Amended]

1. In § 97.3, paragraphs (i) and (k) are deleted and designated (Reserved).

2. A new Subpart H is added to Part 97, as follows:

Subpart H—Amateur-Satellite Service

General

Sec.

97.401 Purposes.
97.403 Definitions.
97.405 Applicability of rules.
97.407 Eligibility for space operation.
97.409 Eligibility for earth operation.
97.411 Eligibility for telecommand operation.
97.413 Space operations requirements.

Technical Requirements

97.415 Frequencies available.

Special Provisions

97.417 Space operation.
97.419 Telemetry.
97.421 Telecommand operation.
97.423 Notification required.

Authority: Secs. 4, 303, 48 Stat., as amended, 1066, 1082; (47 U.S.C. 154, 303).

Subpart H—Amateur-Satellite Service

General

§ 97.401 Purposes.

The Amateur-Satellite Service is a radiocommunication service using stations on earth satellites for the same purposes as those of the Amateur Radio Service.

§ 97.403 Definitions.

(a) *Space operation.* Space-to-earth, and space-to-space, amateur radio communication from a station which is beyond, is intended to go beyond, or has been beyond the major portion of the earth's atmosphere.

(b) *Earth operation.* Earth-to-space-to-earth amateur radiocommunication by means of radio signals automatically retransmitted by stations in space operation.

(c) *Telecommand operation.* Earth-to-space amateur radio communication to initiate, modify, or terminate functions of a station in space operation.

(d) *Telemetry.* Space-to-earth transmissions, by a station in space operation, of results of measurements made in the station, including those relating to the function of the station.

§ 97.405 Applicability of rules.

The rules contained in this subpart apply to radio stations in the Amateur-Satellite Service. All cases not specifically covered by the provisions of this Subpart shall be governed by the provisions of the rules governing

✓Reader Service—see page 274

amateur radio stations and operators (Subpart A through E of this part).

§ 97.407 Eligibility for space operation.

Amateur radio stations licensed to Amateur Extra Class operators are eligible for space operation (see § 97.403(a)). The station licensee may permit any amateur radio operator to be the control operator, subject to the privileges of the control operator's class of license (see § 97.7).

§ 97.409 Eligibility for earth operation.

Any amateur radio station is eligible for earth operation (see § 97.403(b)), subject to the privileges of the control operator's class of license (see § 97.7).

§ 97.411 Eligibility for telecommand operation.

Any amateur radio station designated by the licensee of a station in space operation is eligible to conduct telecommand operation with the station in space operation, subject to the privileges of the control operator's class of license (see § 97.7).

§ 97.413 Space operations requirements.

An amateur radio station may be in space operation where:

(a) The station has not been ordered by the Commission to cease radio transmissions.

(b) The station is capable of effecting a cessation of radio transmissions by commands transmitted by station(s) in telecommand operation whenever such cessation is ordered by the Commission.

(c) There are, in place, sufficient amateur radio stations licensed by the Commission capable of telecommand operation to effect cessation of space operation, whenever such is ordered by the Commission.

(d) The notifications required by § 97.423 are on file with the Commission.

Technical Requirements

§ 97.415 Frequencies available.

The following frequency bands are available for space operation, earth operation, and telecommand operation:

Frequency Bands

kHz

7000–7100	14000–14250

MHz

21.00–21.45	28.00–29.70
144–146	435–438 [1]

GHz

24–24.05

[1] Stations operating in the Amateur-Satellite Service shall not cause harmful interference to other stations between 435 and 438 MHz (See International Radio Regulations, RR MOD 3644/320A).

Special Provisions

§ 97.417 Space operation.

(a) Stations in space operation are exempt from the station identification requirements of § 97.87 on each frequency band when in use.

(b) Stations in space operation may automatically retransmit the radio signals of other stations in earth operation, and space operation.

(c) Stations in space operation are exempt from the control operator requirements of § 97.79 and from the provisions of § 97.88 pertaining to the operation of a station by remote control.

(d) Stations in space operation are exempt from the station log requirements of § 97.103.

§ 97.419 Telemetry.

(a) Telemetry transmission by stations in space operation may consist of specially coded messages intended to facilitate communications.

(b) Telemetry transmissions by stations in space operation are permissible one-way communications.

§ 97.421 Telecommand operation.

(a) Stations in telecommand operation may transmit special codes intended to obscure the meaning of command messages to the station in space operation.

(b) Stations in telecommand operation are exempt from the station identification requirements of § 97.87.

§ 97.423 Notification required.

(a) The licensee of every station in space operation shall give written notifications to the Private Radio Bureau, Federal Communications Commission, Washington, DC 20554.

(b) *Pre-space operation notification.* (1) Three notifications are required prior to initiating space operation. They are:

First notification. Required no less than twenty-seven months prior to initiating space operation.

Second notification. Required no less than fifteen months prior to initiating space operation.

Third notification. Required no less than three months prior to initiating space operation.

(2) The pre-space operation notification shall consist of:

Space operation date. A statement of the expected date space operations will be initiated, and a prediction of the duration of the operation.

Identity of satellite. The name by which the satellite will be known.

Service area. A description of the geographic area on the Earth's surface which is capable of being served by the station in space operation. Specify for both the transmitting and receiving antennas of this station.

Orbital Parameters. A description of the anticipated orbital parameters as follows:

Nongeostationary satellite	Geostationary satellite
(1) Angle of inclination	(1) Nominal geographical longitude.
(2) Period	(2) Longitudinal tolerance.
(3) Apogee (kilometers)	(3) Inclination tolerance.
(4) Perigee (kilometers)	(4) Geographical longitudes marking the extremities of the orbital arc over which the satellite is visible at a minimum angle of elevation of 10° at points within the associated service area.
(5) Number of satellites having the same orbital characteristics	(5) Geographical longitudes marking the extremities of the orbital arc within which the satellite must be located to provide communications to the specified service area.
	(6) Reason when the orbital arc of (5) is less than that of (4).

Technical Parameters. A description of the proposed technical parameters for:

(1) The station in space operation: and

(2) A station in earth operation suitable for use with the station in space operation: and

(3) A station in telecommand operation suitable for use with the station in space operation.

The description shall include:

(1) Carrier frequencies if known: otherwise give frequency range where carrier frequencies will be located.

(2) Necessary bandwidth.
(3) Class of emission.
(4) Total Peak Power.
(5) Maximum power density (watts/Hz).
(6) Antenna radiation pattern.[1]
(7) Antenna gain (main beam).[1]
(8) Antenna pointing accuracy (geostationary satellites only).[1]
(9) Receiving system noise temperature.[2]
(10) Lowest equivalent satellite link noise temperature.[3]

(c) *In space operation notification.* Notification is required after space operation has been initiated. The notification shall update the information contained in the pre-space operation notification. In-space operation notification is required no later than seven days following initiation of space operation.

(d) *Post-space operation notification.* Notification of termination of space operation is required no later than three months after termination is complete. If the termination is ordered by the Commission, notification is required no later than twenty-four hours after termination is complete.

* * * * *

3. In Appendix 2 of Part 97, the undesignated paragraph following the headnote is revised, and a new paragraph Sec. 8 is added as follows:

* * * * *

Appendix 2

Extracts From Radio Regulations Annexed to the International Telecommunications Convention (Geneva, 1959), as revised by the World Administrative Radio Conference for Space Telecommunications, Geneva, 1971.

* * * * * *

Article 41—Amateur Stations

* * * * *

Sec. 8. Space stations in the Amateur-Satellite Service operating in bands shared with other services shall be fitted with appropriate devices for controlling emissions in the event that harmful interference is reported in accordance with the procedure laid down in Article 15. Administrations authorizing such space stations shall inform the International Frequency Registration Board (I.F.R.B.) and shall insure that sufficient earth command stations are established before launch to guarantee that any harmful interference that might be reported can be terminated by the authorizing Administration.

[1] These antenna characteristics shall be provided for both transmitting and receiving antennas.

[2] For a station in space operation.

[3] The total noise temperature at the input of a typical amateur radio station receiver shall include the antenna noise (generated by external sources (ground, sky, etc.) peripheral to the receiving antenna and noise re-radiated by the satellite), plus noise generated internally to the receiver. The additional receiver noise is above thermal noise, kT_oB

Referred to the antenna input terminals, the total system noise temperature is given by

$T_s = T_a + (L-1)\,T_o + L\,T_r$

where: T_a : antenna noise temperature

L : line losses between antenna output terminals and receiver input terminals

T_o : ambient temperature, usually given as 290° K

T_r : receiver noise temperature, this is also given as $(NF-1)T_o$, where NF is receiver noise figure.

LETTERS

from page 24

and telling him that there was a two-letter prefix and a one-letter suffix. Even with this, he still insisted on moving me from the United States to Botswana by calling me A2FM. As a matter of fact, he even asked me if that was a stateside call!

I was about to put the blame for his inability to copy my callsign correctly on weak signal strength or QRM when another station broke in.

"K2---", he said, "This is W3---. He said his call was AF2M. I never heard of an AF2; must be a bootlegger!"

"I never heard of an AF2 either," replied the net control. "He's probably some chicken bander."

After this dialogue occurred, another amateur broke in to defend me. He informed the net control that AF2M was a legitimate callsign and that the FCC has been issuing calls in that format for the past two and a half years.

The net control paid no attention to this. He simply said that he had never heard of it, and therefore it was not a valid call!

Needless to say, I don't appreciate some Conditional class operator telling an Amateur Extra that his callsign is no good. This was not the first time I had problems with this net. When they don't get my callsign messed up, they have asked me to do such things as make a phone patch to a business so someone could place an order!

I think it is about time that the amateurs in this country become aware of the callsign prefix system used. Oddly enough, I've never had problems with DX stations getting confused over the callsign; most of them are well aware of the new prefixes that exist here.

The two-by-ones have been around for well over two years. I think it is disgusting that I am prevented from using my radio because of some ham who must have been living in a hole the past few years.

An amateur radio operator should keep up to date with the rule changes. In addition, they should not "play FCC" and decide for themselves who is a bootlegger and who is not!

Robert Swirsky AF2M
Cedarhurst NY

Bob, the FCC does not give an intelligence test along with the ham exam or else some of the nets I've encountered would be underpopulated. Be thankful that those hams with a short deck are stacked up in nets instead of using up frequencies for one-on-one contacts. We have to have activities for our mentally underprivileged, so stop griping. There are undoubtedly some well-run nets; unfortunately, I've run into a lot of the others. One of the major problems encountered during the recent hurricane emergency was a net control station who had no business controlling a net. The net was almost as much of a disaster as the hurricane.—Wayne.

MENTAL TELEPATHY?

I just wanted to thank you and the many other Elmers for the help given on my way to getting my General ticket. The code is really the hardest thing for me and I sure like your 13+ tape. I used many books and tapes along the way and yours are great.

I would also like this to be a letter of encouragement to others who are working hard to upgrade or get a license; it can be done. At one point (actually many times), I had visions of hams perfecting telepathic communications before I ever got over 10 wpm. So far it has been one year as a Novice, one as a Tech...but the big one for me, along the way, was the General. If I could have mastered the code back when I first wanted to become a ham, I would only have to wait 6 more years to be eligible for the QCWA. As you can see, I am a slow learner.

Thank you again; keep up the good work. To any up-and-coming hams...also keep up the good work; you can do it.

George Weber KA0CCY
Steamboat Springs CO

KAYLA'S KIPLING

I have been re-reading Kipling and came across the following poem which may be the first literary reference to Morse code. The copyright date is 1892.

A CODE OF MORALS
Rudyard Kipling

Now Jones had left his new wed bride to keep his house in order,
And hied away to the Hurrum Hills above the Afghan border,
To sit on a rock with a heliograph, but ere he left he taught
His wife the working of the Code that sets the miles at naught.

And Love had made him very sage, as Nature made her fair;
So Cupid and Apollo linked, per heliograph, the pair.
At dawn across the Hurrum Hills, he flashed her counsel wise—
As e'en, the dying sunset bore her husband's homilies.

He warned her 'gainst seductive youths in scarlet clad and gold,
As much as 'gainst the blandishments paternal of the old;
But kept his gravest warnings for (hereby the ditty hangs)
That snowy-haired Lothario, Lieutenant-General Bangs.

'Twas General Bangs, with Aide and Staff, that tit-tupped on the way,
When they beheld a heliograph tempestuously at play.
They thought of border risings, and of stations sacked and burnt—
So stopped to take the message down—and this is what they learnt:

(Here I take liberties and use dah dit, where Kipling said dash dot.)

"Dah dit dit, dit, dit dah, dit dah dit" twice. The General swore.
"Was ever General Officer addressed as 'dear' before?
'My Love', i' faith! 'My Duck,' gadzooks! 'My darling popsy-wop!'
Spirit of great Lord Wolseley, who is on that mountain top?"

The artless Aide-de-Camp was mute; the gilded Staff were still,
As, dumb with pent-up mirth, they booked that message from the hill;
For clear as summer-lightning flare, the husband's warning ran:
"Don't dance or ride with General Bangs—a most immoral man."

(At dawn, across the Hurrum Hills, he flashed her counsel wise—
But, howsoever Love be blind, the world at large hath eyes.)
With damnatory dot and dash he heliographed his wife
Some interesting details of the General's private life.

The artless Aide-de-Camp was mute; the shining Staff were still,
And red and ever redder grew the General's shaven gill.
And this is what he said at last (his feelings matter not):—
"I think we've tapped a private line. Hi! Threes about there! Trot!"

All honour unto Bangs, for ne'er did Jones thereafter know
By word or act official who read off that helio.;
But the tale is on the Frontier, and from Michni to Mool-tan
They know the worthy General as "that most immoral man."

Kayla Hale W1EMV/TI5
Alajuela, Costa Rica

Hello, Kayla! For ham newcomers, Kayla was the editor of 73 back before she got married... golly...over ten years ago.—Wayne.

AUGUST KUDOS

I just want to say thanks for a hell of a good job you've been doing.

I've been a writer, professional type, for some 30 years or more. Over a thousand credits if you care to count 'em, so there are a few experiences with editors in the old memory sack. Why tell you all this?

Because, to make a point. You look back over your encounters and you start comparing. You remember articles you wrote to your own specs, only to have them bounced with the judge's decision of "lack reader interest." Trouble is, the readers never had a chance to put in their two-bits worth (2¢ inflated). The eds bounced the cream of an 8-hour stint at the mill on the basis of *their* taste.

Now, at *73* you run such articles as "Over There" by Julian N. Jablin W9IWI in the August, 1980, issue. Who in the annals of hamdom would ever suspect that an article like this, with no

schematics, formulas, construction instructions, and the like, would ever get published, much less read and enjoyed? Want to know why *73* is the fattest, best-loved, and most read of any ham mag? Simple. Articles like this as well as the usual nuts and bolts! I was in the Navy, but had some inter-service experience with just such guys as Jablin made come to life again. I'll bet my keepsake Morse key that fastens on my knee with the knob on top that a lot of *73* readers enjoyed that story as much as I did! Maybe some or most of you are youngsters and couldn't get excited over that writing, but you had the good sense to publish it for those of us who could. That's good editing!

I've read every August article. Good balance. Every one interesting in its own way. They are warmly written, like talking to the guy across town on the 2-meter net. What more can I say, except "Keep up the good work!"

Waldo T. Boyd K6DZY
Geyserville CA

Thanks, Waldo, and it has been a pleasure to publish your articles for these many years. I was glad to see the article from Julian, too, for I've known him for some 25 years now and we've been good friends, but I haven't seen him writing much recently. I hope this will break it loose for him and we'll see more ...and more from you, too, Waldo.—Wayne.

SSTV AND THE ARTS

The Amateur Radio Television System (ARTS) is a non-profit organization of amateur television (ATV) operators who are devoted to bringing together peoples of the world via slow scan television. ARTS operates on the commonly recognized SSTV frequencies and has a membership of hundreds of operators who come together for the exchange and relay of video traffic from all parts of the world. ARTS cooperates with the specialty networks of the Military Affiliate Radio System (MARS), providing full coverage of the military as well as the civilian population.

All 50 states and many DX countries have ARTS Directors who oversee video traffic handling in their areas. Some Director positions remain to be filled and more operators are needed. Interested SSTVers are invited to contact me at the address given below. An SASE will be appreciated.

Mike Stone WBØQCD
Director,
ARTS Communications
PO Box ATV
Lowden IA 52255

HEYN AND WEST

My husband Fried Heyn WA6WZO (Extra class license) is running for ARRL SW Division Director in the October election, and Gordon West WB6NOA is running for Vice Director. Fried believes he and Mr. West have considerably *more time* to provide the Division with more leadership, more representation, more service, more ideas, more enthusiasm, more caring, and more courage, plus more qualifications and more experience in amateur radio.

Fried is a math teacher (20 hours a week) having BA, BS, and MA degrees. His past administrative experience includes Production Coordinator for Collins Radio. He is currently an ARRL Assistant Director, Section Communications Manager, chairman of the Orange County Council of ARO, founder (and past president) of the Southern California Amateur Radio Computer Club, honorary member (and past president) of the Orange County ARC, treasurer of the Southern California DX Club, and life member of the ARRL and AMSAT. In addition, he has had experience in public service, writing, lecturing, teaching, conventions, and public ham exhibits. He is very active on the air and has accumulated many awards, including the ARRL National Certificate of Merit, many contest wins, BPL, 5BWAS, WPX, and WAZ. He has over 300 countries confirmed (including DXCC). He is active in many local nets and organizations, including RACES, ARES, and NTS, and he is an active member of 220 SMA, TASMA, and the LA Area Council of ARC. Fried's other national memberships include NC DX Foundation, ISSB #9367, Ten-Ten #8011, MARAC #993, and ARNS #807.

Gordon holds both an Advanced amateur radio license and First Class radiotelephone license (with radar endorsement). He has an MA degree in business administration from Chapman College and currently is an editor, lecturer, writer, and college instructor on marine, citizens band, and amateur radio electronics. He is an ARRL life member and holds field organization appointments of OBS and OVS as well as membership in ARES. He is the honorary president of the West Coast Amateur Radio Club as well as a supporter and member of many local repeater groups. Also, he is a member of the distinguished Radio Club of America and the interference committee of the Personal Communications Foundation. Mr. West is active on all bands from 160 meters through 1296 MHz.

Gordon believes that he and Fried will provide the SW ARRL Division with a "*New Direction*" in increased representation and service to their fellow amateurs.

Sandi Heyn WA6WZN
Costa Mesa CA

Fried Heyn WA6WZO (left) and Gordon West WB6NOA.

LOW VOLTAGE

Readers of the July, 1980, issue were treated to WD4KFF's unique semiconductor tester ("Multi-Media Bench Tester," page 106). I enjoy using mine.

I would like to suggest a battery supply of 4.5 to 5.5 volts (in place of the 6-volt supply indicated on the schematic) since these are the recommended operating limits of most transistor/transistor logic (TTL) devices to ensure proper performance. Thanks.

Mitch Cohen WB4RXB
Margate FL

HT OPPORTUNITIES

Just another letter to let you know how much I continue to enjoy your fine publications, *73* and *Microcomputing*. Both are a credit to the industry, the hobby, and to the professions and fields that they represent.

Sure would like to see some mention made that the hams in the field would like to see the radio manufacturers get on the ball and make some of the excellent hand-held units for some of the bands other than 2 meters. The industry has done wonders with the 2-meter band with the marked advancement of gear now available. With band conditions as they are in certain parts of the country, and with the concern that if "we don't use it, we will lose it," I would like to see some serious effort by the radio manufacturers to get some truly new products and hand-held units out for the 220- and the 440-MHz bands. Even a hand-held for 6 meters would be welcome on the market. I know I am interested in getting some new gear for these bands, but we need some help from the manufacturers!

Please devote some thought and comment to this subject. Two meters would not be what it is today without the gear that is available; now that we have opened and in some cases filled every space on two meters, let's open some of the other bands with some gear that is a pleasure to operate! The market is there—and we are out here just waiting to spend our money.

William D. Mauldin KA4JUL
Boca Raton FL

LOOKING WEST

from page 12

swer, the same answer we used to protect the 220-MHz band: Use it! Keep six meters alive with activity the same way 220 is these days. What about equipment? Except for some high-priced multi-mode transceivers, there is little around, and you do not want to front a bundle of green stamps for a band that may not pay off in contacts. Well, I am willing to bet that many of you have a remnant of the old days lying in the closet or cellar. Maybe it's an old Gonset I, II, III, or IV. Perhaps a vintage Clegg 99er, 66er, or Polycomm 6. How about a venerable Benton Harbor Lunch Box? Dig it out, plug it in, and see if it still works. I'll bet it does. What about an antenna? Well, a simple dipole is more than adequate for local work. "But AM is dead. Nobody uses it anymore." True. AM on VHF is dead, but only because most of those who used to operate 6-meter AM went to 2-meter FM and deserted 6 meters entirely. While AM would not be welcome these days on most bands, six is definitely the exception to the rule. Why? Because there is a lot of spectrum and very little utilization above 50.25. Most six-meter SSB enthusiasts hang around 50.110 or thereabouts. Stay above 50.25 and you won't be bothering a soul. If enough of you dig out these relics of an era gone by and make use of them, you can literally have your own private channels to use as you see fit. Your expense? That of a few feet of coax, some zip cord, and a few hours of work.

"But I don't want to go on AM. It's so old-fashioned." True, AM is out-dated by today's standards, but most old tube-type AM rigs can be easily converted for FM use. The simplest way is to use the existing AM modulator as an FM modulator by reconnecting it to modulate the transmit oscillator. Careful... cut the gain control down...it does not take very much audio to get enough deviation for plus/minus 5 kHz. Most crystal manufacturers can supply a transmit rock for 52.525 which is the place most FMers on 6 meters monitor. As far as the receiver goes, you can simply slope detect or convert the receiver to FM operation with the addition of a simple integrated circuit quad detector mounted on a small PC board. Many quad detector chips have built-in squelch and limiting.

Think such a conversion cannot be done? My new 6-meter FM rig is nothing but a 1960s Lafayette HE-45B with a quad detector powered with voltage stolen from the cathode of the audio output/modulator tube, with the receiver oscillator now crystal controlled. To FM the transmitter, I simply reconnected the modulator to supply modulated B plus to the original crystal oscillator and tied the 2E26 final plate directly to the unmodulated B supply. I picked up 4 extra Watts out in the bargain. Audio reports are good, and those I QSO seem shocked when I tell them what I am running. Even better, this unit looks nicer than some old boat anchor, especially sitting on my desk. The antenna is a simple coaxial vertical made from a length of RG-59/U. Nothing exotic, and a total investment of under $14, including crystals. Not state of the art, but more than sufficient. I also have a vintage Polycomm 6 which I restored to perfect operating condition and left unmodified for other uses. Thus far I have had about a half dozen AM QSOs since returning to the band. The antenna on the Polycomm is also a dipole, but this one a traditional horizontal centerfed type.

Six meters seems dead because most people who operate the band listen rather than talk. They're waiting for the other guy to call CQ. Well, if everyone waits, there will be very few QSOs, won't there? It's up to people like you and me to wake up the band. Old equipment works, is plentiful, and is inexpensive. Even with the most rudimentary equipment, significant DX is possible during sporadic E and F_2 openings. Working extended groundwave, meteor scatter, tropo, and the like takes far more exotic equipment. But you would be amazed at what can be worked with the oldies but goodies. On July 25th, 1961, using a Clegg 99er 7-Watt AM transceiver and an indoor dipole, I QSOed KP4AXC in San Juan, Puerto Rico, from Brooklyn, New York. On May 19th, 1965, while still in Brooklyn, I QSOed WA8BTR in Cincinnati, Ohio. He was running a Hallicrafters HT-40/SX-140 combo and I was using the same HE-45 Lafayette rig that has now become an FM base station. My antenna at the time was a halo atop a 6-story apartment house. Or how about St. Louis, Missouri, on May 30th, 1961? I QSOed WØWKG using my indoor dipole and a 15-Watt homebrew transmitter. Shall I go on? In all, some 42 states plus Puerto Rico worked and 38 confirmed prior to my going to SSB in the late 60s. It can be done, and I have the QSL cards to prove it. Many of you reading this probably do, too. Those were great days. Six-meter DXers cooperated with one another, rag chewing in a DX round table was common when the band was open, and there were none of those time-out timers, jammers, or politicians to concern oneself about. If you are as tired of the latter as I am and happen to have a relic of that era lying around, then why not fire it up? You might not hear much at first, but try calling a CQ. Who knows, if enough of us do this, we could repopulate the band and then move it toward bigger and better things. Most important of all, we can secure this band from potential invasion by illegals. If enough of us are there, they are not going to try anything. But if we leave the band vacant awaiting further FM deregulation for expanded repeater operation, we are inviting disaster. CU on 6...as we used to say...AM, FM, or SSB.

One final note to those of you who think that ITF is playing alarmist and who think that six meters will always be safe because of the TVI problem. In today's day and age, there is no such thing as safe amateur spectrum. Every kHz has a specific dollar value. There are those who look upon the spectrum devoted to amateur radio as potential income if they can steal it from us. At this moment, there is no more vulnerable amateur spectrum than that which lies between 50 and 54 MHz. It is in the same position that 220 was some 5 years ago. I firmly believe that we have two choices. Either we utilize this spectrum or it will be lost to another service. "Six meters—Use It or Lose It."

JAMMER LOSES LICENSE DEPARTMENT

In late 1978, there appeared on the two-meter amateur band in Los Angeles a rather foul-mouthed individual using a phoney callsign. Using the call W6JAM, this individual tormented the users of the then WR6ABN repeater for many months. During this time, many letters were sent to the FCC and other government agencies in an attempt to obtain some form of relief from this menace, but in the end it was his peers who located him. Unfortunately, W6JAM was found to be a licensed amateur operator named Scott Lookholder, whose real callsign was WB6LHB. Lookholder was eventually brought to trial, given a year's suspended sentence, and fined. All this was reported here in LW and in other amateur publications.

In September of 1979, after an inordinate amount of pressure from the amateur community, the Commisssion acted to suspend Lookholder's license. They also issued a Show Cause Order as to why his license should not be revoked. In my possession is a copy of the final Revocation and Suspension Order issued against Lookholder on May 16th, 1980, with an effective date of June 16th, 1980. From It I have learned many things, including the fact that Lookholder never responded to the Show Cause Order.

What I found most interesting, however, were the "Conclusions of Law" upon which the revocation order was based. I got many clues into the thinking of the FCC, as well as a hint as to how similar matters might be handled by them in the future. After noting that Lookholder had been convicted in a Court of Law for repeated violations under 47 U.S.C. 502, and stating that they, the Commission, had a mandate to regulate radio communications based upon the Communications Act itself, they went on to cite some rather interesting legal interpretations that by this order have become possible legal precedent.

The Commission stated, "Lookholder's transmission cannot be treated the same as words spoken in private, words spoken in public, or printed words. The Courts, Congress, and the Commission have recognized that radio communications have special qualities which distinguish them from other modes of communication and expression." (At this point, the findings cited various cases in which broadcasters were involved, including the famed Pacifica case involving radio station WBAI in New York.) Continuing... "Thus while the use of certain expressions such as (expletive deleted) displayed in writing in public may be protected forms of speech, nevertheless, government may properly act in many situations to prohibit intrusion into the privacy of home of unwelcome views and ideas which cannot totally be barred from the public dialogue." In essence, you can say what you want in public, but if you do it on the radio, you can be held responsible for your words. Maybe my interpretation is a bit simple, but I think it fits.

The finding went on: "The Commission has determined that the transmission of radio communications containing certain explicit words (and forms thereof)...are patently offensive to listeners, and that radio communications containing such words fall within the prohibitions of 18 U.S.C. 1464. Consequently, these expressions are prohibited by Section 97:119 of the Commission's Rules. Because of the nature of the Amateur Radio Service and its broad band of frequencies instead of limited channels, the audience of 350,000 amateur radio licensees and in addition shortwave listeners and those studying for an amateur license are constantly tuning in and out of the radio bands and are subjected to unexpected contents of the communications. Like the broadcast in Pacifica, Lookholder's transmissions were uniquely accessible to children and could have enlarged a child's vocabulary in an instant, unlike written messages."

Unless I read something wrong, in this finding the Commission notes that the public has a right to be protected from being forced to listen via electromagnetic communication to anything it deems to be offensive, and cites the case of Pacifica's WBAI in which listeners were "treated" to what some felt was offensive material. They then stated that the actions of Lookholder and those of Pacifica were one and the same, thus citing action in another service as precedence in the revocation of Lookholder's license.

"Moreover, Lookholder's repeated transmission of obscene, indecent, or profane language and its intentional interference with the transmissions of other amateur licensees establishes a record of disinclination to comply with Commission rules. Thus revocation is not only warranted, but essential." I think that no comment is necessary, as this section speaks for itself.

The anger of the amateur community was also noted: "Lookholder's transmissions have angered the amateur community. The amateur community must be assured that the Commission is prepared to act severely when its rules and regulations are blatantly disregarded by amateur licensees, such as Lookholder." Herein the Commission was obviously making reference to the myriad of communications sent to them on the matter by amateurs of this area who were more than a bit upset by the situation. Obviously I am not a lawyer, but I suspect that this finding may give credence to the viability of such complaints as the basis for investigating such instances as this.

The rest of the order was the necessary legalese to invoke the revocation of Lookholder's license. However, a footnote was added that is of extreme significance in that it ties together virtually all forms of radio transmission under the obscenity ban. It reads as follows:

"The Commission's enunciation that such words fell within the prohibition of 18 U.S.C. 1464 was within the context of Broadcast Radio Stations. Of particular concern was the protection of children and unconsenting adults who do not want such language transmitted into their homes. These considerations are equally true of the Amateur Radio Service where there are no minimum age requirements for licensing (97.9), where there are, as this case reveals, complaints against such language on amateur radio, and where the potential reception of the transmission is widespread, as confirmed by the fact that Lookholder's transmissions were on frequencies with potential worldwide propagation."

I have stated in this column many times that it is my belief that an amateur license is not a license to say anything you want, when you want, whether your language is welcome or not. Your license is a permit granted to you by our government to communicate through the use of electromagnetic radiation on pre-determined spectrum in exact accordance with regulations as set forth by the governing body, i.e., the FCC. If you are a jammer or thinking of becoming a jammer, then I suggest you weigh the potential consequences. By this action, the Commission has set a long needed precedent that can be used against you. They can take your license. They can take other punitive action. You might even wind up in prison, or at least have to pay a stiff fine along with court costs.

When Lookholder pled guilty and was hence convicted, many amateurs were angered that it took so long for the FCC to even suspend his license, let alone revoke it. It was well over a year and a half from the time of the conviction until the time the revocation order took effect. Many amateurs openly condemned the Commission for its slowness in acting on the matter, but with the publication of this document, it is apparent that this time was well spent in preparation. It is well thought out, well prepared, and, most important, it seems to set the legal precedent that the Commission needed to act against such offenders. Keep in mind that the next time, the Commission need only cite this case as grounds for a revocation action against a regulatory violator who fills our airwaves with his or her profanity. They obviously were looking to set an air-tight legal precedent, and in my untrained but optimistic view, I think they have. People versed in communications law with whom I have conversed tend to agree. The FCC now has a weapon to use against the foul mouth, and let's hope they go to it swiftly.

There is only one thing I wonder about. Does the real holder of a callsign such as W6JAM have any legal recourse against someone who has blasphemed said call and used it illegally? That's one that some of you legal types might want to look into. Meanwhile, scratch one jammer. He jammed; he got caught; he's no longer an amateur. The bureaucracy of Washington may move slowly, but once the steamroller gets going, there is seemingly no way to stop it.

HAM HELP

I'm looking for a used HF linear amplifier. I'd prefer one without tubes. Condition not important, price is! Please make offers.

Dante Ventriere KA4JRE
17831 NW 81 Ave.
Hialeah FL 33015

I need information on hints, kinks, and modifications for the Kenwood TR-7400A, especially for out-of-band operation. I also need information on a squelch circuit for the Motorola Pagecom low-band pager. I am willing to pay a reasonable price for information.

Richard McLaughlin, Jr.
WB8TOE
4237 Dickman 3B
Springfield MI 49015

I am in need of an operator's manual for a Tempo One transceiver. I also need an operator's manual for a Hallicrafters SR-150 transceiver. I will be glad to pay for postage and copying, but please send a postcard first. Thank you.

Claude Laroche KA1BNA
RFD 2, Georgia Road
St. Albans VT 05478

If anyone has cured an ignition noise problem, on transmit, in the KDK 2016A, I sure would like to know about it. Also, if anyone knows of an RIT mod for the Heath HW-101, please let me know.

Jerry Lynn WB7WBW
3017 First Ave. No.
Great Falls MT 59401

NEW PRODUCTS

from page 32

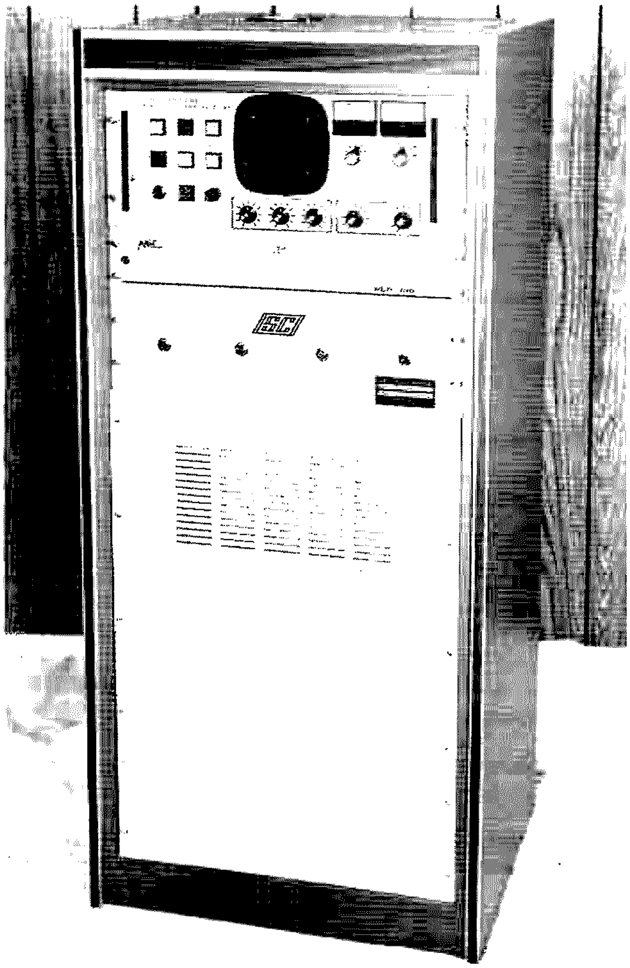
In addition to detecting motion, the Safe House may be used with optional door and window switches to provide perimeter protection. A normally open panic circuit is also offered. A panic switch will activate the alarm regardless of whether it is in the armed or standby mode. No matter what triggers the Safe House, its siren will run for eight minutes and then shut off if no more triggering occurs. This helps to prevent an annoying disturbance if you are away and the alarm is accidentally set off.

Our tests of the Safe House system indicate that its effective range is a bit less than what the owner's manual specifies. When used in an apartment living room approximately 15 × 20 feet in size, the Safe House provided coverage for everything but the areas on its immediate left and right. Motion directly toward or away from the alarm immediately registers; however, lateral motion is less likely to be detected. While this rf disturbance alarm did not seem to be as sensitive as some ultrasonic units, it did not have the falsing problem associated with some of the less expensive units.

The Safe House alarm provides a compact, easily installed way to protect one room and, if the need arises, the system can be expanded. Features like the coded entry sequence and backup battery are offset by a rather cheap looking plastic cabinet. The operation of a low-level microwave signal like the Safe House's is contingent on the premise it does not interfere with licensed microwave users. By the way, there is no protection from interference resulting from other users of the alarm frequency.

The Safe House rf field disturbance alarm is available at Radio Shack stores. The alarm costs $199.95 with a horn speaker, $179.95 without. Reader Service number 478.

Tim Daniel N8RK
***73* Staff**



Spectrum's SCR4000 repeater.

TEN-TEC OFFERS NEW THIRD GENERATION OF THEIR POPULAR "OMNI" TRANSCEIVER

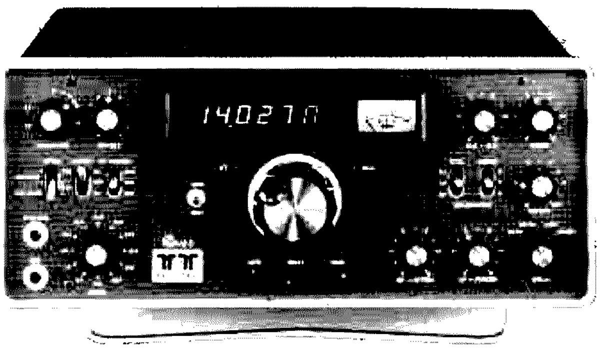
In addition to some interesting new performance features, Ten-Tec's new Omni Series C transceiver is one of the first amateur transceivers to have capability for all nine HF bands.

The Omni-C covers all amateur bands from 160 through 10 meters. Crystals are included for seven of the nine bands (crystals for the 18- and 24.5-MHz bands will be ready when the bands are).

Another unique new feature of the Omni-C is its three-mode, two-range offset tuning capability. It's the first to offer a choice of offset tuning for the receiver section, the transmitter section, or the combined transceiver. The three modes offer complete offset tuning flexibility for all needs, fine tuning interfering signals or chasing DX. The two ranges are ± 500 Hz or ± 4 kHz.

The Omni-C also offers new ease in using the seven response curves of its optimized bandwidth capability. New switching is provided for selecting the standard 2.4-kHz 8-pole SSB filter, the optional 1.8-kHz 8-pole SSB filter, the optional 250-Hz or 500-Hz 8-pole CW filters, cascading them for 16 poles of filtering or putting them in the signal path along with 450- and 150-Hz active audio filters.

New "hang" agc for smoother operation and a standard equipment noise-blanker (2-pole monolithic crystal filter) are other new features. For further information, contact *Ten-Tec, Inc., Highway 411 East, Sevierville TN 37862.*



Ten-Tec's Omni-C transceiver.

SPECTRUM COMMUNICATIONS' NEW UHF FM REPEATER

Spectrum Communications' new FCC type-accepted SCR4000 repeater is a 30 Watts minimum unit, with a 406-512-MHz frequency range. Its features include: excellent receiver sensitivity (0.3 uV/12 dB SINAD), 8-pole front-end filter, very wide receiver dynamic range with double balanced mixer for superior intermod rejection, 8-pole i-f crystal filter plus 4-pole ceramic filter, built-in CW IDer and time-out timer, and all important operating parameters conveniently adjustable and measurable from the front panel. The unit is available complete with community tone panel, matching cabinet, and duplexer. For further information, contact *Spectrum Communications Corp., 1055 W. Germantown Pk., Norristown PA 19401.* Reader Service number 477.

MFJ RECEIVER ANTENNA TUNER/PREAMPLIFIER

For years, hams have espoused the benefits of antenna tuners, match boxes, and transmatches for maximum transmitting antenna efficiency. But how about receivers? Don't they deserve some consideration, too? Certainly, if a transmitter/receiver combination is used, and an adjustable matching device is set for the most efficient signal transfer (nominally 50 Ohms) between the transmitter and antenna, then the same efficiency exists during receive as well.

But many hobbyists enjoy the passive reception of shortwave broadcast stations, utilities, and amateur communications without the intention of pushing rf back out through the antenna. Why pay for a large, expensive transmatch?

Is an antenna feedline matching device really necessary for reception? MFJ seems to think so, and their new model 959 receiver antenna tuner/preamplifier is designed to optimize the coupling between the receiver and its feedline. "Antenna tuner" is somewhat of a misnomer, since the only way one can tune an antenna is at the antenna itself. But assuming that the antenna and feedline are reasonably well matched at their union, there are ways to improve the match between the radio and the feedline for maximum signal transfer efficiency. A transmatch is one way.

The 959 is a flexible instrument, consisting of a fully-adjustable pi-section tuning stage followed by a stage of bipolar transistor amplification. The entire circuit may be bypassed with the rotation of a switch to direct the signal back to direct receiver input from the transmission line.

Theoretically, since modern receivers are designed to accommodate 50 Ohms antenna line impedance, a resonant halfwave antenna cannot be improved upon with any matching device. But rare is the single-frequency application where a perfect match is possible. Most of us—probably *all* of us—tune our receivers for wide frequency excursions, hoping to snag some elusive DX. It would be nice if we had some guarantee that our receivers would be optimally matched throughout the chase. But just how essential is a perfect match for reception, anyhow? In transmitting we are concerned for every Watt of output, both for maximum signal emission as well as equipment safety from high vswr. But with reception, it would seem that a few dBs shouldn't make all that difference. We decided to test out this theory with the 959 tuner.

A harmonically-related off-center-fed windom antenna cut for 80 meters was selected as the test antenna. Since it had large capture area (135 feet long) and was already close to resonance on several harmonically related bands, we knew that it would be hard to improve upon for receiving.

Results of this experiment were mixed. Below about 6 MHz, there was a distinct improvement in received signal strength when using the MFJ-959 tuner rather than operating the windom straight through. Above that frequency, there was no noticeable difference. Naturally, with the 20-dB preamplifier switched in, signals came up, but that would be expected from any additional rf amplifier stage.

Next, we tried a shorter random wire antenna about twenty feet in length. Results were identical. No improvement with the tuner above about 6 MHz.

But before we write off a receiver tuner as a worthless accessory, let's examine a few of its applications to show where it really makes a difference.

One of the problems encountered by receiver manufacturers is in the design of an inexpensive general coverage receiver with wide dynamic range. Strong signals have a tendency to do awful things to receiver circuitry, especially when cost-conscious engineers specify "cost effective" transistors. Inadequate front-end (rf) selectivity is another weakness in wide coverage receivers. The frequent result is the reception of signals which aren't really there! Intermodulation and images generate phantom signals that may interfere with reception all over the dial. This is where a good external preselector comes in handy.

The MFJ-959 also has a switch-selectable attenuator which is useful in reducing interference from nearby transmitters. The additional tuned circuitry provides the increased circuit Q to improve overall rf selectivity as well. Those strange whistles and annoying phantom signals from nowhere disappear when the tuner is peaked on the desired receive frequency.

True, you can't make a silk purse out of a sow's ear, but even the sow tastes pretty good when it's properly prepared! And you can't make a Collins 51S1 out of a Hallicrafters S-38, but you *can* improve the S-38—and other receivers as well!

The MFJ model 959 receiver antenna tuner/preamplifier sells for $89.95. For further information, contact *MFJ Enterprises, POB 494, Mississippi State MS 39762.* Reader Service number 483.

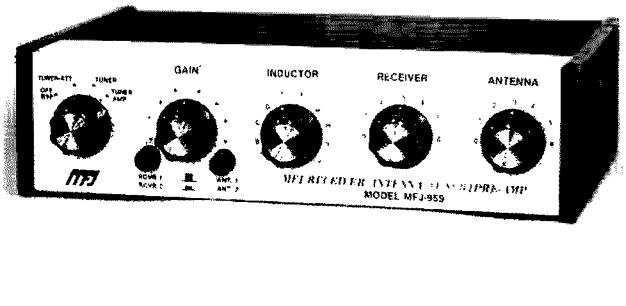
Robert Grove WA4PYQ
Brasstown NC

HAMTRONICS' RECEIVING CONVERTERS

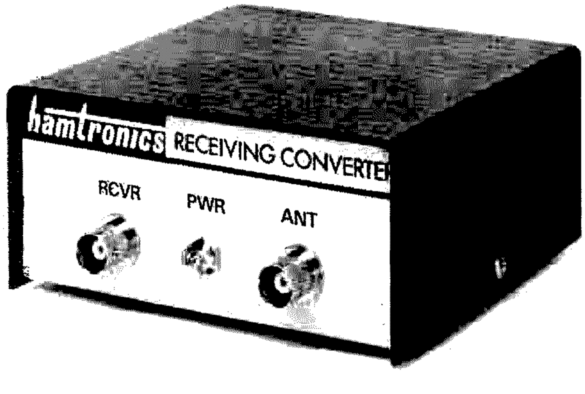
Hamtronics® receiving converters are housed in attractive wood grain aluminum cases and feature a low noise figure, less than 2 dB, for applications requiring exceptional sensitivity. That makes them ideal for reception of OSCAR satellite signals as well as conventional terrestrial activity. Called the "CA" series, these converters are available in a wide range of VHF and UHF bands and in several popular output ranges. VHF models use protected dual-gate MOSFETs in the front end and mixer. UHF models use two of the new MRF-901 bipolar transistors in the rf amplifier and a doubly-balanced Schottky diode mixer for broadband response. The converters are great for all modes of operation, including SSB, CW, FM, and ATV.

A whole new line of Hamtronics® receiver preamps has been added, using new technology similar to that of the converters. These are available either in a new drawn metal enclosure with mounting tabs or as a PC board module. Provisions have also been made to feed the B+ to the preamp via the output coax cable for remote mounting preamps at the antenna.

For further information, contact *Hamtronics, Inc., 65F Moul Rd., Hilton NY 14468.* Reader Service number 481.



The MFJ-959 receiver antenna tuner/preamplifier.



A Hamtronics receiving converter.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

you are aware that 73% of the business phone calls do not get through on the first try.

With some plans I have in mind, I think our entire educational system can be revamped. I envision a system whereby people start learning as early as they want and continue until they lose interest or die. The courses would be done so as to generate enough interest to attract students and get them to want to learn. I think this can be done via a combination of video recording and computers and it is my intention to have Instant Software pioneer this field. I'm not talking about just the US, but teaching the entire world.

If I can find people capable of running the publications, I'll be going off to Africa to push for ham clubs in as many countries as possible, as mentioned earlier. Between amateur radio and microcomputers, mighty changes can be made in many countries in a relatively short time.

YOUR HELP

The preceding is ambitious, but with your help I can do it. I need your support with as many subscribers as you can get for the magazines...with ads... and with club-run classes for new hams. I don't think we have to give away the ham ticket to get new hams...no code-free licenses... no digital licenses. It's hard work...and fun...to study and pass the ham exams. Get your club into the local high school and snare those 14- and 15-year-olds into your classes. And don't forget to tell them about Wayne Green and *73 Magazine.*

OFF TO SEE THE BLIZZARD

Well, the hurricane, anyway.

When word of the destructive Allen hurricane came over the television, I held a hurried meeting of the *73* tech staff and suggested that our collection of a dozen or so HTs, chargers, and assorted low-band rigs which could be run from 12 volts might be of use on St. Lucia.

Tim Daniel N8RK/1 got right to work packing the rigs into some Halliburton metal suitcases in case they would be needed. Next, we contacted Delta Airlines to see about getting the equipment down to Miami as the first step toward St. Lucia and found them extremely cooperative.

We'll have the details of the whole thing as soon as possible; however, it ended up with Tim grabbing a couple of cameras and a toothbrush and accompanying the gear to St. Lucia, where the HTs were put into immediate use.

INCENTIVE LICENSING?

There is a misunderstanding...and I notice that *73* has been contributing to this. A letter in the September issue, which was published without comment (I didn't see it), confused Incentive Licensing, which was the proposal made in 1963 by the ARRL to get the General class licensees off all the major phone bands, with the currently used Progressive Licensing system.

The additional privileges of our current system may indeed provide an incentive for stepping up your class of license, but this is *not* Incentive Licensing. The battle that *73* and a great number of hams put up against the League back in the 60s saved half of the phone bands for the General class.

One other point. The small number of additional frequencies now available to the Extra class was *not* the incentive which made that license class popular. Indeed, virtually no one upgraded to Extra until the funny callsigns rule went through. Up until that time, only about 2% of the hams had upgraded to Extra. All this was reported in detail down through the years in *73* as these events happened. Most newcomers are unaware of our history...and a lot of old-timers have rewritten history in their minds to protect the memory of our beloved League.

There goes Wayne with his ARRL hate campaign...no, not at all. I honestly don't hate the ARRL...contempt, maybe, for those directors who get elected for ego reasons (most of them) and for the HQ people who don't give a good damn about amateur radio but are professional bureaucrats. There are some exceptions at HQ...and there is no question but that some things the ARRL does are beneficial.

I've often lauded the DXCC program which drives most rare DX operators off the air in a matter of days. And I am right up front in complimenting their many contests which keep thousands of other amateurs off the air on weekends while dozens of fanatic contesters exchange numbers and vie for certificates of lasting value. And who could complain about the ARRL traffic system which beats the accursed phone company out of hundreds of thousands of dollars? No, in many ways I am as loyal an ARRL fan as they come.

DIGITAL LICENSES?

If you have read many of my editorials, you know that I feel it is important for us to have a lot more hams than we do. I think it will be valuable to amateur radio...and also to our country, in that the more hams we have, the more technicians and engineers we will have. The two do go hand in hand.

The code test...one can make a powerful case for or against it. It doesn't prove anything since it is merely a skill which is acquired. True, on the other hand, the achievement of this skill is an indication that a person has had enough interest in getting a ham license to put in a lot of hard work.

With the Bash cheat sheets, the written exams are virtually worthless as any indication of anything, so without the code test, anyone wanting a ham license can get one just for the work of memorizing a handful of questions and answers. But, to be fair to Bash, his series is not very much different from the ARRL *Q&A Manual*, only more accurate and thus more devastating.

The original idea for the Novice ticket was to encourage newcomers to get on the air and practice their code instead of just listening. This scheme never did work out well. It couldn't, actually, because the whole basis of the idea was stupid. Novices working Novices, all at around five words per minute, is unlikely to train anyone to copy code at 13 per. All it does is develop acute frustration.

The Novice ticket, when it first was issued, included some two-meter phone channels, so naturally most Novices quickly bought two-meter rigs and gossiped their licenses away on two. When that was shut off, Novices went out and bought cheap CW rigs (why spend a lot of money if you might not get the General license?) and found life in the jam-packed Novice bands exceedingly aggravating. Their el cheapo receivers brought in half the band at once, and their transmitters didn't have enough power to clean off a channel. So they tried and tried to make decent contacts, but most of them were lost in the QRM. An awful lot of Novices never made it to General.

Then there was the Tech ticket...another bummer. Once started, this license kept tens of thousands of hams from ever discovering the low bands. To make matters worse, for the first few years the Tech ranks were packed with chaps who had cheated and didn't even know the code at 5 wpm. These people were not likely to make a serious effort at a General ticket. So they went through life talking on two meters, eventually either getting fed up and dropping out or else dying of apoplexy over a repeater kerchunker.

Yes, it was more difficult to get that first ham ticket before the Novice license was invented, but I seriously wonder if the FCC has done amateur radio any favors with the Novice and Tech licenses. It takes a bit more work to get the first ticket when you start with General, but you do, right off the bat, have the full range of ham bands available to you. Thus you can get a lot more out of hamming because you will tend to go out and buy a first class rig rather than try to make do with a klunker in case you fail to upgrade.

From a practical standpoint, the FCC is doing no one any favors by forcing everyone to first learn the code at 5 words per minute. More and more ham

classes are proving that it is possible to learn the code at 13 words per minute in almost the same time as 5 wpm...if you start right out at that speed and don't horse around with the slower speed. The lower speed tends to encourage people to use the ARRL system of gradual speed increase...which is one of the worst systems of learning the code ever devised and which has lost us hundreds of thousands of good prospective hams.

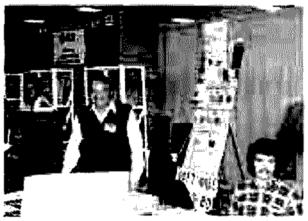
Which brings me to the digital license recently proposed in *QST*. Phooey. If clubs will set up classes, beat the bushes around high schools for impressionable youngsters in the 14-15 year age bracket, we'll have all the hams we and our country need. Kids that age are suckers for ham radio...they are too young to realize that they are being talked into a life involvement from which they will never really escape. Even if you told them about it they haven't enough experience to kick the habit before it becomes overpowering.

If we cut out everything below the General license, it might take a few weeks longer to graduate new hams, but we would end up with a lot more in the end and be a lot happier. We might get away from a lot of this kerchunking and bad language...and we might get a lot more newcomers into building and designing equipment. We can use more experimenters.

What do *you* think?

BALTIMORE

One of my three scheduled talks at hamfests this year was at Baltimore...and they sure managed to pull a great crowd for that show. A good part of the commercial exhibit area was computer-oriented...something I'm seeing more and more these days. In fact, at some hamfests the computer exhibits outnumber the ham exhibits.



I was not dismayed to see Instant Software prominently on display at one of the booths.

The best part of the hamfest was the indoor flea market...packed with good things and so many hams pawing over the stuff that it was difficult to even get close to the better bargains.

The heavy flea-market attendance seemed to detract from the sale of ham gear by ham dealers. I asked around late in the hamfest to see how they were doing on selling major pieces of ham gear and found that they were mostly doing business with small parts and the ham rigs were going begging. I think the money went for parts and second-hand gear this time.

RICHLAND HAMFEST/ COMPUTERFEST

At last! Wayne's name up in lights! A bit tacky, as might be expected, but definitely up there for all to see. That's show biz.

Considering the remoteness of the area, the tri-cities put on a darned good hamfest in July. I flew out to give a talk at the banquet on amateur radio and an afternoon talk on computing. The gossip at the hamfest was, of course, about Mount St. Helens, not very far away. They talked so much about it that I began to wonder what everyone talked about before the mountain blew up.

Among the souvenirs laid on me were pumice stones blown out of the mountain and picked up 18 miles away, a bottle of ash, a beautiful book on the mountain with a day-by-day account of the disaster, and a bumper sticker saying, "Chicken Little Was Right...Mt. St. Helens, May 18th."

Mary Lewis W7QGP, who has been trying for some years to get a fair shake from the League, was there...but I did *not* see the League director for the division. I guess he was just too busy to get to the hamfest and represent the League.

I hope that the full story of Mary gets into print. The League seems to be absolutely set on making sure that they never have a woman director, as some directors have bragged. The ARRL does a lot of good things, but when they stoop to underhanded stuff such as they have pulled on Mary, few people in the know have any respect for them. I gather that director Thurston stays in office by dint of this skulduggery...a shame on amateur radio.

Though RTTY was on display, the clattering old machine didn't get the attention of the new microcomputer-oriented units.

The computer-oriented exhibits outnumbered the ham exhibits by a wide margin...something which is happening more and more at hamfests lately. Here we see a TRS-80 all suited up in a custom made box.

One of the Washington area ham manufacturers is AEF, and they were there showing their latest antennas. How about that Tinker Toy portable two-meter quad?

The kids got a big kick out of the computers. Here is a PET entertaining one kid while a couple others are working on a TRS-80 next to it.

This Apple was kept busy all day with kids at the helm...here is a hangman program in progress.

There was also a demonstration of satellite reception of television signals, complete with a big dish set up outside of the exhibition area. This drew a lot of attention. . . and presumably some sales. I snapped a picture of a replay of an interview with me which was done by a local TV station.

Among the flea-market goodies was this most reasonably priced early model reel-to-reel video recorder. I think I have one of those up in the attic somewhere. Black and white and with a 20-minute capacity, it is not relevant with today's VTR systems.

The local computer store was there with an exhibit, too. I also stopped off to see their store and was pleased to find Instant Software on display.

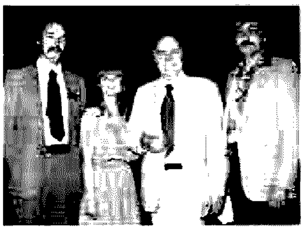
The committee did a nice job of organizing the hamfest. I think they might have pulled more hams if they had done a lot more PR work, getting the word on some of the special events out a few months before the hamfest so people could plan for the trip. I know that I got very little information on the hamfest in time to get it into *73 Magazine*.

The banquet was very well attended and was certainly one of the better banquets I've had as far as the food was concerned. First rate. The speaker. . . well. . . modesty forbids any comments.

BONUS TALK

In addition to my scheduled hamfest talks at Baltimore and Richland (WA) this year, I did take time off from work at computer shows to give short and relatively unannounced talks at Cerritos College in Cerritos (near Anaheim) and Triton College, near Chicago.

The Chicago Suburban Radio Association set up the details for my talk during the Summer Consumer Electronics Show in Chicago in June. They did a nice job of filling much of the room at the college and were kind enough not to snore too loudly as they dozed off. Nice group. I really hate it when people fall out of their chairs while I am talking.



This is the obligatory PR shot of the Powers That Be of the CSRA, flanking Sherry and me. On the left is Bill True WA9ASD and on the right Greg Johnson WB9ZHA, who made the arrangements for my appearance. Talk of his subsequent tar and feathering is merely rumor.

THOSE LOW GAS PRICES

Someone (WA6ILQ) mentioned the other day that gas prices have not really gone up, it's just that the value of the dollar has gone down with inflation.

That was a new idea, so I grappled with it for a bit and had to agree that there was much to the concept. Those of us who are getting on in years are able to remember the days of the nickel cone, the nickel hot dog, the nickel beer, the nickel subway ride, the nickel Coke, and so forth. Most of those nostalgic nickel items are now twelve to fifteen times as expensive, so a ten times increase in gas prices, which is about what we've had, seems hardly worth getting bent out of shape over.

In some cases, prices have gone down through the years. . . such as with electronics. Where technology has been able to cut labor costs, this makes sense. . . and packing the equivalent of a hundred thousand tube circuits on a chip a quarter inch square is quite a technological advance. But oil still is a resource with few technological improvements. . . and thus not amenable to significant lowering of costs. Larger ships and pipes have cut costs somewhat, but then we've had to get the oil from more distant and more expensive environments such as Alaska.

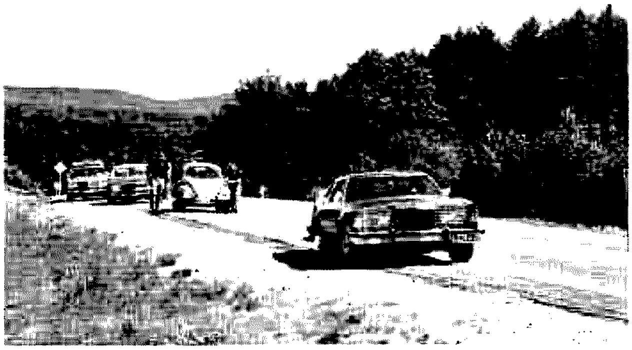
Where we ran into a lot of trouble was by keeping the oil prices from growing with inflation for several years, thus encouraging the building of poorly insulated buildings, inefficient power generation, and other oil wasters. Instead of pursuing more efficient uses of energy over the years, the artificial holding down of oil prices encouraged the use of oil. Thus we have little research done in steam-powered cars, hybrid oil/electric cars, methane cars, hydrogen power, etc.

RADAR TEST

A team from Dave Bell Associates, the people who have been doing the fine amateur radio promotional films, came up one Sunday to do a bit on police radar. Since I probably have more radar detectors in the *73 Magazine* van than does any other car in the country, Peterborough was a natural spot to film.

We spent the best part of a whole day filming a four- or five-minute segment for showing on NBC in late August. You no doubt missed it. The New Hampshire state police cooperated by sending two patrol cars to hand out speeding tickets at the favorite Peterborough moneymaker. . . right in front of our Instant Software building. The filming team got fine pictures of the stopping and ticketing of the people. . . and a couple of interviews with the ticketees.

I showed the crew the difference in sensitivity between the regular radar detectors, which picked up the police signals just as the van came over the crest of the hill, barely giving time to avoid a heavy fine and loss of a driver's license. . . and the new superhet systems, such as the Escort and Super Whistler, which picked up the radar unit over a half mile further away . . . down at the bottom of the hill and far out of sight and range of the radar units.



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Specializing in Amateur Radio Test Guides. F.C.C. Advanced Class test is a snap with our manual. **Bash Educational Services, 15373 Edgemoor St., P.O. Box 382, San Leandro CA 94577.**

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Cushcraft, Bencher, Hy-Gain, Telex, Barker & Williamson, Nye-Viking, Hustler, MFJ, Callbook, Murch, Unadilla, OK, Saxton, ARRL Books, Used equipment, Electronic parts and accessories, free catalog. **Donovan Electronics, Inc., 2510 Norwich, New London Tpke, Uncasville CT 06382, 848-3434.**

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ICOM, Ten-Tek, Swan, KDK, NDI, Tempo, Wilson; Authorized dealer: 1 mile off I-95. No sales tax. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

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Kenwood, Drake, ICOM, Ten-Tec, Swan, Dentron, Tempo and many ham accessories. Also computers by Apple and Exidy. **The Comm Center, Inc., Laurel Plaza—Rt. 198, Laurel MD 20810, 792-0600.**

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Waveguide & coaxial microwave components & equipment. Laboratory grade test instruments, power supplies. Buy, sell & trade all popular makes, HP, GR, FXR, ESI, Sorensen, Singer, etc. **Lectronic Research Labs., 1423 Ferry Ave., Camden NJ 08104, 541-4200.**

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All major brands featured in the biggest and best ham store for miles around. Come in and twist the knobs before you buy. **Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866 4267.**

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EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	14	7	7	7	7	7	7	14	14	21	21A
ARGENTINA	14A	14	7A	7	7	7	14A	21A	21A	21A	21A	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	7B	14	14	21A	21A
CANAL ZONE	21	14	7	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7A	7	7	7	7	7A	14	21A	21A	21	14A	14
HAWAII	21A	14	7B	7	7	7	7	7B	14A	21A	21A	21A
INDIA	14	7B	7B	7B	7B	7B	14	21	14	14	14	14
JAPAN	21	14	14	7B	7B	7	7	7B	7B	7B	14	21A
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PUERTO RICO	14	7A	7	7	7	7	7A	21	21A	21A	21	14A
SOUTH AFRICA	14	14	7	7B	7B	14	21	21A	21A	21A	21A	21
U. S. S. R.	7	7	7	7	7B	7B	14	21A	21A	14	14	7
WEST COAST	21A	14	7	7	7	7	7	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

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ARGENTINA	21	14	14	7	7	7	14	21A	21A	21A	21A	21
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SOUTH AFRICA	14	14	7	7B	7B	7B	14	21	21A	21A	21A	21
U. S. S. R.	7	7	7	7	7B	7B	7B	21	21	14	14	7B

WESTERN UNITED STATES TO:

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ARGENTINA	21A	21	14	7	7	7	7B	14	21A	21A	21A	21
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ENGLAND	7B	7B	7	7	7	7	7B	14	21A	21	14A	14
HAWAII	21A	21A	14A	14	7	7	7	7	14A	21A	21A	21A
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	21A	21	14	7B	7B	7	7	7	7	7	14	21A
MEXICO	21	14	14	7	7	7	7	7A	21	21	21A	21A
PHILIPPINES	21A	21	14	7B	7B	7B	7B	7	14	14	14	21
PUERTO RICO	21	14	7A	7	7	7	7	14A	21A	21A	21A	21
SOUTH AFRICA	14	14	7	7B	7B	7B	7B	14	21	21A	21A	21
U. S. S. R.	7	7	7	7	7B	7B	7B	7B	14	14	14	7B
EAST COAST	21A	14	7	7	7	7	7	14	21A	21A	21A	21A

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair G = Good P = Poor
SF = Chance of solar flares

october

sun	mon	tue	wed	thu	fri	sat
			1 G	2 G	3 G/SF	4 F/SF
5 P/SF	6 F/SF	7 G	8 G	9 G	10 G	11 G
12 G	13 G	14 G	15 G	16 G	17 G	18 G
19 G	20 F	21 G	22 G	23 G	24 G	25 F
26 F	27 F	28 G	29 G	30 G	31 G	

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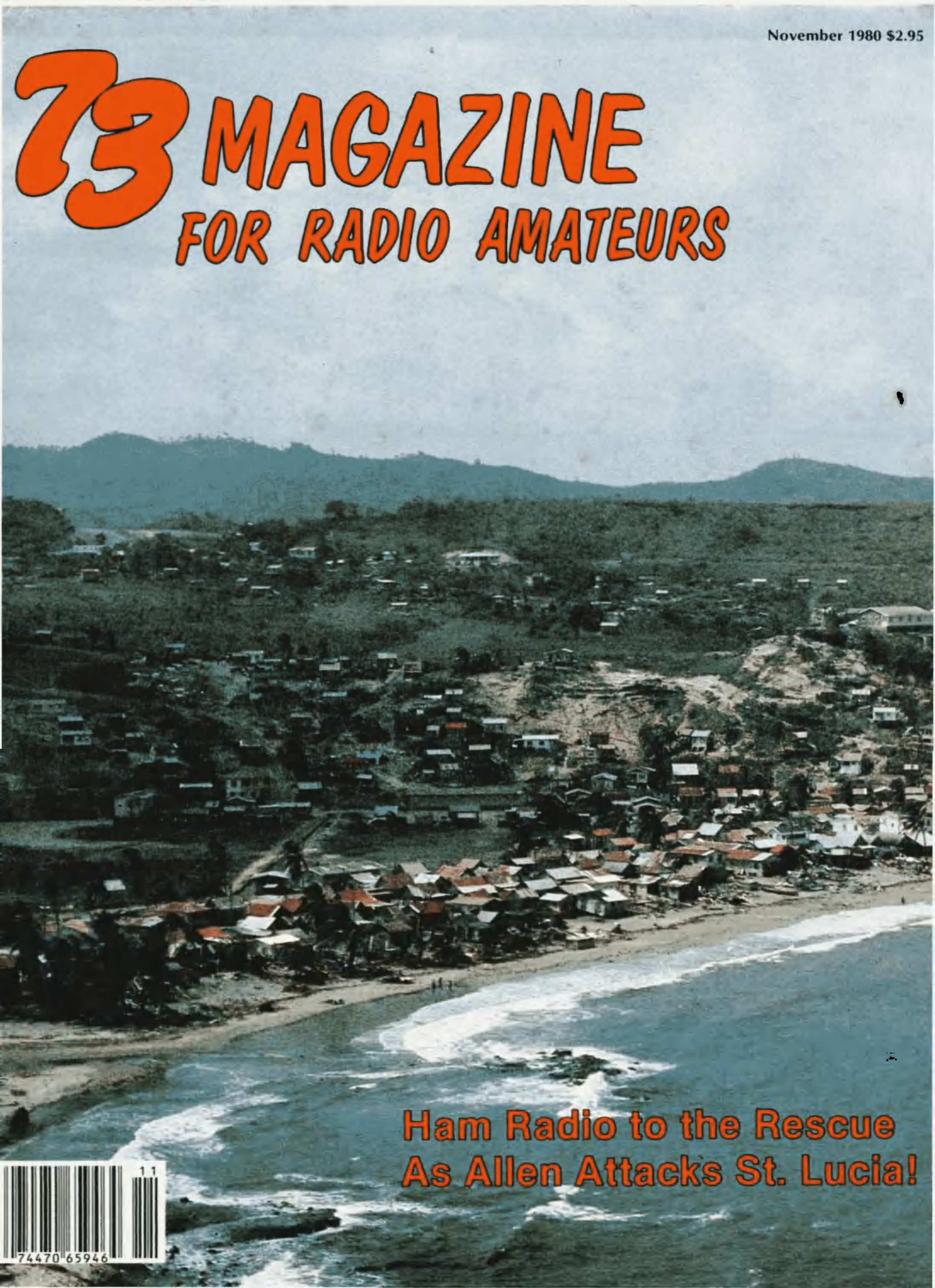

Ham Radio to the Rescue
As Allen Attacks St. Lucia!

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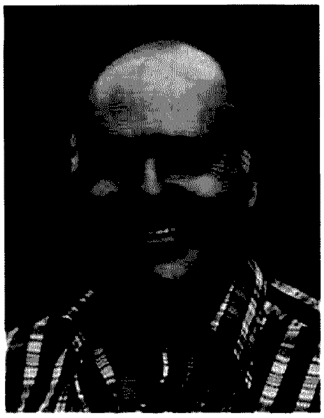
nov. 80
73 MAGAZINE

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



CRFI

There are two ways of going about getting into RTTY these days...one via the old noisy Teletype™ machines and the other via a simple connection to any of the microcomputers. With some 35,000 active hams already having computers, the latter approach is the obvious one. Also, those hams not yet having computers need the extra push to get aboard this part of the electronics hobby.

The main drawback to using a microcomputer for RTTY is the hellish noise it generates at radio frequencies...and I mean right up into the VHF ranges. The problem here stems from the need for a clock frequency for synchronizing the signals traveling through the computer, which is usually in the 2-4 MHz range. That isn't so bad in itself, but all of your computer signals are digital (I hope that is not news) and this means square waves...and a square wave is made up of an almost infinite number of odd harmonics. The resultant of all that is rf hash which will boggle any radio in the vicinity of a computer.

The FCC, reacting with characteristic speed, took almost five years to discover that home computers were being built which were generating RFI. They sometimes remind me of the dinosaurs, whose nervous system was so slow that it took minutes for word to get to the brain when the tail had been stepped on. The FCC is not that fast. Eventually the news did reach the "brains" of the FCC ...and I use that term in quotation marks for obvious reasons ...and word came down on tablets for the microcomputer industry to start shielding their computers.

What this means to amateurs is this: If you want to wait until next January, you may find an assortment of relatively quiet computers being offered for sale. If you are impatient or have already made your investment, you'll want to know how to put a damper on all that racket.

First, I'm sure that the readers of *73* are, for the most part, as interested as I am in getting reports on the noise-proofing accomplished by the industry. If you get a new computer, you might make some noise measurements and let us know how successful you are in using the system in your ham shack... and how noisy or quiet it is on the various bands. Second, if you are going to tackle the shielding and bypassing of your computer, please make notes and pass along word of your success...or failure. That bypassing may be ticklish, since the rounding off of signals on data lines is not likely to enhance the operation of the computer, and some of the microcomputers are right on the edge of disaster in this department to start with. You'll have to be careful and check each move you make for a lessening of the noise and continued operation of the system. More is called for than putting in some aluminum foil around the bottom of the case.

This is a call for articles on the subject so our brethren can get their systems RTTYfied. We'll also want to know what you are using in the way of interfaces...and any other developments. Keep writing.

Can we expect much help from the major villain—Radio Shack? Nothing encouraging on that front as yet. I've a copy of some correspondence one ham has had with Radio Shack and the degree of obtuseness is almost unbelievable. The ham asked about curing interference to his receiver and asked it quite clearly. The answer had to do with reducing TV interference ...which, by the way, is not inconsiderable. My TRS-80 in my office wipes out the TV set in that room plus three upstairs ...and I'm using cable!

The interference with most microcomputers is two-way, with the transmitter screwing up the computer as much as the computer wipes out the shack receiver. Even an HT can recycle many computers since the signal wires inside are unshielded for most systems. These wires run all over the place and act as very efficient antennas for both transmitting and receiving.

The newer Radio Shack systems are much quieter, so I know the industry will be able to meet the FCC specs in January. But that doesn't stop our need for ways to fix the systems we already have.

LETTER TO ADVERTISERS

It's time that I wrote a bit in the magazine aimed at advertisers and prospective advertisers...with some words which may also be of interest to the regular reader. The topic in particular has to do with those Reader Service cards which we put into the back of each issue of the magazine.

Readers should recognize that we spend a bundle on this service...and it is a service for both the advertiser and the reader. With a magazine the size of *73*, we are talking about a couple thousand dollars for the cards to be printed and put in the magazine, a couple thousand more in postage to get them from you, and three or four thousand for the Neilsen Company to put the requests on a computer and send the labels to the advertisers. That's per month!

We used to be trying to do the computer part on our Prime, but with the breakdowns in the system, the service got a couple months behind and it was just one more disaster. We're hoping to get a microcomputer set up to handle the requests and thus be able to save a thousand or two dollars a month...a little here, a little there...it mounts up and the first thing you know we may have enough to print another 32-page section of the magazine.

One might think that the average full-page advertiser who is spending about $80 of his ad money for this service would use it as productively as possible. Unfortunately, this is not always the case. Those firms which are making full use of the labels received tell us that the service is fantastic. Mail-order firms often get over 50% of their total sales from a particular ad from these labels. This means that firms which throw out the labels or who do not make effective use of them are essentially throwing out about 50% of the sales they might have gotten from their ad.

A full-page ad runs around $1,500 these days and the rule of thumb is that this should bring in about $15,000 in sales, minimum. Can you imagine firms being so disorganized that they knowingly throw out around $10,000 in business each month? Perhaps this will explain to you why so many firms manage to go out of business, even when they have good products.

I'm sure you have had the same experience I have had... circling a number for a response on a product which interests me. When I do that there is a darned good chance that I will buy the product. But this can only happen if the firm gets information to me quickly, the information is well done, and the price is right. Then, if they make it simple for me to buy, they get my order on the spot.

Firms have discovered a num-

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ber of ways to discourage me from buying. Those firms who care so little about my business that they merely send me a copy of their ad...which I obviously had in the first place...are not going to get money from me. Firms which care so little that they don't include the prices of the product are wasting their postage and printing costs on me for their brochures go in the wastebasket. I have no intention of writing twice for information. I want to know about the product and the price is a key element for me...and for anyone else. The day is long off when I will buy something without even asking what the price is.

When I ask for information, I *want* to be sold. I do not want to get some silly little mimeo sheet or a small blah folder. I want to know what the product is going to do for me...why I should buy it...how much it costs...how I can get it quickly...things like that. The easier the firm makes it for me to buy, the more likely they are to get my money.

I also want to have confidence in the firm. A mimeo sheet tells me that this is just a couple of kids pretending to be in business. I want to deal with serious people who are more likely to have a good product and are going to stand behind it. A good businessman realizes that the image his firm projects is of great importance. His ads will be well done...professional. His literature will be professional. I figure, like most folks, that if a firm doesn't take care with their ads and literature, I really can't expect them to do better with their products and service.

Jim Gray, our advertising manager, mentioned the other day that several of the firms advertising in *73* were not following up on Reader Service requests. Well, I can understand some skepticism about the labels which might be left over from one of the other magazines in the field. They apparently just printed out labels from a large part of their subscriber list each month and sent these to the advertisers. The result was enormous piles of labels...and heavy literature and postage expenses for the advertisers... but with hardly anything to show for it in sales. Rather than suspecting foul play, many firms just got the idea that Reader Service labels are a waste of time and money.

It's a pity that one magazine should screw things up for some of the others...and in the process get a number of firms used to virtually throwing away $50,000 to $200,000 in sales per year which they might have otherwise made.

From the ham viewpoint, it is a lot of fun to buy a new piece of equipment, but most of us want more Information than appears in the ad before we are going to spend our money. Far too few advertisers tell the whole story, including price and how to order, all in their ad. So we have to go about buying in two steps ...or more. If the product is sold through a dealer, I'm much in favor of that because that gives me a place to get service and someone I can have confidence in to back up the product. Even the best of products break down...and it can happen during the first hours of use. To have to send it (at my expense) all the way back to Seattle or someplace for repairs takes weeks and money, so I like to have a dealer taking care of this for me.

If you have found some of our advertisers to be doing a first-rate job of responding to your requests for information, please drop me a line and let me know who they are. If you have trouble with some, I'd like to know that, too.

It is difficult for a magazine publisher to keep his hands clean in working with Reader Service requests. Many advertisers use these labels as the main indicator of the success of their ad (rather than making an effort to count sales). This sort of thinking forces some publishers to start cheating on the labels and adding some extra circles as the cards arrive to make sure that a particular advertiser gets lots of response. Even when we did all of our processing at the magazine, we were scrupulous about being honest with Reader Service requests...often watching advertisers go away to the other magazine which was cheating. That hurts.

I hope that every reader will use the card we bind into each issue. It's not only a way of getting information about products you are interested in buying, but it is also a sort of vote for the magazine which gets sent along to the advertisers...and it is *their* ads which pay for the pages you read.

SIXTH ANNUAL INDUSTRY MEETING

The annual meeting of ham manufacturers, dealers, and publishers will take place, as usual, in Colorado during the second week of January. This comes right after the Winter CES show in Las Vegas. The meeting this year will be in Vail, running from Saturday to Saturday.

In addition to the usual feature of lots of skiing, there will be the usual symposiums on selling the ham market, aimed at helping dealers cope with the problems of 1981 such as shoppers using the 800 WATS lines, coping with manufacturer service and credit policies, and a look at the most profitable ham equipment for dealers to handle.

Manufacturers will be interested in sessions discussing needs for new techniques and circuits which should dominate ham sales in the next few years. Evaluations of the viability of equipment for satellite use, slow scan, RTTY, and other special modes will be explored. Why pay $1,000 for a bogus industry report on hamming in the 80s when you can get one which is just as bogus at the Annual Industry Meeting and enjoy the $1,000 while you ski. You might even have some money left over, if you can keep your wife out of the boutiques.

The emphasis is on bringing the industry together...friendship, eating, skiing...with some serious business discussions. Everyone will have HTs for keeping in touch while skiing or shopping around town, so don't forget to bring one or two of those.

You'll have to make your own reservations (good luck), but Vail is small.

Speaking of boutiques, I got to thinking about the shopping in Vail and Aspen (about 100 miles further from Denver), and it brought to mind a recent visit to San Marino, that small enclave in Italy (M1). Sherry and I were driving around Italy setting up sales for Instant Software and we decided to add one more country to my list of countries visited. San Marino, for those of you who have not taken the time to visit it, is a large mass

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LOOKING WEST

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A few months ago we reported that TASMA, southern California's 2-meter coordination council, was faring poorly in comparison to its 220-MHz counterpart. Having to report this hurt on a personal level in that I had spent many years working with the SCRA prior to the 1979 split that led to the formation of both TASMA and 220-SMA. I am happy to report that things are getting a lot better for TASMA. Interest in the organization is again growing and so is its overall membership. In fact, the only things missing are the old-line repeater owners. These are the people who formed the original SCRA and decided to boycott the TASMA organization when the new structure permitted non-repeater owners a voting voice.

According to my friend Bob Thornburg WB6JPI, who still serves with TASMA, the turnabout began when the current chairman, Tom Polley WA6GEV, decided to hold regularly scheduled Technical Committee meetings which were open to the general amateur public. Attendance at these meetings has grown to the point where more amateurs show up for Technical Committee meetings than usually come out to general membership meetings. Bob told me that having 40 or 50 amateurs show up at a Tech Committee meeting is not uncommon. Moreover, those attending show a definite interest in what's happening. Some are the new-generation repeater owners, while others are simply spectrum users. Note I said "spectrum" rather than "repeater" users. This is because the new open format in TASMA is pulling a total cross-section of the southern California 2-meter community—not just FM people.

I doubt if TASMA will ever get the old-liners back in the fold. They seem to live in their own world. Many have openly called the "user" an unnecessary byproduct of a repeater ownership and have made themselves totally unavailable to TASMA, their users, or anyone else. I guess they still see themselves as the gods of the mountaintops, but the days of repeater gods are gone. For a while, there were rumors abounding that the old-liners were about to make a comeback of their own with a totally new organization to challenge the viability of TASMA and 220-SMA, but this has not happened and I doubt if it ever will. Under its current leadership, TASMA has weathered the worst of the storm and is now on the road to becoming a national leadership organization in the field of voluntary spectrum management.

SEANARC '80

This year's ARRL National Convention, dubbed SEANARC '80 by its sponsors, was held at a beautiful motor hotel known as the SEA-TAC Airport Red Lion Motor Inn. Arrival and departure were a snap. Within 30 minutes of deplaning, we were at the convention site, baggage in hand. In fact, the Red Lion sent over a courtesy car to pick me up and drive me over. Now, that's service.

I did not attend last year's conclave in Baton Rouge, but I have heard the disaster reports first-hand, especially from disgruntled dealers and manufacturers who were unhappy with the way things went. I think that Newington must have listened to the complaints, because none were heard this year. I tape-recorded interviews with at least half of the manufacturers, manufacturer reps, and dealers, and to a man they were ecstatic about the facilities and crowd turnout at SEANARC '80. Both DSI and Opto just about sold out all their merchandise, and new products at the manufacturers' booths drew day-long crowds. There was even a very novel grand prize: a year's lease on a VW Rabbit equipped with a two-meter radio.

There were seminars galore, running right through to the close of the show on Sunday. In fact, that was the reason I was in attendance. I had been asked by the planners of two seminar sessions to appear on their panels, and I spent most of Saturday morning and part of the afternoon on the dual session repeater-FM panel. I had to excuse myself around 2:30 in order to make it to the media seminar. Both were well attended. I'll get into more detail about these two seminars later on, but for the moment let me continue with the convention overview.

Saturday night's banquet was a total sellout even before I arrived. In fact, I did not get to the banquet and wound up having dinner with two friends at a restaurant. I can give you a simple reason for the banquet sellout: Its featured speaker was my friend Roy Neal K6DUE of NBC News. Roy is probably one of the best public speakers around these days. His stories of the early days of amateur radio and covering the early days of the space race, combined with his personal projections for the future of amateur communications, make for a truly awe-inspiring evening. I know this for a fact, as I was at his talk in St. Louis at ARCH '80 when he left his audience spellbound. I was able to obtain an audio tape of his talk this time and spent a good part of the next morning pulling out bits and pieces of it and fitting them into a Westlink newscast that would air that evening, even before I returned to Los Angeles. At about 10:00 am Sunday morning, I cornered Gordon West WB6NOA and conned him into playing reporter for this story. We went off for half an hour and recorded the anchor script on cassette. An hour later, the tape cassette of Roy's talk, another with Gordon's report, and a copy of the script were en route back to Westlink's Production Coordinator, Bill Orenstein KH6IAF, in Los Angeles.

Every convention has a certain air about it. A topic that's on just about everyone's lips. This one was no different, and the topic of the day seemed to be combatting the problem of willful and malicious interference caused to amateur communications by other amateurs who chronically violate the amateur regulations. Maybe the presence at the convention of Joe Merdler N6AHU (who has been leading the cleanup campaign) and the head of the League's Ad-Hoc Committee on Malicious Interference, Carl Smith WØBWJ, along with Southwestern Division Director Jay Holladay W6EJJ (also an activist in this area) had something to do with this. I cannot say. I will tell you that the problem itself and finding solutions to it were on just about everyone's lips. An example of this was at the Repeater and FM Forum, at which the topic dominated at least half of the morning session and came up again at the afternoon session. It was at this forum that I first learned that the League had announced the formation of a new task force to work at combatting the problem on all levels. The exact make-up of this task force was not announced, though it will have as members those who are considered experts in the problem and finding solutions to it. Carl did remark that a good deal of the effort will be made at the local level through existing radio clubs, repeater councils, and T-hunt groups. Exactly how the task force will perform its appointed duties was not made clear.

As long as we are talking about the Repeater-FM Forum, let me continue for a moment. This session was hosted by the Western Washington Amateur Relay Association, or WWARA for short. The panel consisted of WWARA President John Marcinko W7FHZ, Secretary Clay Freinwald K7CR, and members Dale Justice K7WWR and Bob St. Andre WA7NAN. Others included ARRL Vice President Carl Smith WØBWJ, Hudson Division Vice Director and VRAC board liaison George Diehl W2IHA, Oregon Regional Relay Council UHF Coordinator Neil McKie WA6KLA, and yours truly. I should note that I was not a directed representative of TASMA, 220-SMA, or SCRRBA. I was asked by Ray Clark K5ZMS of SMIRK to represent 6-meter weak-signal interests at the meeting, but in actuality I was invited based on my experience in frequency coordination matters rather than as a representative of any one specific group. I must say that being in this position made me feel more at ease than when I have had to represent someone else's views as has happened in the past on occasion. I kind of like being able to be myself and speak my own mind. This seminar put me in that very position and I felt very

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DX

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Last night I dreamed it was the peak of the sunspot cycle, all the new HF bands were in place, and I was sitting at the radios with five minutes to go before the big DX contest. I had antennas for all nine bands on 160-10 meters and was ready for a big effort. With four minutes to go, I programmed the memory keyer, sharpened all the number three pencils, and made certain I had a "dupe" sheet for every band; it took three cut up grocery cartons to provide backing for nine sheets and they were strewn here and there.

With three minutes to go, I checked 160, often open at 0000 UTC this time of year; yep, some Caribbean DXpeditions were warming up for their skeds at contest beginning. 80 was open to Europe pretty well, ditto on 40. The new 10-MHz band sounded like 40, only with stronger signals. Good old 20 meters was going to be open all forty-eight hours of the activity. Two minutes to go as I checked 18 MHz; Japanese contesters warming up there, as on 21 and 24 MHz. Heard deep Russian Asians on 10 meters. What band to do first?

A minute left now, with commercial amplifier warmed up, homemade linear for the three new bands cooking away, transceiver with its 15-position bandswitch ready. I reached for the 10-position antenna selector knob but it started spinning by itself—160, 80, 40, 30, 20, 18, 15, 12, 10, dummy, dummy, dummy. The automatic digital selector which puts the transceiver on the appropriate amplifier began clacking away in unison but out of sync with the antenna switch. Then dupe sheets began flying around the room in a paper hurricane but there was no wind anywhere and...

I put the headphones on to hear what was happening to cause this (nuclear war, maybe?) while the receiver switched itself from band to band and mode to mode. It was JA stations on 160, static on 10 meters, the Woodpecker, or was it just my ears? Then the clock struck. Everything went back to normal electronically and I had a nervous breakdown.

Of course it was only a dream, but this is no joke. Mel Farrer of KLM Electronics gave a talk last month at one of the conventions on the coming new bands and hinted that log periodic antennas just may be a necessity to the operator who wants to have capabilities everywhere he is allowed in the HF spectrum. DXers have always been ready for any contingency: The Caribbean DXpedition which falls prey to extremely poor conditions and can only make contacts on 3.5 MHz CW, for example.

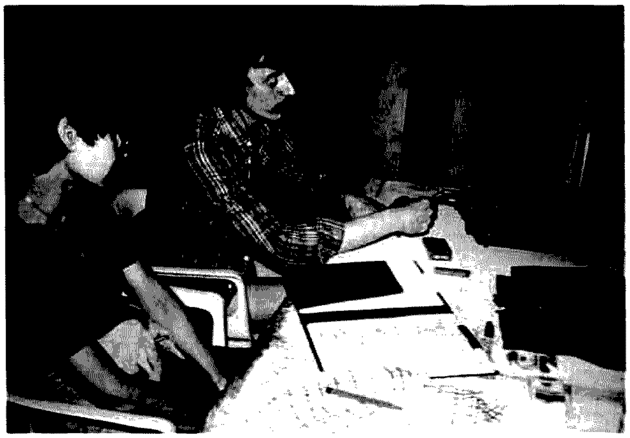
It has been just a year since word began sneaking out of WARC that some new allocations were in store for amateurs. Of course, we don't have them yet, but another year might see at least one band open. The ARRL Board of Directors has already made recommendations on the 10-MHz band, and the others will be undoubtedly treated in upcoming meetings. Some manufacturers already had radios that could be crystalled for a certain number of new bands and others have come out with brand new rigs that can work on the three new slots. Pretty soon the rest will have caught up and certainly the antenna manufacturers only have to change a few cutting fixtures to make new lengths of booms, elements, quad spiders, and matching devices. We in the industrialized countries will be ready. Amateurs in areas where home brew is still the norm will have more work cut out for them but we wager that come opening gun, the Russians and others will be there with us.

Remember November, 1968, when the new Extra class segments on 80- and 15-meter phone opened up? Both were packed at 0000 UTC, although there had been some doubt as to if the FCC had meant November 23 local time or UTC. What the heck, hams use UTC and who could wait? That was an exciting evening, but when an entirely new *band* opens, the Extra segments will pale by comparison. It will be the biggest happening since the opening of 15 meters 25 years ago.

We are currently struggling with an antenna dilemma which hints at the nature of the upcoming situation. Our old dilapidated tower will support one antenna and one human being at the top—no more. Our 6-element tribander is coming down to make way for a homemade 7-element 10-meter beam in honor of 1980, probably the last truly good year of this sunspot cycle. That will mean no beam on 15 or 20 meters, but it is nice to be really competitive on at least one band! If a new country comes on but avoids 10 meters, we can probably work them with the vertical on one of the other bands. The tribander works OK on all three bands but is just not a *real* beam, in our eyes. It is time to get used to that sort of thing because the new bands are going to require a bunch of compromises by most of us. There will be a lot of dipoles in use on the new bands that first season, which might not be a bad thing as it will allow more people to use the bands, signals not being so overpowering. Much of the activity will be sans amplifier, too, also not a bad thing.

And don't forget the race for 7-band DXCC, 7-band WAZ, and 7-band WAS!

As for this year, in early September 10 meters was already open to Japan from the East Coast. As the peak of the current sunspot cycle is generally accepted to have taken place in November, 1979, it would seem



Anne DF3KX/FR0ACB and husband Hans DK9KX, working CW from Glorioso.

These were the antennas near the operating site of last April's Glorioso Island operation by a six-member German team.

Active Japanese DXer JA1JXR proudly displays his American-made ham gear!

FH8YL (above) and husband FH8OM are the two active amateurs on Mayotte Island.

reasonable to assume that 1980 will be about the same propagation-wise as 1978, and thus far that is holding true. K1RM set an all-time record in the *CQ* Worldwide Phone Contest last year on 15 meters, the highest single-band score ever on *any* band, and he is out after 10 meters this year. His record, if not broken in 1980, will surely stand until the next sunspot peak. VP2KC made an incredible 38 million points in the multi-transmitter category which may also stand for a few years.

In some ways, it might have been fun to get the new HF bands *now*, at the peak, but that also might have diluted their impact. Actually, they will be most handy when sunspots are down, as we will all have more choices of where to effect our communications. And we are being given time to gear up for them (pun intended) by having a few years. Now, if the deal doesn't fall through (you know politicians), we *will* be ready.

ROCKS AND REEFS UNLIMITED

About two dozen entities on the DXCC countries list have no permanent population; some have weather stations with rotating crews and some just have zero people always, except for a boatload of visiting hams every decade or so. With some regularity, the "should these count for DXCC?" question comes up. The arguments are well-worn but bear repeating here.

On the pro side of the argument, the justification goes like this. Although uninhabited rocks and reefs are certainly not "countries" in the average person's eyes, and even though DXers refer to them as "entities," not countries, they are legitimate for DXCC because DXCC is merely a game which the rocks and reefs make more interesting and fun to play. And besides, the R and Rs are not as rare on the radio as some countries. Furthermore, world politics actually plays little part in DXCCing, thus no attempt need be made to have DXCC reflect the world at large, i.e., real countries.

The con side of the argument points out that it is nearly im-

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Call	Via
A4XIH	G4GIR
A7XA	DJ9ZB
A7XD	PO Box 4747, Doha, Qatar
CO7RCB	Box 52, Camaguey (No IRCs)
CS1BI	CT1XK
CT2CE	AG1K
CT2DE	WB3IFD
C31MJ	EA3NE
C31MK	EA3WZ
C31MS	EA3MS
C31TD	WA3OMQ
C31UB	DL7HZ
C31UI	K7VAY
C31UN	DF3HN
C31UZ	WB7VDN
C5ABK	G3LQP
C5ACC	KB4GQ
C5ACO	W2TK
DX3UB/1	JA3UB
WA2UUK/DU	WB9MFC
D68AP	WB2OHD
EA9GJ	Box 544, Cueta
EL6A	K4SE
FB8XY	F6CIU
FB8ZO	F6EYB
FM7BW	WB4IWW
FM7WW	WB4AXN
FMØFJE	F5VU
FPØFOM	FPØFON W1IHN
FRØFLO	Box 200, Tampon via 97430 France
DJ2BW/HBØ	*Callbook* address
DF4GU/HBØ	*Callbook* address
HKØBKX	WB4QFH PO Box 1139, West Palm Beach FL 33402
HS1AMI	VE3DPB
H44PD	Box 350, Haniari, Solomons
H44SH	AD1S
I21ZC/IA5	I2USR
J28AZ	I8JN
KG4KK	N6AWD
KG4WM	WB1COR
KC6DC	AD1S, G. Adkins, PO Box 32735, Oklahoma City OK 73123
W6SOT/LX	KA5CCD
OHØSUF	OH1PA
OH2VY/OHØ	*Callbook* address
OHØXZ	OH2KI
OJØMA	8/80 OHØNA
PJ2FR	K2TJ
P29LB	WB2FLB
DJ1US/ST3	DF2RG
SVØAO	KA2FRP
SVØAT	AF4B
TL8JM	W5RU
TU2IJ	Box 520, Abidjan
TU4AT	HB9BTQ
TU4AW	K5TC
T3AT	G3XZF
UA1PAL	UA1OSM Box 47, Archangel
VK9CCT	VK5QX
VK9ZG	VK3OT
VP2KC	W4HR
VP2MM	W1CDC
VP2VGA	WA3UBN
VP8PP	W6TKV
VQ9CY	K5HK
VU2RAK	WBØTNY
YJ8DH	JA3ARY
YJ8IND	Box 39, Port Villa, Vanvatu
ZB2GK	Box 292
ZK1CF	ZL2AOF
ZK2YY	K5YY
ZL3MA/C	WB8WMS
3B8BD	K5BDX
3B8ZV	ZL1BIL
3B9ZV	ZL1BIL
3D2EI	W5RBO
3D6BS	N7RO
4S7EA	WB9OQU
5H3AA	Box 83, Bagamoyo, Tanzania
5NØKUY	JI1IMD
5Z4YV	JA2AJA
6OØDX	I2YAE
8Q7AZ	Four Winds, Male, Maldives
9G1RF	WA1ZFS
9G1RI	Box 76, Ghana
9M8PW	Bureau
9Z7CSJ	9Y4BW

QSL Managers—Lists of QSLing information are available everywhere, and we do mean everywhere. We have tried to make this list useful in a special way by listing stations actively worked on the bands during the month of August. This is a regular part of this DX *column in* 73. *You will note some listings which are the same as they have been for years. The idea is to provide you with useful information for your recent DXing.*

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

DELAWARE VALLEY RADIO ASSOC. QSO PARTY
Starts: 0000 GMT November 1
Ends: 2400 GMT November 2

The Delaware Valley Radio Association is celebrating its 50th year of operation with this first annual QSO party. Contestants must work a total of five DVRA members on 80 through 10 meters during the 48-hour period. Use the lower portion of each General class phone and CW band.

Log sheets are to be submitted to: William Cunnane KA2BBZ, Apt. 18, Princeton Arms East, Cranbury NJ 08512. Please include an SASE. All participants with the required number of QSOs will receive a formal printed award.

DELAWARE QSO PARTY
Starts: 1700 GMT November 8
Ends: 2300 GMT November 9

Sponsored by the Delaware ARC. Stations may be worked once per band and mode for QSO and multiplier credits.

EXCHANGE:
QSO number, RS(T), and DEL county, ARRL section, or country.

FREQUENCIES:
CW—1805, 3560, 7060, 14060, 21060, 28160.
SSB—1815, 3975, 7275, 14325, 21425, 28650.
Novice—3710, 7120, 21120, 28120.

SCORING:
DEL stations score 1 point per QSO. Multiply total by the number of ARRL sections and DX countries worked.

Others score 5 points per DEL station worked. Multiply total by the number of DEL counties worked on each band and each mode (maximum of 36 multipliers possible). Three DEL counties are Kent, New Castle, and Sussex.

ENTRIES & AWARDS:
Appropriate awards will be given to the top scorers. In addition, a certificate will be awarded to all stations working all three Delaware counties. If you work all three counties and want the WDEL Award, send two 15-cent stamps and an address label. Mail logs by December 15th to: Charlie Sculley AE3H, 103 E. Van Buren Avenue, New Castle DE 19720. Send an SASE for a copy of the results.

IPA CONTEST
Contest periods are: 0700 to 1000 and 1400 to 1800 GMT on both days, November 8 & 9

The International Police Association Radio Club (IPARC) British Section is sponsoring this year's contest. Participants are eligible to work the Sherlock Holmes Award (SHA) and the contest is open to all radio amateurs and SWLs. Use all bands on CW and SSB. No cross-band or cross-mode contacts are permitted. For a contact to be valid, one of the two stations must be an IPA RC member. Each station can be worked only once per band.

EXCHANGE:
Non-members send RS(T) and serial number. IPA members

Continued on page 199

CALENDAR

Nov 1-2	ARRL Sweepstakes—CW
Nov 1-2	Delaware Valley Radio Assoc. QSO Party
Nov 8-9	European DX Contest—RTTY
Nov 8-9	IPA Contest
Nov 8-9	Delaware QSO Party
Nov 9	International OK DX Contest
Nov 15	DARC Corona 10-Meter RTTY Contest
Nov 15-16	ARRL Sweepstakes—Phone
Nov 29-30	CQ Worldwide DX Contest—CW
Dec 6-7	ARRL 160-Meter Contest
Dec 6-8	Connecticut QSO Party
Dec 13-14	ARRL 10-Meter Contest
Jan 10-11	Hunting Lions in the Air
Jan 17-18	73's International 160-Meter Phone Contest
Jan 18	FRACAP Worldwide Contest
Mar 7-8	1981 SSTV Contest

RESULTS

1980 MASSACHUSETTS QSO PARTY

Bristol County	
K1KJT	91,576
N1AS	15,150
W1FJI	14,112
Essex County	
WA1UZH	10,802
Franklin County	
K1UR	554
Hampden County	
K1UR	6
Hampshire County	
K1NWE	90,530
K1UR	342
Plymouth County	
WB1ANT	165,330
KA1GQ	70,710
K1VUT	18,142
Berkshire County	
WB1HIH	104,576
K1UR	9,230
Middlesex County	
KA1CLV	4,500
K1UR	176
Norfolk County	
N1ADY	10,878
K1MEM	7,602
K1UR	170
Suffolk County	
N1EE	68,262
K1UR	24
Worcester County	
K1UR	156
STATES	
Arizona	
AK7J	58
California	
W6TPC	582
W6OUL	120
Colorado	
KA9CLS	104
Delaware	
N3AHA	388
Georgia	
K4VN	326
Kentucky	
WA4QMQ	146
AB4Y	140
Montana	
K7PGL	182
KA1EA	58
Nebraska	
W0OLL	74
New Mexico	
KB5DQ	140
New Jersey	
K9CW	168
WA2WJL	156
W2CC	8
KA2EGO	8
New York	
WB2THN	196
W2WSS	150
N. Dakota	
KC0W	112
Oklahoma	
WD5ICO	170
KA5FVJ	8
Oregon	
KA7EOG	74
Pennsylvania	
WA3JXW	24
Washington	
WD9OCL	372
K7NW	66
Wisconsin	
K9GTQ	324
K9GDF	210

High Novice Score — **KA1CLV with 4,500 points**
High Score in 1980 Mass. QSO Party—
WB1ANT with 165, 330 points
High Club — **Yankee Clipper Contest Club with 244,394 points**
K1UR worked 8 counties mobile—
1st in 3, 2nd in 4, and 3rd in 1.
LU8EF — **1st Argentina**
PA3AIC — **1st Netherlands**

SPONSORS — K1KJT, N1AS, W1FJI

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

November—the month of Thanksgiving! And what does a columnist have to be thankful for if not his readership. Let's take a look into the mailbag and see what some of you have had to say.

We start off this month with a note from Frank Salerno III in Welrton, West Virginia, who writes that he recently read *73's Introduction to RTTY* (available from *73*'s Radio Bookshop at $2.00) and was impressed by RTTY art. Frank wonders if there are any current sources of RTTY pictures.

Sorry to say, Frank, I know of none. A company representing itself as a purveyor of RTTY art popped up in these pages a number of months back, but no one had seen any products. It would seem as though some demand exists for this service, though, and perhaps someone will step into the void in the near future. Until then, though, the best way to get pictures is off the air, either in contacts or just by monitoring. Especially at this time of year, with the Christmas season approaching, the airwaves are full of sleighs, reindeer, and scantily clad girls. If you do not have facilities to receive, perhaps another ham in the area can help you out. Ask around.

Chaplain Paul E. Phelps WA8ZLJ/6, a major in the U.S. Army stationed in California, writes about his 6800 computer system, based on the Motorola MEK-D2. With 40K of RAM, a Percom LFD-400 disk, and a HAL DS-3000 terminal, Paul has more than a minimal system! He would like to use his ASCII printer, type unspecified, to copy off the air. His stumbling block is getting the five-level Baudot code into the computer for translation to ASCII.

Well, Paul, there is no way that I know of to input five-level Baudot at machine speed into an ACIA. Although the ACIA is basically a UART, it uses programmable registers to set up the bit pattern, speed, parity, etc. Five bits just ain't one of the choices! Now, you can, if you need to input through a serial port, use a conventional UART, such as the 1013, to input five bits onto an eight-bit bus, and just tie the extra bits down. The technique I use in my RTTY program, also written for the 6800, is to use one bit of a PIA as a software UART, much as Motorola did when they created the (in)famous MIKBUG. Since you do not need the whole PIA for input, just one bit, you might look closely at your existing I/O slots to see if there is not one lone bit hanging around that you could use. The program published here about two years ago would make an easy job of receiving with such an input.

Another military man, Capt. S. C. Anderson W2GFN, USN RET, drops a line about a machine I have not heard much about. He has a Teletype Corporation Model 35 and believes that the loop current should be 500 mA. He notes that this is no real problem, as he has the 500-mA selector magnet driver card. He wonders, however, whether the magnets should be in series or parallel. Tell you the truth, Captain, I don't know. But I am sure one of our readers does, and I will pass along the information as soon as I get it.

A letter from Cary, North Carolina, brings news of a new RTTY repeater. Howard Cochran W4PPN relates that a group has formed to put a RTTY repeater on the air in the Raleigh, North Carolina, area. The frequency pair to be used will probably be 144.75/145.35 MHz, in the new lower subband. Apparently, the more widely used 146.10/146.70 pair was already in use in the area as a voice repeater. Howard makes a plea for groups in other areas to consider RTTY when laying out bandplans, as well as other non-voice users.

Of the continuing saga of getting this piece of equipment or that one onto RTTY, there is never an end. Charles Dykes K4CUU of Florence, Alabama, has been trying to key the FSK circuit on his Kenwood TS-180S with an Info-Tech M-150. While Info-Tech advised him that the keyboard should work just peachy, he has had problems. With FSK, he is reported as having hum or ac on his signal, with a fuzzy mark. No problems are noted with AFSK input or SSB, just on FSK. Grounds and all have been checked, and Charles even plugged a dummy plug into the jack and got the hum without the Info-Tech or cable attached. Kenwood drew a blank. Any of y'all (he is from Alabama!) have an idea? If so, drop me a note, and I will be sure to pass it along to Charles and the rest of us.

Storage of messages, pictures, etc., is always a headache, especially if you have to contend with miles of punched paper tape. Some years back I tinkered with recording AFSK on tape as a storage medium; that was B.K.C. (Before Kansas City), don't 'cha know, but it worked, after a fashion. Now comes word from Stan Henderson N6BHT/DU2, a.k.a. NNN0IDR on Navy MARS, that he is doing just that, and doing it well. Fig. 1 is a diagram of just how he does it, too.

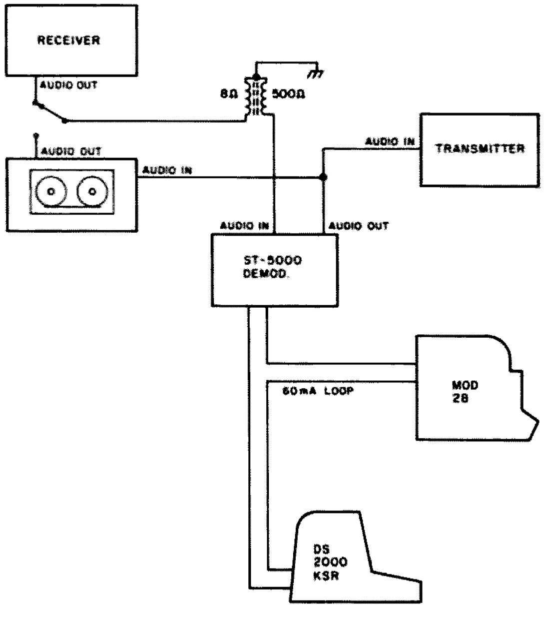


Fig. 1.

Stan uses a HAL DS-2000KSR terminal and HAL ST-5000 demodulator. The ST-5000 regenerates audio input as new AFSK output tones. Recording these clean tones solves many of the problems I used to have with recording off-the-air signals. He uses it to record many of the transmissions passing through his station, which otherwise would require paper tape. Since he uses common audio cassettes, he has many of the same advantages users of computer cassette interfaces enjoy, such as long recording times in a small package and easy availability of media.

The heartbreak Stan notes is when you record a picture at the beginning of the tape, thus on the leader. While Stan advises us to check the cassette carefully to wind the leader past the heads, he could also use the short leaderless tape now marketed for computer use.

A small audio transformer is used to match the speaker output to the 500-Ohm line; this would not be necessary if a 500-Ohm output were available from the receiver. Any small, cheap transformer of the appropriate impedance should suffice.

Stan has a viable system here, which should appeal to those who cannot get paper tape, or who need an auxiliary storage system. Incidentally, the RTTY Loop in the April, 1978, *73 Magazine* covered various kinds of storage media, including audio tapes.

More on the boards for next month—"Something for Everyone," as the song goes. Have something you would like to share with other RTTY or computer freaks? Drop it along to me, at the above address, for inclusion in the Loop. Please remember, though, if you want a personal reply, to include a self-addressed, stamped envelope.

AWARDS

Bill Gosney WB7BFK
2665 North 1250 East
Whidbey Island
Oak Harbor WA 98277

Over the past year, it has been my pleasure to work with a very knowledgeable friend, Mr. Chuck Ellis WØYBV, founder, editor, and publisher of the *New DX Awards Guide*. Determined to consolidate a single source of information for would-be DXers, Chuck has compiled what I feel is probably the most comprehensive awards manual in existence today.

I believe one of the features particularly original is that Chuck has provided application forms for the many incentives offered. Though these applications are not a specified format of the sponsor, they can be appreciated as a great aid to the many volunteers who have to validate applications as they are received.

Packed within the covers of this 164-page manual, you will find award programs featured from all parts of the world. What's even greater, the manual is assembled in a loose-leaf format so changes, additions, and deletions easily can be made as they occur.

A lot of hard work and countless hours burning the midnight oil went into the editing of this publication. Conservatively priced at $14.95 prepaid ($14.95 + 16 oz. postage charge for overseas), I consider this manual a must buy for the serious award hunter. Be sure to inform Chuck that you read about his *Awards Guide* right here in the Awards Column of *73*. And most important, should you learn of additional awards which either Chuck or myself can utilize for either of our awards publications, be sure to submit them at your earliest convenience.

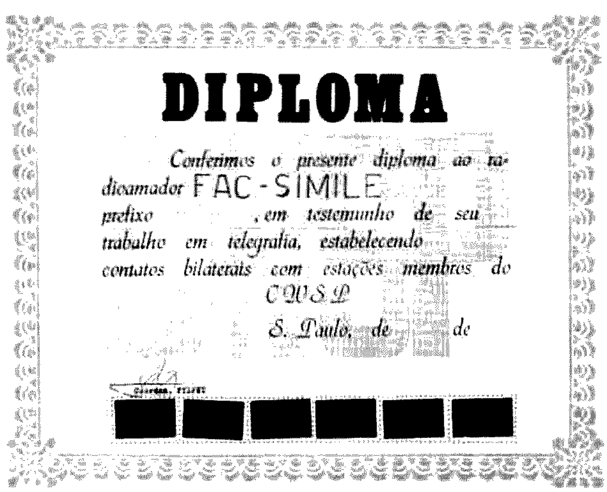
Order your *New DX Awards Guide* by enclosing your payment to Charles Ellis, Box 1136 Welch Station, Ames IA 50010.

Traveling south of the border, this month we learn of three very popular awards from the country of Brazil.

PACW AWARD

The PACW Award is issued by the Para CW Group, our South American friends in Brazil. To qualify for this award, amateurs must have worked at least two of the PACW members via CW on or after January 1, 1980.

To apply for this award, state the callsign, date and time in GMT, and signal report. Applicants are requested not to send QSL cards! Have your list of contacts verified by two amateurs, a club secretary, or by a notary public. Award fee is 10 IRCs. Send your applications to: PACW, PO Box 203, 66.000 Belem, Para, Brasil, South America.



I might add that this award is available to shortwave listeners as well. The same award rules apply.

PACW members who qualify for contacts are: PY8AA, PY8ACR, PY8ACS, PY8AFH, PY8BI, PY8DP, PY8EL, PY8FI, PY8HP, PY8JS, and PY8ZIC.

My special thanks to Fred Van Aalst WR4RAD for providing this award information for our column.

CWSP AWARD

The CWSP Award is issued by the "Sao Paulo Group of CW" for all radio amateurs who have worked five different members of the organization on CW only. To be valid, all contacts must be made after October 15, 1976.

Do not send QSL cards when making application. Merely list all five QSOs by stating the call of the station worked, the date and time in GMT, the band, and signal report. Enclose your application along with an awards fee of 10 IRCs. Be sure to have your list of contacts verified by at least two amateurs, a radio club secretary, or by a notary public. SWL endorsements also will be granted utilizing the same rule requirements. Special endorsements will be given for 10, 20, 30, and additional multiples of 10 stations worked.

Mail your application to: CWSP, PO Box No. 15.098, 01000—Sao Paulo, Brasil, South America.

CWSP members are: PY2 AA, AAI, ACH, ADI, AEO, AES, APE, ARX, ASI, ATL, AVB, AWL, BTR, BW, BWD, BZD, CJW, CPU, CQM, CZX, DCP, HDP, DJE, DML, DY, EM, EMM, ESY, FFA, FWR, FWT, GPA, GVV, GXC, GWF, GWO, GYB, JM, JN, JX, KN, OE, RG, SI, TR, WD, WSS, XB, YP, ZA, and PY1DG/2.

BRYLA AWARD

The YLs of Brazil offer a special award incentive for working the many YLs of their own country and countries around the world.

Known as the BRYLA Award, the applicant must make contact with YLs of 12 countries on 3 continents plus 8 YLs in Brazil.

List the usual logbook information and have your contacts verified by at least two amateurs, a local club secretary, or by a notary public. Submit your application along with an award fee of 10 IRCs to: Therezinha Cardoso PT2TF, SON 102, Bloco E Apto 604, Brasilia DF CEP 70.000 Brasil, South America.

And while speaking of YL Awards, we have a couple I'd like to mention that are being offered stateside.

DX-YL CERTIFICATE

Known as the DX-YL AWARD, applicants may only be YL operators. They are required to work 25 other YLs outside their own country. All contacts must have been made on or after April 1, 1958, to qualify.

All QSOs have to be made from the same QTH, or within a 25-mile radius. Contacts do not have to be with 25 separate countries but contacts with 25 DX-YLs are required.

Do not send QSL cards! Have your logs verified by at least two amateurs or a local radio club official. Submit your log to the Award Custodian: Emma Berg WØJUV, RFD 2 Box 171, Lawrence KS 66044. Stickers will be awarded for each group of 10 YLs contacted outside your own country.

Even though there is no charge for the DX-YL Award, applicants may donate stamps or small amounts of cash to defray costs.

DX-YLCC AWARD

Looking over the rules of the DX-YLCC Award, I would have to say that this is probably one of the toughest awards on the DX scene. To qualify, two-way communications must be made on any amateur band with 100 different licensed DX YLs, with not more than two YL contacts from any one country.

All contacts must be made from the same QTH and not to exceed a 25-mile radius if a change of QTH is necessary. Any band or mode may be utilized, but crossmode contacts do not count.

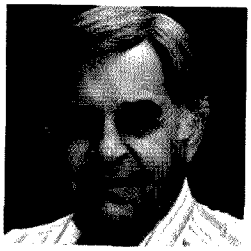
YLs contacted must be located in countries listed on the ARRL DX Countries List. The QSL confirmation must clearly state the station contacted was operated by a duly licensed woman amateur operator.

QSLs are to accompany all award applications. Include a list of contacts in prefix order. Include the callsign, operator's first name, the band and mode of operation, and the date and time in GMT.

Though the award is issued at

Continued on page 185

LEAKY LINES



Dave Mann K2AGZ
3 Daniel Lane
Kinnelon NJ 07405

As long-time readers of Leaky Lines may know, my real line of work is a bit off the beaten track. I've been a professional songwriter for years, having been lucky enough to have produced several pretty important songs. This can lead to complications when you want to get on the air for a few contacts. Word has a way of getting around and it can be a real problem.

One thing I duck immediately is any query concerning the titles of my songs. Then comes the inevitable question: "Have you written anything that I might know?"

"Sure!" I answer, making a joke out of it. "The Star Spangled Banner," "Happy Birthday to You" and "Hail, Hail, the Gang's All Here." This usually will discourage any further questions—but not always. There's always that persistent cuss who gets an idea in his teeth and hangs on like a bulldog. I generally tell him to go to his local library's reference section and look me up in the *ASCAP Biographical Dictionary*, where he can find the information. But even that doesn't satisfy some of these people...they simply won't take no for an answer. But I want no part of it, for good and ample reasons.

I was once in contact with a ham who was interested in my writing credits. Some days afterward, I got a piece of mail and for some reason failed to deal with it in my customary fashion. (I generally mark it "REFUSED" in big red letters and give it back to the postman.) I opened the envelope inadvertently and regretted it immediately, for there were some song lyrics inside. I glanced at them quickly and threw them right into the basket. Apparently one was called "I Remember September."

About two years later, I wrote a song called "November Memories," a totally undistinguished song that was unsuccessful. It wasn't even my title, but that of my co-writer. But, evidently the guy who had sent me the unsolicited manuscripts had a son who had recently completed law school, and he must have convinced the joker that he ought to file an action claiming plagiarism or infringement.

I had to get an attorney, he had to file briefs, and there were all sorts of other costs involved, not to mention the enormous loss of time. Despite the notorious tone deafness of judges and juries, the case was thrown out. The guy didn't get a penny.

Why was he unsuccessful? Simply because there was nothing even remotely similar in the two songs. Only the titles were somewhat related because of the use of a month and the concept of memory. But titles are not protected by copyright. That is why they write thousands of "I Love Your..." songs. There's no possibility of doing anything truly original any more. All songs are variations of other songs.

Notwithstanding the unvarnished truth that professional songwriters have no intention of becoming involved with amateurs, these characters (and there must be millions of them) insist upon imagining that the world is just waiting breathlessly for their "masterpieces." It's ridiculous.

That's why I detest it when hams insist on talking about songs. How do you suppose a physician would feel about discussing medicine on the air? How would a professional athlete feel about arguing with some dummy who'd never gone beyond sandlot, pickup ball games? I'm not looking for collaborators...I have more than a sufficiency of them. What makes some amateur think that a professional would be even remotely interested in collaborating with him?

I wasn't exaggerating about enormous throngs of would-be songwriters. I've been stopped on highways by state troopers who, when they found out what I do for a living, Immediately pulled some scruffy song poems out of their tunic pockets, and tried to pressure me to write melodies for them. I demurred, preferring to take the summons instead. I've been approached by elevator operators, waiters, busboys, dentists, service technicians and mechanics, school teachers, grocery clerks, mailmen, barbers (they're just about the worst), painters, plumbers, golf caddies, and God alone knows how many others. And all of them seem to believe that if only they can get one little break, they will replace Irving Berlin and Burt Bacharach!

On the way into the Brill Building some years ago (this building was known as Tin Pan Alley, for most music publishers were located there), I was accosted by some guy who was always hanging around. I had heard that he was in the button business, but he was songstruck. He had it in his mind to be a writer but had no talent, only nerve. He handed me a piece of lined copybook paper on which there was a scrawled lyric. I got no further than the title. It repelled and disgusted me. In big block letters, it stretched across the top of the page: "THE SUICIDE SONG." I handed it back to him without a word, continuing toward the elevators in the rear of the lobby. When he pressed me for my reasons, I told him that I regarded it as a revolting song idea, not worth the time to look at seriously. He slunk away, his face as dark as a thundercloud, muttering imprecations and curses under his breath.

I promptly forgot all about the incident, but some weeks afterward, when I arrived home one evening, my wife greeted me with an implausible story. It seemed that the phone had rung ...it was another writer, Lee Kuhn, a close friend.

"Hello, Bobby? Are you all right?"

"Of course, Lee. What's up?"

"Are you sure you're all right?"

"I don't understand you, Lee. What's the matter?"

"When...when are the services?"

"What are you talking about, Lee?"

"Well, I was listening to Martin Bloch on the Make Believe Ballroom on WNEW, and he halted the show for a news bulletin. It seemed that David Mann, the songwriter, had taken his own life. Bloch commented that he could not understand this, as he knew David Mann, and he just wasn't the type to do such a thing."

"Listen, Lee. I just got off the phone with David about ten minutes ago. He called from the garage to tell me he was on his way home. I expect him any minute."

I didn't know what to make of it. Then all at once it hit me. The jerk in the Brill Building, angry and frustrated about my unceremonious rejection of his rotten song, had dreamed this up as a sort of just retribution.

I hesitate to speculate on what he might have done if the song had involved murder instead of suicide!

So there you have it...a small glimpse into the trials and tribulations of the songwriter. Perhaps it will give you some understanding of the problem and will explain why I don't like to talk about popular songs on the air.

I simply want to avoid getting inundated with unsolicited song material from guys who are looking to capitalize on the slightest connection. I have no objection to their writing of songs. But I just don't want to be a party to it, that's all.

Editor's Note: Among Dave's many songwriting credits are, "There, I've Said It Again," "Wee Small Hours," "Don't Go To Strangers," and "Dearie (You're Much Older Than I)."

HAM HELP

I need a copy of a complete schematic or a manual for an RME 4350 receiver. I will pay postage and copying costs, but I'd rather copy at my end.

Will George W4LHJ
1731 Country Club Drive
Tullahoma TN 37388

TR7
ACCESSORIES

**Aux7 must be used with either Model 1546 RRM-7 Range Receive Module, or Model 1547 RTM-7 Range Transceive Module. Use one module per 500 kHz range. Modules plug directly into Aux7.

Model 1336	Drake TR7 General Coverage Digital R/O Transceiver
Model 1338	Drake RV7 Remote VFO
Model 1502	Drake PS7 120/240V Ac Supply for continuous duty operation (25 amps)
Model 1570	Drake PS75 120/240V Ac supply for intermittent duty (15 amps continuous, 25 amps intermittent)
Model 1553	Drake SP75 Speech Processor
Model 1230	Drake LA7 Line Amplifier
Model 1533	Drake CS7 Coax Switch
Model 7077	Drake Desk Microphone
Model 1520	Drake P75 Phone Patch
Model 1536	Drake Aux7 Range Program Board **
Model 1531	Drake MS7 Matching Speaker
Model 1537	Drake NB7 Noise Blanker
Model 1529	Drake FA7 Fan
Model 7021	Drake SL-300 Cw Filter, 300 Hz
Model 7022	Drake SL-500 Cw Filter, 500 Hz
Model 7023	Drake SL-1800 Ssb/RTTY Filter, 1.8 kHz
Model 7024	Drake SL-6000 A-m Filter, 6.0 kHz
Model 1335	Drake MMK-7 Mobile Mounting Kit
Model 7037	Drake TR7 Service Kit/Extender Board Set
Model 385-0004	Drake TR7 Service/Schematic Book

TR7 SPECIFICATIONS

GENERAL

Receive

Without Aux7	1.5 to 30 MHz, continuous, no gaps.
With Aux7	Same, plus 0 to 1.5 MHz at reduced performance.

Transmit

Without Aux7	1.8-2.0, 3.5-4.0, 7.0-7.5, 14.0-14.5, 21.0-21.5, 28.0-30.0 MHz.
With Aux7*	Above ranges, plus any eight 500 kHz segments from 1.8 to 30 MHz.
Modes of Operation	Usb, Lsb, Cw, RTTY, A-m equiv. (A-3H).
Frequency Stability	Less than 1 kHz first hour. Less than 150 Hz per hour after 1 hour warm up. Less than 100 Hz for ±10% line voltage change.

Frequency Readout Accuracy

Analog	Better than ±1 kHz when calibrated at the nearest marker point.
Digital	15 ppm ± 100 Hz.

External Counter Mode

Maximum Input Freq.	150 MHz.
Input Level Range	50 mV to 2 V, rms.

Power Supply Requirements

11-16 V-dc (13.6 V-dc nominal), 3A receive, 25A transmit.

Dimensions

Depth	12.5 in. (31.75 cm), excluding knobs and connectors.
Width	13.6 in. (34.6 cm).
Height	4.6 in. (11.6 cm) excluding feet.
Weight	17.1 lb. (7.75 kg).

RECEIVER

Sensitivity

Ssb, Cw	Less than 0.5 μV for 10 dB (S+N)/N.
A-m (30% Mod.)	Less than 2.0 μV for 10 dB (S+N)/N.
Selectivity	2.3 kHz at −6 dB and 4.4 kHz at −60 dB (1.8:1 shape factor).
Ultimate Selectivity	Greater than 100 dB.
Agc	Less than 4 dB output variation for 100 dB input signal change, referenced to agc threshold.
Intermodulation	Intercept Point, +20 dBm. Two-tone Dynamic Range, 99 dB (at spacings of 100 kHz and greater).
I-f Frequency	First i-f—48.05 MHz. Second i-f—5.645 MHz.
Image and I-f Rejection	Greater than 80 dB.
Spurious Response	Greater than 60 dB down.
Internally Generated Spurious	Less than 1 μV equivalent, except 3 μV equivalent from 5 to 6 MHz (reduced specs on internal osc frequencies).
Audio Output	2.0 watts @ less than 10% THD (4 ohm load).

TRANSMITTER

Power Input (Nominal)

Ssb	250 watts PEP.
Cw	250 watts.
A-m equiv.	80 watts (carrier), plus upper sideband.
Load Impedance	50 ohms, nominal.
Spurious Output	Greater than 50 dB down.
Harmonic Output	Greater than 45 dB down.
Intermodulation Distortion	30 dB below PEP (24 dB below one of two tones).

Undesired Sideband Suppression

Greater than 60 dB @ 1 kHz.

Duty Cycle

Ssb, Cw	100%.
Tune, SSTV, RTTY, A-m	w/o 1529 FA7 Fan—33%, 5 min. transmit, max. with 1529 FA7 Fan—100%.
Wattmeter Accuracy	±5% @ 100 watts (50 ohm load).
Carrier Suppression	Greater than 50 dB.
Microphone Input	High Impedance.

Specifications, availability and prices subject to change without notice or obligation.

R. L. DRAKE COMPANY DRAKE

540 Richard St., Miamisburg, Ohio 45342 USA
Phone (513) 866-2421 • Telex 288-017

✓19

✓ Reader Service—see page 226

LETTERS

BASHED

Our article on Dick Bash in the September issue elicited quite a response from our readers. Letters fell into three categories: those in favor of Bash, those against, and those requesting his address. Considering reader requests for Mr. Bash's address as evidence of at least tacit approval of his activities, the mail ran approximately 2 to 1 in his favor. Below is a cross section of the many letters we received.

I do not, as a rule, write letters to publications, or anything... but after reading your article on Dick Bash, I felt that at last someone feels as I do and I had to say so.

Anthony D. Tartaglia
Titusville FL

I enjoyed your article on Dick Bash and would like to order one of his books. Search as I did, however, I could not find his address in the September issue of *73*. Was it purposely left out?

Paul Powell, M.D.
Borger TX

Yes.—Ed.

I say hooray for Dick Bash! I'm trying to find a copy of *The Final Exam* for my General. I worked and got my Novice and now I want to use phone privileges.

I really don't want to go back to illegal CB, but if the hams and FCC don't make it easier, I will, cause I just want to shoot the bull.

Harlan Steffen KA9GDF
Appleton WI

I read your interesting article about Dick Bash and his license manual, *The Final Exam*. I am interested in the Advanced manual.

In June, 1977, I passed my 13 wpm code but failed the Advanced for the second time. It seemed as though I was doing well in my licensing progression and then all of a sudden I didn't seem to be able to answer the questions right. It happened twice, so I thought that anything I can do to pass on the third try would be worth the effort. I am seventy-two years old—got a late start in ham radio.

Wilbur T. Reed WB9KDB
Marion IN

I've just finished your excellent article on Dick Bash. More power to the guy. He's doing just what he should—make it as easy as possible to get a ham license.

I'm sure that its the old-guard hams who don't want changes who are against Dick. I love ham radio as a hobby. It has added a lot to the quality of my life and I would do anything to help someone get on the air.

Alan D. Kline WB1FOD
Swampscott MA

If your article is not a complete put on, please send info on where to send for the Dick Bash manuals. I know several people who are interested.

T. J. Ward
Weyworth MA

I enjoyed your article in September's issue on Dick Bash KL7IHP.

While being new to ham radio, I have much experience with the "Feds." I hold FAA single and multi-engine instrument and commercial ratings, instructor for single engine and instrument, and flight engineer, turbojet, as well as a Boeing 707/720 type rating. I now work for a major air carrier. It is virtually impossible to pass the FAA's written tests from just the regulations and tech orders. You must literally learn the test!

I just completed a course at a local radio club on the Novice license. The electronics section was first baffling but now is intriguing. I *can* handle the circuits for the General test. Given a few years' study, I may be able to handle the Advanced or Extra. I agree with Mr. Bash in most areas. More emphasis should be placed on how to use equipment than why it works. I intend to use Kenwood equipment; I couldn't modify those circuits if I wanted to.

Ham radio is a fascinating hobby. Teach me how to communicate legally—not build a replacement for WWV!

David R. Remont
Covington LA

I enjoyed your recent article about Dick Bash KL7IHP and I agree about all the FCC "trick" questions.

C. D. Isenburg WD4LTM
Stone Mountain GA

Congratulations on the fine profile on Dick Bash KL7IHP in the September issue. The word "malaise" hardly describes the illness which is pervading the Amateur Radio Service. The arrival of one Dick Bash and the acceptance of his views and justifications by a growing segment of the prospective amateurs signal the galloping decline of what was a proud fraternity.

The FCC is understandably in a quandary about how to promote the high ideals of our service, with Dick Bash selling the test answers. In that regard, I have a suggestion.

The Commission could herald the arrival of Dick Bash as a Special Event. Then, relaxing the current ban on Special Events callsigns, they could unblock the computer and recycle Bash's name for assignment of a Special Events callsign befitting the occasion. If the computer then selected the callsign W6ASS, Bash would be very appropriately honored. The callsign is not currently assigned, and I can think of few who deserve it more.

Robert G. Wheaton W5XW
San Antonio TX

I won't bore you with the details of how hard I had to work to pass the FCC license tests, but I know that since I did have to put out a little effort I have a much greater respect for the Amateur Radio Service and the privileges (and they are privileges) it provides.

When it finally gets to the point that anyone who can afford to buy the answers to the FCC tests and be practically guaranteed of passing, when the only real knowledge required is the ability to read and plug the transmitter into the wall, and when the bands become so crowded with unknowledgeable and immature operators who are concerned only with getting everything they want the easy way, amateur radio as we know it today will be a thing of the past.

When that happens, I will say a little prayer over it and go on to something else.

George Hogue KB5OU
Bridgeport TX

I read Chris Brown's profile on Dick Bash KL7IHP with amused interest. I think Mr. Bash can best be described as a businessman, and a good one at that!

The author spoke of a malaise affecting ham radio, which apparently afflicts this society, too—that is, the shift in people's attitude and priorities. There are definitely people who would like to get things done the easiest way, irrespective of reason, and they do not care one bit as to how this will be attained. Mr. Bash certainly serves these people well.

So, just like the oldest profession, for as long as there are people buyin', they will come sellin'.

Frederico Po DU1FP
Berkeley CA

"Who am I to judge morality?"

Who else, Dick Bash? You, I, Wayne Green, and, in this case, a lot of other hams—not Jerry Brown and Melvin Belli.

Those of us who have callsigns, Dick, we and no other will judge the morality, will establish the morality. You seem to have forgotten us altogether.

What you and your high-priced legal talent really need to think about are the little, forgotten things, like pride, dignity, and common decency.

Sadly, I am reasonably sure that nothing can be done about this sort of thing and you'll sell lots of your books.

John B. Stolp KA6BRT
Oakland CA

Wayne, after reading Mr. Bash's article in your magazine, I was both shocked and disgusted by the irresponsible behavior of you two. It is very apparent that neither of you deserve the trust given you as amateur radio operators.

I have a question for both of you. I want to get my FAA pilot's license but I don't want to learn

Continued on page 194

OSCAR ORBITS

Courtesy of AMSAT

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80TM microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR NOVEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
27277	1	0000:45	74.5
27290	2	0054:59	88.1
27303	3	0149:14	101.7
27315	4	0048:32	86.6
27328	5	0142:46	100.2
27340	6	0042:04	85.0
27353	7	0136:19	98.6
27365	8	0035:37	83.4
27378	9	0129:52	97.0
27390	10	0029:10	81.9
27403	11	0123:24	95.5
27415	12	0022:42	80.3
27428	13	0116:57	93.9
27440	14	0016:15	78.7
27453	15	0110:29	92.3
27465	16	0009:47	77.2
27478	17	0104:02	90.8
27490	18	0003:20	75.6
27503	19	0057:34	89.2
27516	20	0151:49	102.8
27528	21	0051:07	87.6
27541	22	0145:21	101.2
27553	23	0044:39	86.1
27566	24	0138:54	99.7
27578	25	0038:12	84.5
27591	26	0132:26	98.1
27603	27	0031:44	82.9
27616	28	0125:59	96.5
27628	29	0025:17	81.4
27641	30	0119:31	95.0

OSCAR 8 ORBITAL INFORMATION FOR NOVEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
13551	1	0116:47	74.7
13565	2	0121:34	75.9
13579	3	0126:21	77.2
13593	4	0131:08	78.4
13607	5	0135:55	79.6
13621	6	0140:41	80.8
13634	7	0002:16	56.2
13648	8	0007:03	57.5
13662	9	0011:50	58.7
13676	10	0016:36	59.9
13690	11	0021:23	61.1
13704	12	0026:09	62.4
13718	13	0030:56	63.6
13732	14	0035:42	64.8
13746	15	0040:28	66.0
13760	16	0045:15	67.2
13774	17	0050:01	68.5
13788	18	0054:47	69.7
13802	19	0059:34	70.9
13816	20	0104:20	72.1
13830	21	0109:06	73.3
13844	22	0113:52	74.5
13858	23	0118:38	75.8
13872	24	0123:24	77.0
13886	25	0128:10	78.2
13900	26	0132:56	79.4
13914	27	0137:42	80.6
13928	28	0142:28	81.9
13941	29	0004:02	57.3
13955	30	0008:48	58.5

OSCAR 7 ORBITAL INFORMATION FOR DECEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
27653	1	0018:49	79.8
27666	2	0113:04	93.4
27678	3	0012:22	78.2
27691	4	0106:36	91.8
27703	5	0005:54	76.7
27716	6	0100:09	90.3
27729	7	0154:23	103.9
27741	8	0053:41	88.7
27754	9	0147:56	102.3
27766	10	0047:14	87.1
27779	11	0141:28	100.7
27791	12	0040:46	85.6
27804	13	0135:00	99.2
27816	14	0034:18	84.0
27829	15	0128:33	97.6
27841	16	0027:51	82.4
27854	17	0122:05	96.0
27866	18	0021:23	80.9
27879	19	0115:37	94.5
27891	20	0014:55	79.3
27904	21	0109:10	92.9
27916	22	0008:27	77.7
27929	23	0102:42	91.3
27941	24	0002:00	76.2
27954	25	0056:14	89.8
27967	26	0150:29	103.4
27979	27	0049:46	88.2
27992	28	0144:01	101.8
28004	29	0043:19	86.6
28017	30	0137:33	100.2
28029	31	0036:51	85.1

OSCAR 8 ORBITAL INFORMATION FOR DECEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
13969	1	0013:34	59.7
13983	2	0018:20	60.9
13997	3	0023:06	62.1
14011	4	0027:51	63.4
14025	5	0032:37	64.6
14039	6	0037:23	65.8
14053	7	0042:08	67.0
14067	8	0046:54	68.2
14081	9	0051:39	69.5
14095	10	0056:25	70.7
14109	11	0101:10	71.9
14123	12	0105:56	73.1
14137	13	0110:41	74.3
14151	14	0115:26	75.5
14165	15	0120:12	76.8
14179	16	0124:57	78.0
14193	17	0129:42	79.2
14207	18	0134:27	80.4
14221	19	0139:13	81.6
14234	20	0000:46	57.0
14248	21	0005:31	58.2
14262	22	0010:16	59.5
14276	23	0015:01	60.7
14290	24	0019:46	61.9
14304	25	0024:31	63.1
14318	26	0029:16	64.3
14332	27	0034:01	65.5
14346	28	0038:46	66.8
14360	29	0043:30	68.0
14374	30	0048:15	69.2
14388	31	0053:00	70.4

FUN!

John Edwards WB2IBE
78-56 86th Street
Glendale NY 11385

Each month's "Fun!" brings you all manner of delights and amusements. Included will be crossword puzzles, matching questions, scrambled words, and ham acrostics, all designed to help you pass the idle hours while waiting for the DX list to work toward your call.

We'll have trivial questions, important questions, questions that will amaze, confound, and perplex you. And why do we do it? So you can have an alternative to boring FCC tests, a way to learn about our hobby that will make the learning fun. You may not get a new license when you pass a Fun! ham test, but you won't have to travel to the Federal Building, either.

To get the ball rolling, this month's test will concentrate on that most challenging and complex mode of amateur communications—repeater operation! Answers appear on page 193.

ELEMENT 1—CROSSWORD PUZZLE (Illustration 1)

Across

1 G.E. FM surplus rig
10 Multi-skip
11 Element (abbr.)
12 IC feature
13 Pre-FM mode (abbr.)
14 Like full-quieting (abbr.)
15 "Secret" tone (abbr.)
16 High end of band
17 Phone sigs on 2-meter's bottom (abbr.)
18 Author's suffix
19 RTTY repeater test string
20 Radio control (abbr.)
22 W1AF's QTH (abbr.)
24 Microphone (abbr.)
26 FM frequencies
28 Anxious repeater owner's air-date
30 Original repeater source
33 Repeater antenna calculation (abbr.)
35 Morse "and"
36 E =
37 Repeater hearing problem
38 Squelch appendage

Down

1 Most popular repeater modulation
2 Some machines have these memories (abbr.)
4 Repeater task
5 Liberian prefix
6 A repeater halved pair
7 Long Island (abbr.)
8 Repeater noise
9 Effective radiated power (abbr.)
19 To apply power
21 Backwards integrated circuit (abbr.)
22 Amateur Radio op
23 Hard-line (abbr.)
25 A ham rock
26 Unfriendly machine
27 FCC special permission (abbr.)
29 Repeater scheme
31 To employ a frequency
32 Legal threat
33 Can I ______ that machine from here?
34 Amateur Radio Association (abbr.)

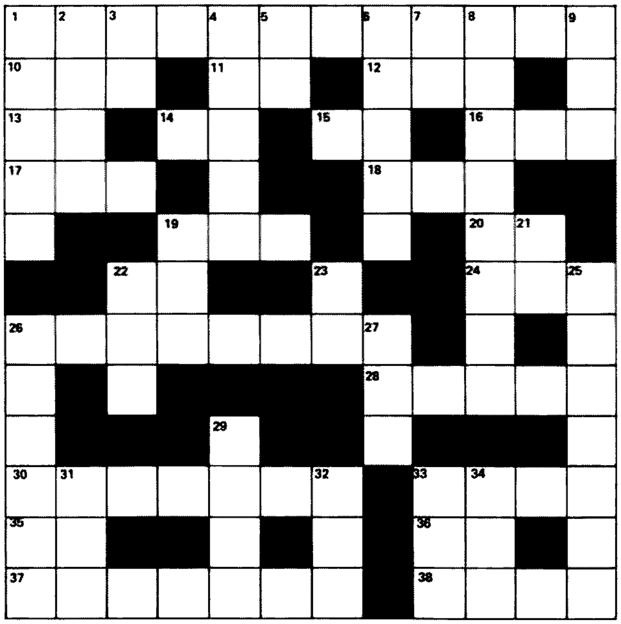


Illustration 1.

ELEMENT 2—MULTIPLE CHOICE

1) What many believe to be the first VHF repeater was installed near Springfield, Massachusetts, in the early 1930s. The callsign of this 5-meter machine closely resembled that of a noted station of today. It was . . .

1) KCBS
2) W1AWW
3) W1MK/R
4) W6RO/1

2) Back in the early 1970s, when repeaters were just coming into their own, one way of bringing up a tone-accessed machine was by using a little device known as a "Captain Crunch" whistle. How did this item get its name?

1) From its English inventor, Captain Sir Joseph Crunch.
2) The prototype whistles were modeled after toys that came in cereal boxes.
3) From the "crunchy" sound the whistles made.
4) From a ham who thought he was being funny.

3) Before synthesized HTs became popular, one particular rock-bound HT was the desire of every 2-meter FMer. Although the units were originally designed for commercial use, possession of this HT by an amateur marked its owner as a man of taste, distinction, and wealth. What was the name of this fabled HT?

1) The RCA PortaTalk
2) The G.E. TR-50
3) The Kenwood TS-520
4) The Motorola HT-220

4) We all know that WR-prefixed repeater callsigns are currently being phased out in favor of the station operator's primary call. However, before the first WR calls were issued by the FCC in 1972, what system was used for repeater identification?

1) Basically, that same system that is coming back today.
2) KN-prefixed calls.
3) KR-prefixed calls.
4) WC—RACES—calls.

5) In what year did the FCC open the 2-meter band to amateurs?

1) 1914
2) 1954
3) 1945
4) 1968

ELEMENT 3—SCRAMBLED WORDS

Unscramble these familiar repeater terms:

vondiiaet	xelpud	mmajre	resranimttt
tchupaoat	tnlorco	hwpi	hcquesl
retmi	tesi	emcanih	uspr
nevo	bmolie	tsam	pamflieri
orc	ortpblea	ttanois	notireecj

Continued on page 193

NEW PRODUCTS

DRAKE R7 GENERAL COVERAGE COMMUNICATIONS RECEIVER

While a good number of imported general coverage receivers are now available, the emergence of a competitive domestic product is worthy of special note. The new R7 receiver from Drake is an example of a quality product for serious listening applications. Early problems of power supply harmonics in the VLF tuning range have been resolved.

An accurate 6-digit LED display is presented through a divided bezel which separates the megahertz window from the kilohertz window, affording a slight psychological cognitive advantage when quickly glancing at the frequency display. The sixth digit indicates tenths of a kilohertz (100 Hz), assuring great tuning accuracy.

An internal 25-kHz crystal calibrator seems an unnecessary luxury.

Selectivity of the R7 is factory-supplied with a 2.3-kHz 8-pole crystal filter; optional switch-selectable filters of 4.0-, 1.8-, 0.5-, and 0.3-kHz filters are available from the factory at $55 each. The same filters are used on both AM and SSB/CW detection modes. Image and i-f rejections are at least 80 dB.

One of the major drawing cards of the R7 is its passband tuning feature. By slightly shifting the intermediate frequency of the receiver, an interfering signal may be substantially reduced or even eliminated. This is nice, and on the R7 it works well.

A high-level double-balanced mixer is used in an up-conversion scheme to create the first i-f (48.05 MHz). Both front-end overload and intermodulation are kept to a minimum with this approach. A second i-f of 5645 kHz and a third i-f of 50 kHz help maintain the receiver's 100-dB ultimate selectivity.

Apparent receiver sensitivity is good; undoubtedly, careful attention to filter matching and input losses has helped preserve its 0.5-microvolt shortwave sensitivity on SSB and CW reception. AM sensitivity is better than 2.0 microvolts.

On the standard broadcast band and below, sensitivity is better than 1.0 microvolt on SSB/CW and 4.0 microvolts on AM.

Sensitivity of the receiver may be enhanced somewhat through the utilization of an integral preamplifier which boosts gain some 10 dB. Since noise is also boosted somewhat, the effective net improvement in receiver sensitivity using the preamp is actually around 5 or 6 dB.

The R7 exhibits high thermal and mechanical stability. At power-on, bfo adjusted to a low heterodyne on an incoming signal, no detectable drift occurred on our sample. A substantial rap on the cabinet also failed to produce a warble in pitch. That's good stability!

Receiver incremental tuning (RIT) allows ±3-kHz independent frequency adjustment when used in a transceive mode with a matching transmitter. The frequency display moves with the RIT adjustment.

A "store" control permits the operator to lock the display on its present receive frequency and then tune up and down without the display changing. This feature is a "visual scratch pad" useful for net operation.

Frequency bands are selected both by rotating a bandswitch and by pressing appropriate "up" or "down" keys to jump in 500-kHz increments.

An auxiliary program board (AUX-7) may be purchased ($45 plus modules and crystals) to permit crystal-controlled operation of the R7. No preselection is required in any tuning mode.

An i-f notch filter is useful in reducing adjacent-frequency heterodyne interference some 40 dB, and is variable over several kilohertz of passband.

AGC attack time is one millisecond, and release times may be selected from 4 choices, 0 through 2 seconds. An optional noise blanker may be purchased separately and controlled from the front panel.

A highly-flexible antenna switching provision allows a variety of converters and antennas to be used with the R7, attachable through a row of RCA phono plugs on the rear apron. Although purists may scoff at the use of phono connectors for antenna jacks on an expensive receiver, such devices perform perfectly well at these frequencies.

An rf gain control is useful for reducing background interference on loud signals. The af gain control, for some reason, does not allow complete reduction of audio. While the internal speaker is capable of good audio, rear-apron provision for an external speaker, and front-panel provision for headphones, are both made.

Power requirements for the R7 may be selected from 120 or 240 V ac, 50/60 Hz, or 12 V dc at 3 Amps.

While a few spurious signals were noted, especially in the VLF range, we were generally impressed with the performance of the R7 receiver, and feel that it affords a great deal of flexibility for the array of imaginative requirements of most amateurs and listening hobbyists. The R7 receiver is listed at $1449. *R. L. Drake Co., 540 Richard Street, Miamisburg OH 45342.* Reader Service number 476.

Robert Grove WA4PYQ
Brasstown NC

Drake's R7 general coverage receiver.

RADIO SHACK DX-302 GENERAL COVERAGE RECEIVER

It has been a couple of years since Radio Shack released their DX-300 digital-display general coverage receiver. Reports from users varied from praise to eternal damnation, but one thing was certain: It had problems.

The DX-300 was plagued with horrendous spurious signals, largely due to self-oscillation. Frequency drift, lack of i-f selectivity, and cumbersome two-step peaking were others.

It was evident that redesigning would be necessary, and the new DX-302 (why not 301?) was the result. Is it any better? Yes. Is it a lot better? Well . . . in order to answer the question of just how good a receiver is, we have to view the product from the perspective of the market for whom it is manufactured.

The DX-302 is intended for a broad consumer audience not sophisticated in electronics. The bulk of these listeners will apply their listening time to AM international broadcast, using the bfo provision less often. This is just as well, as the DX-302 still exhibits frequency drift.

Some AGC pumping with strong CW and SSB signals

Radio Shack's DX-302 general coverage receiver.

might be objectionable, showing a need for slower decay time.

The i-f selectivity problem has been improved considerably in the DX-302; the −6 dB and −60 dB points are at 3.5 kHz and 6.0 kHz in the wide position and at 2.5 kHz and 4.0 kHz in the narrow position. The spurs which were evident in the DX-300 are now extinct. Two-step peaking is still necessary.

Sensitivity of the DX-302 is excellent, averaging 0.3 microvolts throughout the shortwave spectrum. Image rejection is 60-70 dB down. Upper or lower sideband selection adds to the receiver's flexibility.

Frequency coverage is another plus, permitting continuous-coverage reception from 10 kHz through 30 MHz. Frequency display is provided by a five-digit LED readout—and it's accurate. A drop of oil behind the spindle of the spinner knob did wonders for our sample, loosening the stiff turning feel.

The receiver is relatively straightforward, reflecting design philosophies incorporated into the new breed of synthesized receivers. Incoming signals are up-converted to 55 MHz where they are tuned in 1-MHz increments into a 3-2 MHz tunable i-f. Triple conversion finally results in a conventional 455-kHz 3rd i-f which is also the bfo frequency (± 1.5 kHz).

Power requirements may be selected from 120 V ac at 60 Hz (220-volt, 50-Hz models available for Europe and Australia), 12 V dc for mobile operation, or 8 internal C cells for fully portable operation.

While the DX-302 would not be recommended for primary reception, it would make a good standby receiver. And, most important, it would be a good introductory receiver for a newcomer to the fascinating world of shortwave listening. The DX-302's self-contained code practice oscillator just might encourage that newcomer to go one step further!

The Radio Shack DX-302 general coverage receiver lists for $379.95. For further information, contact *Radio Shack, a division of Tandy Corporation, 1300 One Tandy Center, Ft. Worth TX 76102.* Reader Service number 490.

Robert Grove WA4PYQ
Brasstown NC

MIRAGE'S MODEL B23 2M AMP

Mirage has announed the latest member in its line of quality amateur equipment, the B23 2-meter all-mode low-power amplifier. The B23 is designed to be used with all available HT and low-power SSB transmitters.

Mirage's newest amplifier will provide 30 Watts of output with 2 Watts of drive. The B23 is linear and may be keyed with as little as 100 mW and up to as much as 5 Watts. Five Watts input will give 40 to 45 Watts output.

The B23 is packaged in a rugged, compact enclosure that may be mounted anywhere or left unmounted for maximum portability.

For more information, contact Everett Gracey WA6CBA or Ken Holladay K6HCP at *Mirage Communications Equipment, Inc., PO Box 1393, Gilroy CA 95020; (408)-847-1857.* Reader Service number 482.

JE610 ASCII-ENCODED KEYBOARD KIT ANNOUNCED BY JAMECO

Jameco Electronics has developed the JE610 ASCII-Encoded Keyboard Kit which can be interfaced into almost any computer system.

The kit comes complete with a 62-key industrial grade keyboard switch assembly, integrated circuits, sockets, connector, electronic components and a double-sided printed circuit board. Complete, easy-to-follow step-by-step wiring instructions and circuit diagram are also included.

The keyboard switches are SPST mechanical action and 60 keys generate the full 128 characters, upper and lower case, of the ASCII set. Two user defined keys are provided for custom applications. This unit is fully buffered and there is a caps lock for upper case alpha characters.

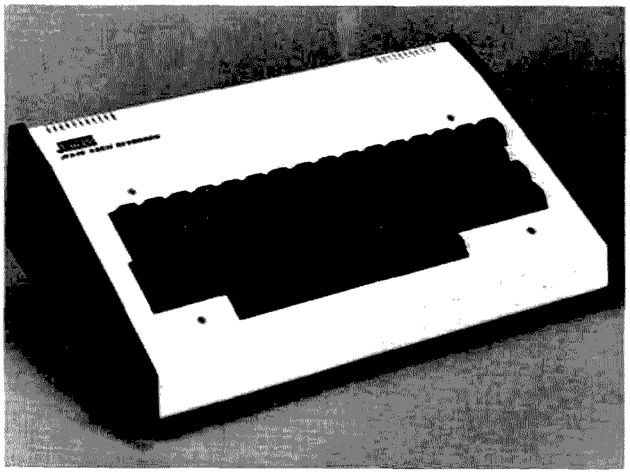
The heart of the system is a 40-pin ROM (AY5-2376) with outputs directly compatible with TTL/DTL or MOS logic arrays. The keyboard assembly requires +5 V dc at 150 mA and −12 V dc at 10 mA for operation. Interfacing is accomplished by a 16-pin DIP or an 18-pin edge card connector.

For more information, write to *Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002.* Reader Service number 488.

BROADBAND VHF/UHF BEAM ANTENNA ANNOUNCED BY GROVE ENTERPRISES

Intended primarily for the hobby scanner radio market, the new Scanner Beam from Grove Enterprises is designed to work over the continuous frequency range of 18 through 512 MHz. A seven-element, log-periodic di-

Mirage's Model B23 2m amp.



Jameco's JE610 ASCII-encoded keyboard.

pole array, the Scanner Beam is said to offer gain approaching 8 dB above a dipole on high band and UHF. An additional 15-dB front-to-back ratio makes the Scanner Beam particularly suitable for long distance, weak-signal directional reception. Average vswr is 1.92:1.

On low band (30-50 MHz), the antenna resembles an omnidirectional vertical dipole.

Constructed of heavy-duty aluminum tubing, the Scanner Beam features unbreakable ABS Cycolac insulators and 4-foot baked enamel painted boom, and includes a 4:1 matching balun transformer for either 50- or 75-Ohm coaxial feedline.

A universal offset mount permits the Scanner Beam to be attached to a metal mast with a minimum of interaction, and additionally allows the antenna to be tilted in a vertical plane for satellite reception. Hams will find the Scanner Beam also useful for transmitting in the 144-, 220-, and 420-MHz bands.

A matching coaxial cable assembly is also available. Constructed of 65 feet of low-loss, foam-dielectric, copper-braided shield, the cable assembly comes with factory installed F connector, Motorola connector, and weather boot.

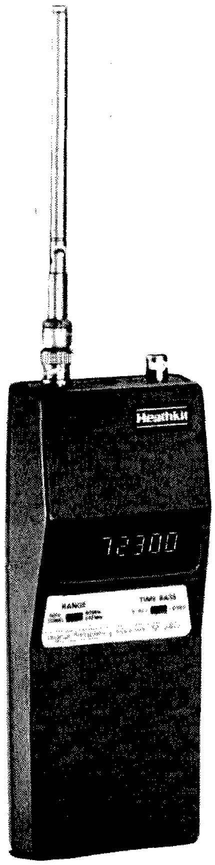
For further information, contact *Grove Enterprises, Inc., Route 1, Box 156K, Brasstown NC 28902.* Reader Service number 486.

HEATH INTRODUCES NEW LINE OF FREQUENCY COUNTERS

Heath Company has introduced two new digital frequency counter kits. The IM-2400, Heath's first hand-held counter, features a 50 Hz-512 MHz frequency range—while the portable IM-2410 offers a single input for its entire 10 Hz-255 MHz frequency range.

Weighing just 4/5 of a pound, the Heathkit IM-2400 hand-held frequency counter can be used anywhere in the field—or on the test bench. Large-scale integration and CMOS technology allow the IM-2400 to fit into a cabinet measuring only 1-5/8" H x 3-3/8" W x 8-3/8" L.

The IM-2400's crystal-controlled 10-MHz time base provides improved accuracy and 10-ppm temperature stability, according to a Heath spokesperson. With a typical sensitivity of 10 millivolts, the IM-2400

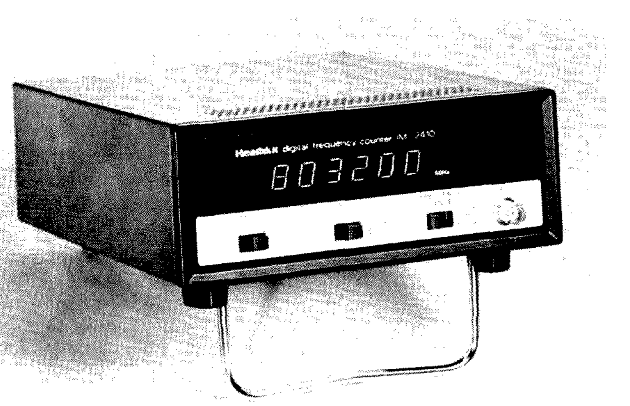


Heathkit's IM-2400 hand-held frequency counter.

can read weaker signals. And the 7-digit LED display is 3/8" high, for more legible readings.

True hand-held portability is achieved by placing the five rechargeable nickel-cadmium batteries inside the housing of the IM-2400.

The IM-2410 portable frequency counter measures input signals between 10 Hz and 225 MHz, with good accuracy and



Heathkit's new IM-2410 portable frequency counter.

10-ppm temperature stability. A durable metal cabinet, improved RFI shielding, and complete voltage protection help ensure proper operation.

A pivoting stand and locking swing-down bail place the 8-digit LED display at a convenient viewing angle.

Both the IM-2400 and IM-2410 counters may be connected directly to the component under measurement. Or, for counting without any connections, the optional SMA-2400-1 swiveling telescopic antenna may be used. This right-angle antenna with BNC connector may also be used on many 2-meter transceivers. The chrome-plated SMA-2400-1 is frequency-tunable, by extending or retracting the telescoping sections.

For more information, contact *Heath Company, Dept. 350-500, Benton Harbor MI 49022*. Reader Service number 485.

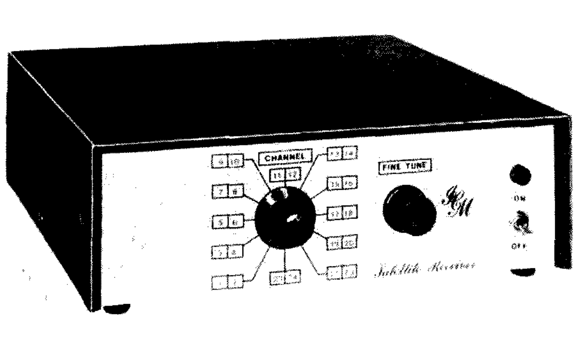
INTERNATIONAL INTRODUCES THE TV-4300 SATELLITE RECEIVER

A new 24-channel satellite receiver is now available from International Crystal Manufacturing Co.

The high-performance receiver tunes all channels within the 3.7-4.2-GHz band. Standard dual audio output is provided at 6.2 and 6.8 MHz. Others are available.

The TV-4300 is a fully packaged and assembled receiver complete with a built-in LNA power supply, built-in AFC, tuner, control circuitry, and power cable. All output levels are compatible with video monitor and VTR input.

ICM offers several options including a remote tuning control and selectable audio with stereo output. For complete information, write *International Crystal Manufacturing Co., Inc., 10 North Lee, Oklahoma City OK 73102*. Reader Service number 483.



International Crystal's TV-4300 satellite receiver.

RTTY89

COMMSOFT, a software company located in Palo Alto, California, has introduced RTTY89 for the Heath H89 or H8/H17/H19 computer. By taking advantage of the disk and dynamic video graphics capabilities of either computer, this program adds a new dimension to amateur radio communications. Version 3.0 of the W6LLO program provides exclusive 3-level split screen to allow pretyping messages while copying incoming data. Other features include: disk-based autostart (record incoming/outgoing data on disk); disk load into pretype buffer; sophisticated on-screen graphics displaying complete system status including time; automatic CW identification; and ASCII or Baudot operation. These and many other features are described in a free brochure.

For further information, contact *COMMSOFT, 665 Maybell Avenue, Palo Alto CA 94306; (415)-493-2184*. Reader Service number 481.

DTMF DECODER

The Teltone M-917 is a DTMF decoder and rotary dial pulse counter in a modular package. It accepts touchtone™ (dual tone-multifrequency) signals from telephone, radio, pre-recorded tape and other sources. Output is logic level binary with strobe, and other options. It can be used to drive a low-power TTL gate or transistor, CMOS, or MOS devices. The low-cost, sealed modular unit (3.5 × 2.5 × .65 inches) meets or exceeds all telephone industry standards for use in central office equipment. It contains a proprietary LSI, high-impedance input buffer, dial-tone filter, high- and low-bandpass filter, and a crystal-controlled, digital frequency detector that can recognize all 16 DTMF digits.

For further information, contact *Teltone Corporation, 10801-120th Avenue NE, Kirkland WA 98033; (206)-827-9626*. Reader Service number 484.

KANTRONICS' FIELD DAY 2 SWL MODEL

There was time not too long ago when the thought of copying radioteletype would conjure up a mental image of cumbersome, noisy teleprinters. The venerable Model 15 has been in the shacks of countless thousands of stalwart experimenters, clacking away and spewing out rolls of paper.

The RTTY scene has changed dramatically. No longer are the mechanical monsters necessary for the registration of RTTY copy, nor are the touchy demodulators with their bevy of controls.

Digital technology has come to the rescue with several self-contained readers, displaying their copy faultlessly via an LED readout.

One of the most popular of these automatic RTTY readers is the Field Day 2 from Kantronics. For use with general coverage receivers, a specially-shielded SWL model is available at a slight additional cost.

Far more flexible than any of the mechanical teleprinters, the Field Day 2 has provision for automatic Morse code display, on-

ly a dream when the mechanical teleprinter was king. The Field Day 2 will track any Morse speed, from 3 to 80 words per minute.

On RTTY, speeds of 60, 67, 75, and 100 wpm are selectable, with the additional compatibility with 110 and 300 wpm ASCII. An internal 24-hour clock is also included.

The Field Day recognizes virtually all of the conventional characters, numerals, and prosigns on all three modes. Presentation of readout is on ten 14-segment, alphanumeric, half-inch LEDs. The message moves from right to left, Times-Square style, and is quite easy to read after a moment's practice.

In actual operation, an audio cable (not included) is simply plugged into the earphone jack or external speaker jack of the receiver. The receiver dial is adjusted until the audio frequency falls into the sharp audio passband of the Kantronics active filter (750 Hz, ± 100 Hz). On CW, the dots and dashes are processed by their relative timing. On RTTY, only the mark signal is copied and processed.

The audio input impedance will adequately match 8-100 Ohms.

The Field Day 2 is operable from ac only (117 V ac @ 60 Hz; a 220 V ac @ 50 Hz export model is available on special order at no extra cost).

A built-in speaker assists the operator in centering in on the desired signal. The speaker may be defeated by plugging an unwired miniature phone plug into the appropriate jack on the rear apron. This simple move will prevent a RTTY enthusiast from coming unwired after a few minutes of listening to the incessant "diddly-diddly-diddly" from his favorite RTTY station, and could conceivably save his marriage as well.

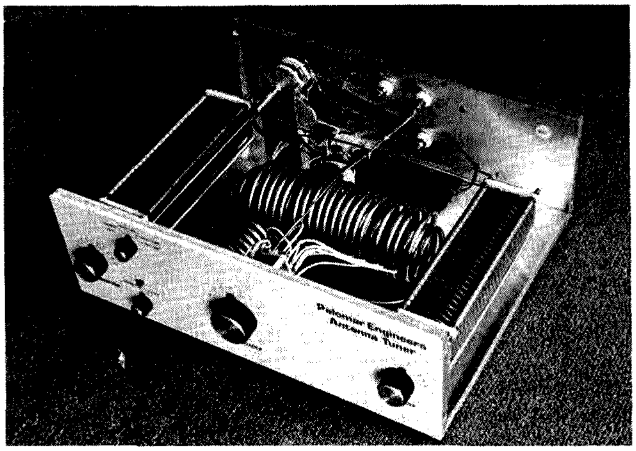
Additional jacks are provided to accommodate a key for Morse code practice (the display reads your fist) and TTL-compatible demodulator output (if desired for ancillary equipment).

In Actual Use

We found the Field Day 2 complicated at first, but a little familiarization session changed the complication into push-button flexibility.

A row of 5 push-buttons provides full control of the unit. Let's examine them in order.

Kantronics' Field Day 2 SWL model.



Palomar Engineers' PT-3000 antenna tuner.

1. RESET clears the display of its last-received information as well as permits the internal computer to adjust to a dramatic change in code speed.
2. SPEED calls up a numeric display of received Morse or RTTY speed.
3. EDITOR assists in the copy of sloppy or weighted code. (SPEED and EDITOR are also used to set the 24-hour clock.)
4. MODE chooses between the reception of Morse or RTTY/ASCII.
5. POWER is, of course, the on/off switch. The clock begins at zero at power-up, and continues as a 24-hour timer unless reset to time of day.

We found the reader easiest to use by audibly tuning in a signal with the receiver speaker, then plugging the Field Day cord into the receiver phone jack. We had previously disabled the Kantronics speaker by plugging the disabling jack with an open connector.

Our silent copy was a pleasure. Bright, large-digit characters danced across the display faithfully reproducing the messages being sent on the other end of the circuit.

Not having to worry about hard-copy printers, demodulators, video displays, or other complex accessories was both financially and cosmetically reassuring.

For the receive-only shortwave enthusiast, the Kantronics Field Day 2 is hard to beat.

The Kantronics Field Day 2 SWL model lists at $464.95. For further information, contact *Kantronics, 1202 E. 23rd Street, Lawrence KS 66044.*

Robert Grove WA4PYQ
Brasstown NC

CURRENT SHUNTS FOR DMM'S

An inexpensive one-milliohm shunt extends the current measuring capability of digital multimeters to hundreds of Amperes. Each millivolt of voltage drop across the shunt means that one Ampere of current is flowing through the shunt. A DMM can thus read all the currents, both ac and dc, found in the home, laboratory, or shop when used with this shunt. In addition, the current in an automobile, including the Amperes to the starter motor and from the charging system, can be read by a DMM.

The shunt is a special low-resistance cable made up of 105 strands of tinned copper wire for flexibility. Solid copper clamps, rated at 75 Amperes and capable of handling much larger intermittent currents, connect the shunt into a circuit. Meter connections are made to the shunt cable through combination jacks that accept tip plugs, banana plugs, or alligator clips. For further information, contact *R. H. Johns-Scientific Instruments, 3379 Papermill Road, Huntingdon Valley PA 19006.* Reader Service number 479.

PALOMAR ENGINEERS' PT-2500 AND PT-3000 ANTENNA TUNERS

It is hard to get excited about antenna tuners. They are just one of those accessories you take for granted. In fact, the name "antenna tuner" is often not correct since many times these matching devices are located far from the actual antenna. Regardless of their name, tuners seem to be a popular way to make your skywire meet the approval of a new rig that balks at any load that causes a mismatch of 1.5:1 or more. Big deal.

Pollution Stopper

Palomar Engineers has taken a new approach to tuner design and operation and in so doing has made this review easier to write and more interesting for you to read. Now, with Palomar's PT-2500 and PT-3000 antenna tuners you can get that perfect match without hours of keydown pollution of the airwaves. A noise bridge allows you to determine the settings that will give a good swr and not strain your rig's final tubes or transistors in the process. You merely flip the front panel switch from operate to tune and then adjust the controls until the introduced noise on your receiver is at a minimum, indicating a match close to 50 Ohms.

Aside from the noise bridge, several other design features set the Palomar products apart from typical tuners. The PT-2500 and PT-3000 adhere to the popular T-type network and use a tapped inductor that is connected to an 18-position switch. When a balanced line is used, the step-down balun is placed at the transmitter terminals; most other tuners put the balun at the antenna input. Palomar claims the relocated balun adds to efficiency.

On the Air

The built-in bridge does not greatly reduce the amount of knob twisting required. However, the noise bridge and its external 9-volt battery do the work, rather than those expensive finals. There is no magic way to find the correct combination of settings. However, once you find them, a quick fine tuning with your transmitter and swr meter is all that is needed to minimize the swr. Jot down the settings so you won't forget them.

The noise bridge cannot be switched in line when you are transmitting. A fuse acts as a means of idiot-proofing. However, if you are like me it won't be long before the fuse is "accidentally" blown. Often the bridge will continue to work after the fuse is blown, but the nulls it gives may be false. The solution, of course, is a new fuse. But where do you buy 1/200-Ampere fuses? This inconvenience emphasizes the need to switch from "tune" to "operate" before you transmit.

These tuners are designed so that you can match balanced lines, random length wires, and coaxial feedlines. In addition, the transmitted signal can be switched to a dummy load via an auxiliary position on the front panel. Our on-the-air tests confirmed the usefulness of the PT-2500's noise bridge and the tuner's ability to match most of the loads we tried. When using high power on 40 meters with the tuner matching a balanced line feeding a tuned doublet, the amount of rf in the shack caused problems with the IC-701 transceiver's solid-state circuitry. This can be partly blamed on the PT-2500's two-piece cabinet which gives less than ideal shielding.

This reviewer has always believed that antenna tuners are one of the few things that today's hams can home-brew easily. A look at advertising shows that many amateurs don't agree and are buying their

tuners. Palomar offers a product that goes beyond the typical matchbox. The PT-2500 and PT-3000 each cost $349.95. More details are available from *Palomar Engineers, Box 455, Escondido CA 92025.*

Tim Daniel N8RK
***73 Magazine* Staff**

ETCO CATALOG

The ETCO Idea Book contains more than 4,000 electronic items, many of them hard-to-find special purchases and factory buyouts. The 96-page catalog is designed for hams, hobbyists, teachers, students, experimenters, and anyone else involved in electronics.

The ETCO Idea Book is free upon request from *ETCO Electronics, Dept. 166, Box 796, Plattsburgh NY 12901.* Reader Service number 489.

RADIO SHACK'S SPACE-SAVER DESK

If you've been looking for a compact, sturdy table for your radio gear, you know by now that most of the presentable alternatives require you to part with a substantial amount of hard-earned cash. Surprise! Radio Shack has come to the rescue with a $49.95 table that is attractive enough to hold a place of honor in your living room.

The Radio Shack Space-Saver Desk is designed for use with the TRS-80 computer system, but it makes an ideal operating position for a ham with a modest amount of radio equipment. The walnut-veneer-covered tabletop looks good and measures 23-3/4 × 37-1/2 inches. On the back of the top surface is a 9½-inch deep shelf with plenty of room for a transceiver, power supply, rotor control, keyer, and other accessories. Underneath the shelf is just enough space for logs, callbooks, and all the usual small paraphernalia that accumulates in a ham station. The shelf is about eight inches shorter than the tabletop, allowing ideal placement of a key or paddle.

The tabletop is supported by two nicely-finished black metal l-shaped legs, which are equipped with screw-in levelers.

In short, if you need a place to put your R390 receiver, 32S-1 transmitter and Alpha 77DX am-

Continued on page 196

Gary L. Anderson WBØGWP
1528 34th Street S.E.
Cedar Rapids IA 52403

VSWR. . .Automatically!

—simplify antenna matching with this self-calibrating tune-up aid

The antennas used at my station have always been simple—usually a dipole cut for 80 meters, fed with about 52′ of 300-Ohm twinlead and tuned with a transmatch, resulting in complete 80 through 10 coverage. The one station accessory always present is the common vswr meter. Over the years, I have used two types, the single-meter version, with the adjust pot and forward-reflected switch, and the dual-meter version, with only the adjust pot.

The Problem

Assuming you have used one or both of the above examples, you know the frustration of trying a new antenna, changing bands, or even just moving within a band. There are at least a half-dozen adjustments to make to get tuned up: grid, plate, and loading on the rig, assuming tube finals which most of us have, full-scale forward set, and forward-reflected switch on the vswr meter, and, finally, two or three adjustments on the transmatch. This can be quite a juggling act.

There are times when vswr decreases and so does forward power, and times when forward power increases as well as vswr. During tune-up, the transmitter power level constantly changes due to a changing load and so does the vswr. Indications change so drastically that, in some cases, quite a bit of time is used hunting for resonance. This can result in lost contacts and some worry to those who own rigs with solid-state finals. This all occurs because the standard vswr meter is also sensitive to power level and this condition helps mask what we are really trying to correct—the source-to-load mismatch.

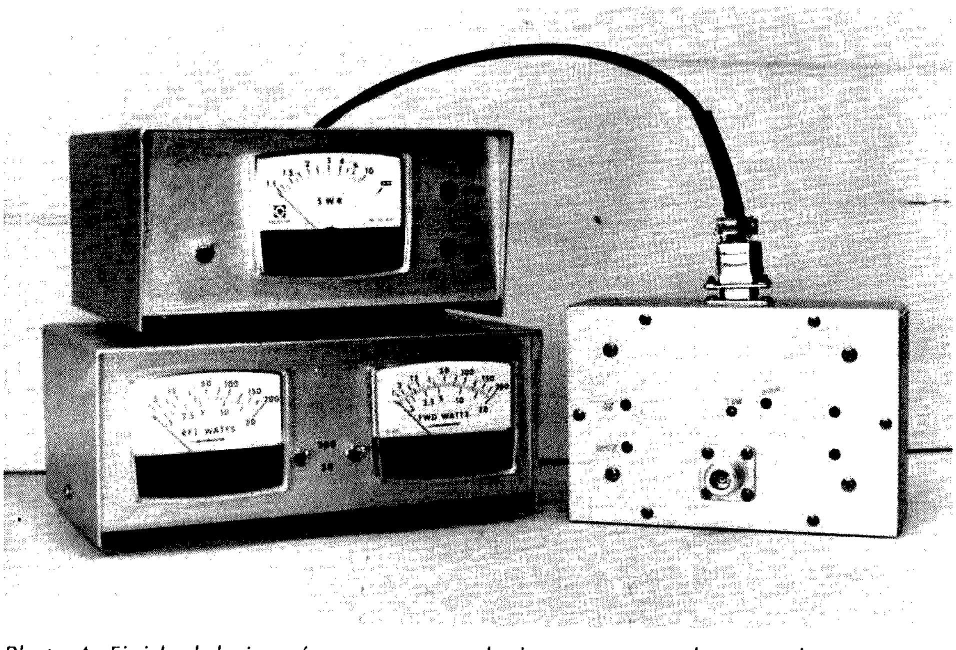


Photo A. Finished design of power sensor, dual wattmeter, and automatic vswr meter.

The Solution

What is needed is a vswr meter which does not react to power levels, but displays only the mismatch. Tune-up would then only require: (1) nulling the vswr

at the transmatch and (2) peaking the transmitter. This would be the end of tune-up. With solid-state finals, step two is omitted and tune-up becomes a real breeze. Photo A shows the finished design, which consists of a power sensor, dual wattmeter, and automatic vswr meter.

I know of another project article on an automatic vswr meter and I credit this one for getting me interested in this idea.[1] However, there were some things that I felt needed to be changed.

First of all, I have always had trouble in the past constructing a power sensor with a flat enough frequency response to cover 80 through 10 meters. Instead of building one from scratch, I used some circuit boards which were purchased from a popular kit manufacturer and which have worked out great.

Second, the earlier design incorporated a dual wattmeter into the solid-state circuitry. If you do not have 115 V ac, you do not have any way to measure power for mobile or battery operation. My design separates the wattmeter and the vswr meter and treats the latter as an attachment to be used when 115 V ac is available.

Third, the earlier design has five calibration adjustments in the vswr meter portion of the circuit. After some work, I got that down to one. Calibration of my vswr meter is very easy and accurate.

Finally, the wattmeter scales in the earlier design were obtained through calibration and the vswr scale through theoretical computations. Unfortunately, they do not match very well: 25 percent reflected power is a 3:1 vswr and not 2.5:1. My vswr meter scale was derived from the wattmeter scale data which provides for a much more accurate indication.

Power Sensor and Dual Wattmeter

Fig. 1 shows the schematic of the power sensor and dual wattmeter. The power sensor was designed around two circuit boards and their associated parts purchased from the Heath Company. The circuit board comes from Heath's vswr/wattmeter kit. The 200-Watt adjustment is the same as the original Heath design, but the line used for forward vswr set is now used for the 20-Watt position with the addition of a 50k-Ohm pot. There is also an adjustment provided for 2000-Watt capability, if desired. The lines going to the null position of the calibration switches in the dual wattmeter were originally used for the reflected vswr position in Heath's vswr/wattmeter and are now used for calibration of the power sensor that will be discussed later. Ferrite beads (not shown) are used on each internal and external lead at the power sensor to reduce rf currents.

The dual wattmeter uses two 0-50-uA meter movements from Radio Shack. The 1.54k-Ohm resistors let the meters appear to have the same impedance as Heath's. The 4.22k-Ohm resistors in series with the power meters raise the voltage that will drive the automatic vswr meter such that a full-scale deflection on a power meter will be equivalent to 500 mV dc at the vswr meter. The 0.1-uF bypass capacitors were added to minimize rf pickup on the forward and reflected lines and across the meters.

Automatic Vswr Meter

The circuit of Fig. 2 does nothing but compute the ratio of two dc voltages. If the meter scale were left at 0-1 mA, then it would read the ratio of V dc-reflected/V

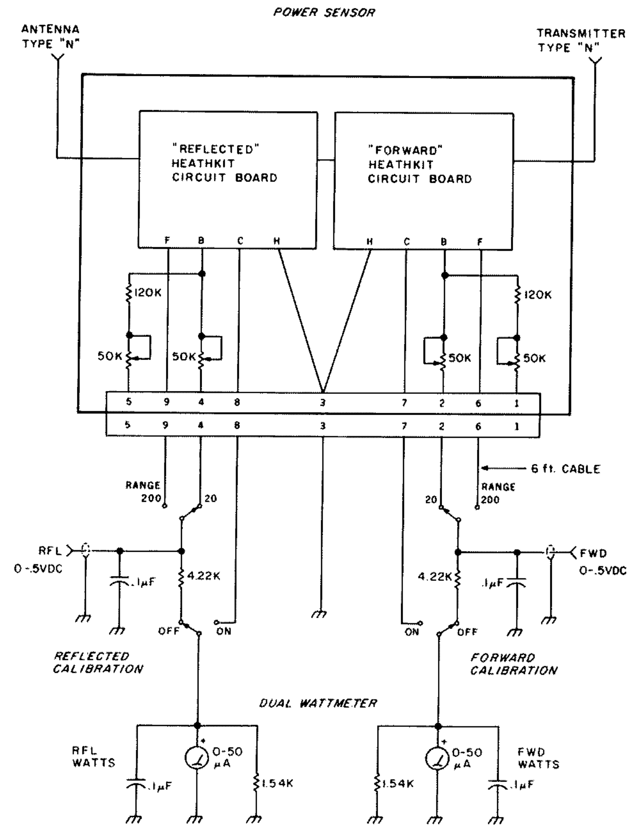


Fig. 1. Schematic of power sensor and dual wattmeter.

dc-forward directly. First of all, the two dc voltages are filtered to keep out rf and then amplified by a gain of about 20 in the LM108As. Note the relatively large values, 0.001 uF, of frequency compensation capacitors on pins 1 and 8 of the LM108As. This also helps in keeping rf from causing erratic operation of the circuit. Next, these two amplified dc voltages are compared against a ramp generated by the digital-to-analog converter as implemented by the 4040 counter IC and the R/2R ladder network. This comparison takes place at the LF356Hs (note the positive feedback for hysteresis). The output of the LF356Hs is a square wave, going from about +11 V dc to −11 V dc since bipolar op amps do not conduct to the supply rail. The negative portion of the square wave is clipped off by the 15k-Ohm resistor and 1N4454 diode combination.

From here, the signals go to digital circuitry. The reflected side gets buffered by two sections of a 4049 hex inverter IC, then drives the meter directly through a calibration pot—that's right, a square wave drives the meter. The forward side generates a reset pulse with the 4013 flip-flop IC which clears the 4040 and starts the ramp all over again. The end result of all this is a meter driven by a square wave whose duty cycle is directly proportional to the ratio of the two voltages V dc-reflected/V dc-forward.

Fig. 3 shows that as the forward component changes in amplitude, the maximum amplitude of the ramp changes also, since it is this comparison which ultimately generates the reset pulse. Consequently, the frequency of the square wave driving the meter also changes, but since the meter is not sensitive to fre-

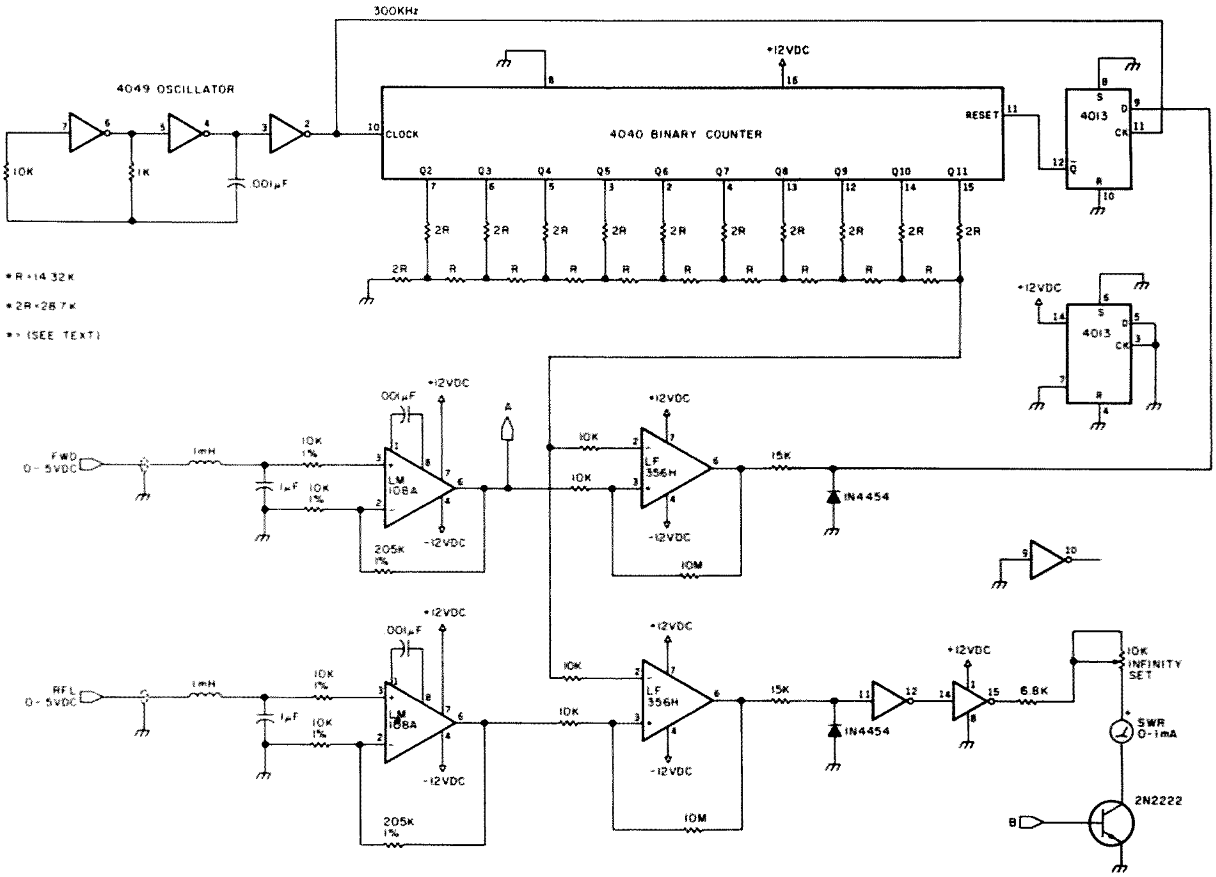


Fig. 2. Schematic of computing portion of automatic vswr meter.

quency, only duty cycle, this is of no importance.

Also, note the absence of a filter cap across the meter. The square wave is at a fast enough frequency such that no meter jitter is observed. The frequency of the 4049 oscillator is approximately 300 kHz. The frequency of the square wave driving the meter will vary from approximately 2000 Hz at a low forward-power reading to 175 Hz for a full-scale forward power reading. The exact frequency is not critical, so no adjustment of the oscillator was provided. The oscillator also clocks the 4013 flip-flop IC to generate a clean reset pulse which starts the ramp over again.

The reason for buffering the square wave with the 4049 inverter IC was to add stability to the amplitude of this signal driving the meter. CMOS logic con-

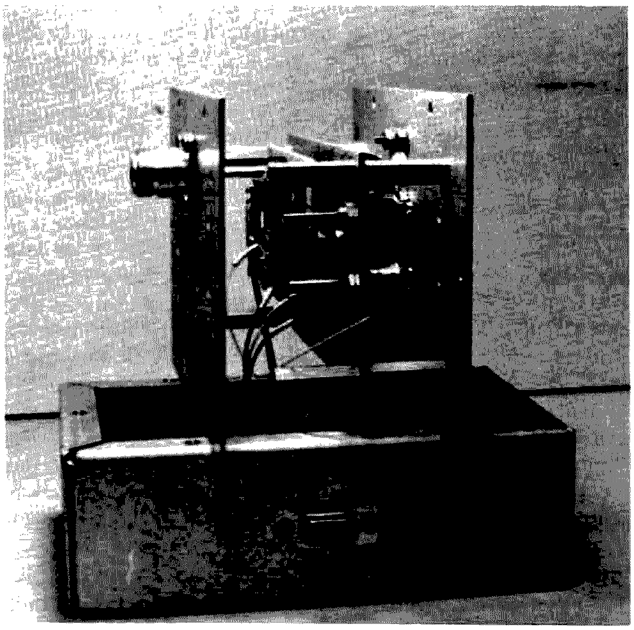


Photo B. Inside view of power sensor sandwich. Note removable side plate.

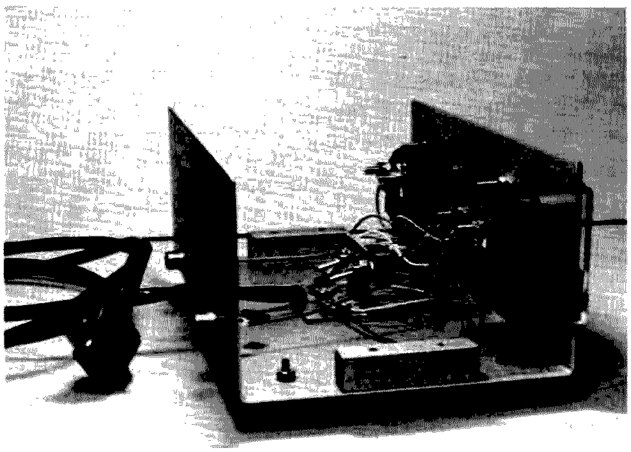


Photo C. Inside view of dual wattmeter. Calibration switches were mounted internally.

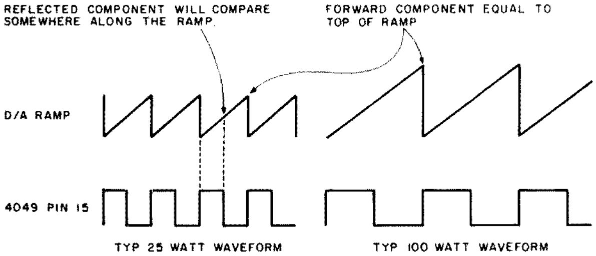


Fig. 3. Waveforms showing change in frequency of the square wave driving the meter with change in power level. A 50% duty cycle, as shown here, equals a 3:1 vswr in both cases (25 and 100 Watts).

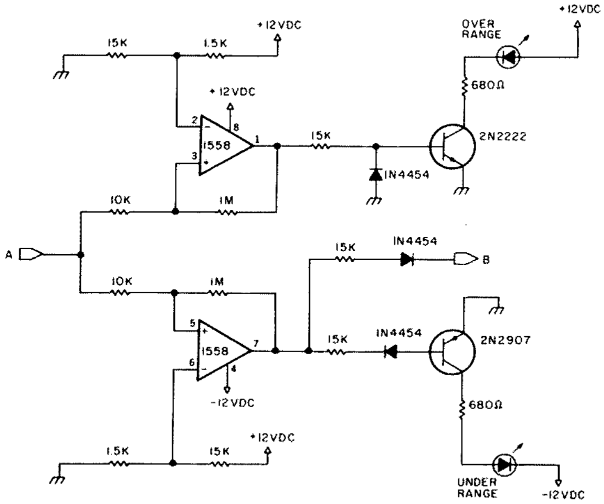


Fig. 4.

ducts to the supply rail and the +12 V dc supply is regulated. The result is a nice, amplitude-stable square wave.

The value of R in the ladder network (Fig. 2) is not that critical. I would stay between 10k Ohms and 15k. The important thing here is that the value of 2R must be exactly double. These resistors must also be 1% in tolerance for a smooth ramp.

A Few Problems

1. During times of no forward or reflected power, as during receive, the vswr computer tries to generate a square wave whose characteristics would indicate a vswr of infinity—this is unacceptable.

2. At low forward-power levels for the range selected, the resolution of the circuit becomes degraded. Consider that the maximum count of the D/A converter is 1,024. A reflected component would then have one of 1,024 counts to compare against if the forward component was high enough to cause a count of 1,024. However, if the forward component caused a count of only 10, that would mean that the reflected component would have only 10 counts to compare against, resulting in a visibly-stepped meter response.

3. An over-range forward component causes erroneously high vswr readings. When watching the vswr meter during tune-up, you may not be aware of the forward power level. Example: Let's say both forward and reflected range switches are in the 20-Watt position, but you are putting out much more than 20 Watts forward, let's say 100 Watts. The LM108A op amp that amplifies the forward dc component will have peaked out at slightly over 20 Watts and will remain saturated at 100 Watts. Now let's say the reflected power is around 5 Watts. The meter will display around a 3:1 vswr when, in fact, it is around 1.5:1.

The Fixes

For problems 1 and 2, I chose to disable the 0-1-mA meter when the forward power was at the low end of the range. I picked a point at about 3 Watts on the 200-Watt range and 0.5 Watts on the 20-Watt range.

As shown in Fig. 4, this was implemented by one section of a 1558 dual op amp IC in a comparator configuration. When the forward component gets too low, the base drive is removed from the 2N2222 that provides the ground for the 0-1-mA meter movement. At the same time, the under-range light-emitting diode is turned on giving you a solid indication that the meter is turned off and not indicating a 1:1 vswr.

For problem 3, I chose to provide an over-range indication to aid the operator. This was implemented by the other half of the 1558 op amp, also in a comparator configuration. The only difference is that the trip point is at the high end of the range instead of at the low end.

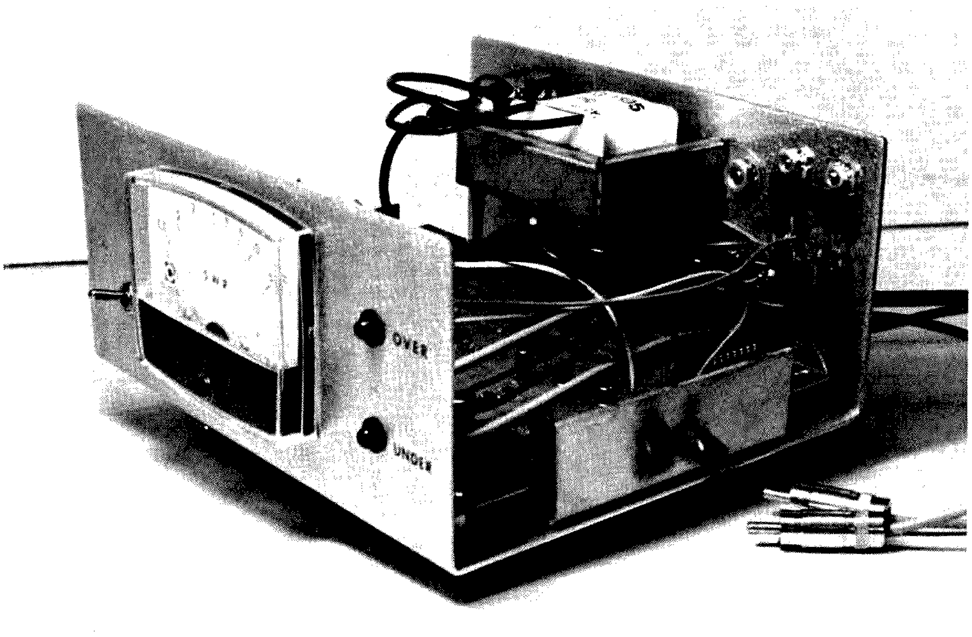


Photo D. Automatic vswr meter. Note that one of the three-terminal regulators is insulated from the chassis.

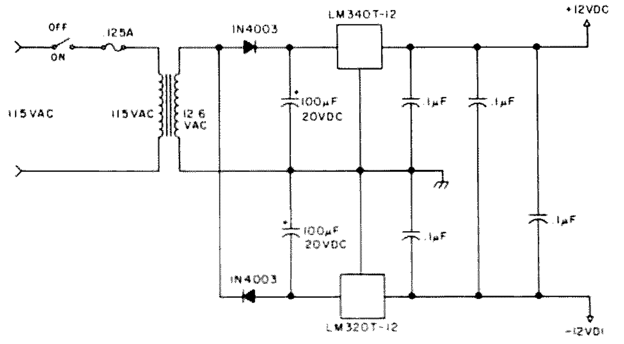


Fig. 5. Power Supply.

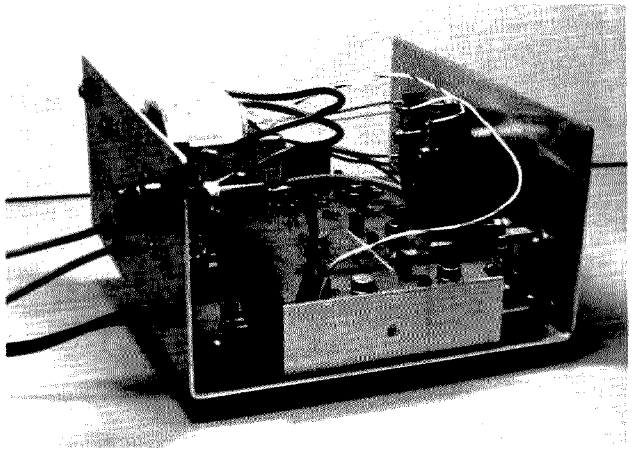


Photo E. Automatic vswr meter, rear side view.

The power supply in Fig. 5 is as simple as I could make it: a voltage-doubler configuration with the capacitors center-tapped to obtain both polarities, a pair of three-terminal regulators, and then some 0.1-uF bypass capacitors. The current consumption is relatively small, about 30 mA for the negative supply and 50 mA for the positive supply. No power-on indicator was included because the under-range light-emitting diode effectively fulfills this function.

Construction Notes

Power Sensor. Photo B shows the wattmeter head "sandwich." Keep in mind that in order for one circuit board to be used for forward Watts and the other for reflected Watts, they must be mounted back to back. One of the sides is removable by modifying one of the type "N" connectors. There are retaining rings holding the center pin in place. Remove the ring from the front of the connector so the pin can slide out the back. Solder the pin to the piece of heavy-gauge bus wire which goes through the toroids of the circuit boards. Do not forget to insulate the bus wire as it goes through the eyelet holding the toroid. A list of the parts needed for the circuit boards can be obtained by ordering the manual from the Heath Company

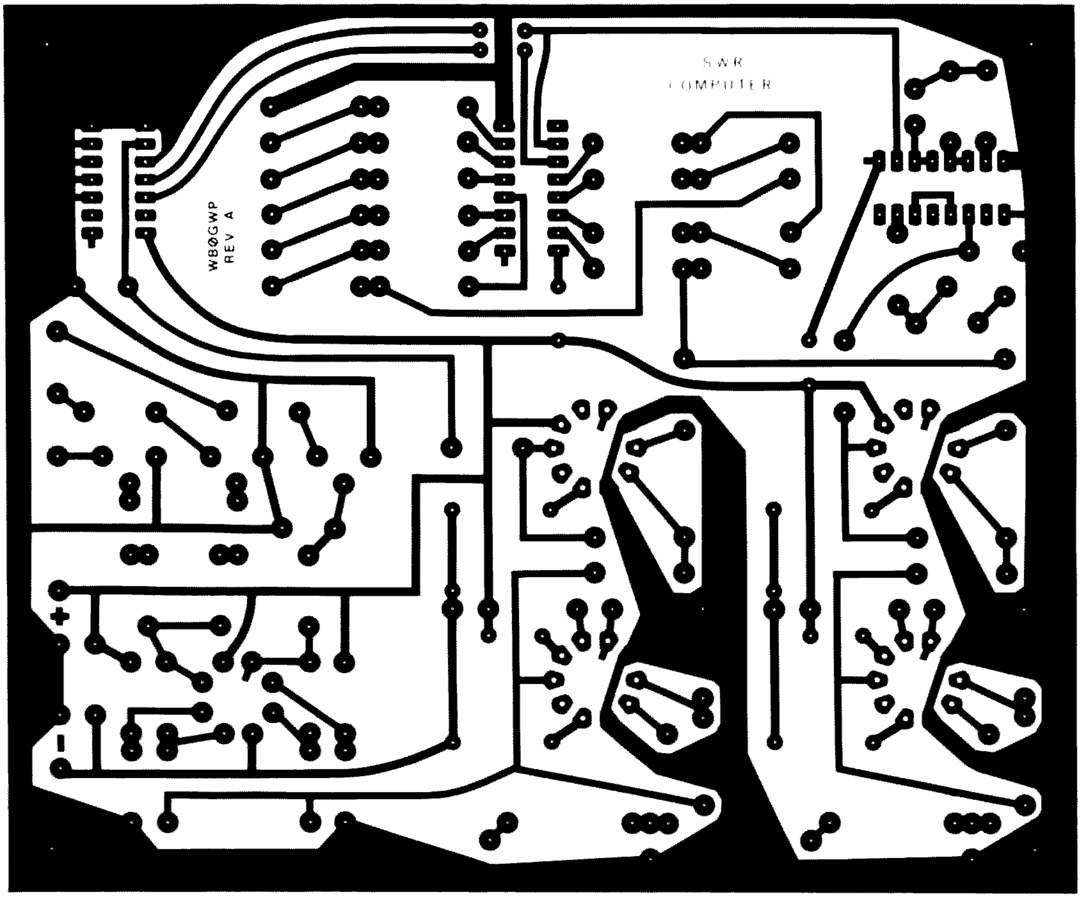


Fig. 6. PC board layout for automatic vswr meter.

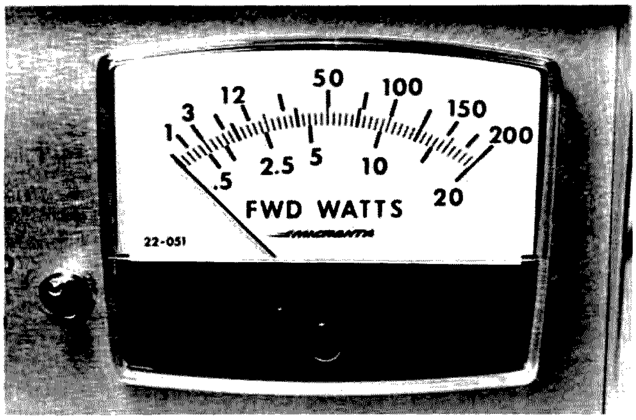


Photo F. Forward power wattmeter scale. Reflected power wattmeter scale is identical.

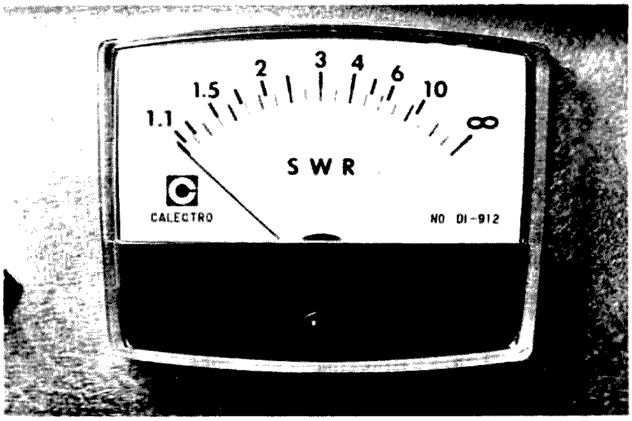


Photo G. Vswr meter scale.

for the HM-102 HF Wattmeter/SWR Bridge.

Dual Wattmeter. Photo C shows the enclosure holding the dual wattmeter. The enclosure was homemade out of aluminum and measures 8″ × 3″ × 5″. The two null-calibration switches were mounted inside the wattmeter enclosure to keep them out of the way. I decided to use two separate SPDT switches for the wattmeter ranges instead of one DPDT switch. I like the added flexibility of being able to look at low levels of reflected power while on the 200-Watt forward power range. Keep in mind that when the two range switches are not in the same position, the vswr meter will not give totally accurate readings.

Vswr Meter. Photos D and E show the vswr meter enclosure which measures 6½″ × 3″ × 5½″. An important point to remember is to insulate the tab of the LM320T-12 from the chassis because the tab is not at ground potential. The circuit board measures 5″ × 6″ and was mounted on 3/8″ standoffs. The circuit board foil pattern and component layout are shown in Figs. 6 and 7, respectively.

Meter Scales. Photo F shows the forward Watts meter scale. The reflected Watts meter scale is identical. The data was obtained by using the equipment in the calibration lab at work. From 80 through 15 meters, the accuracy is within 5% and on 10 meters, it is within 8%.

I removed the existing nomenclature on the 0-50-uA meter scales with the use of an electric eraser.

Parts List

Power Sensor

1	2″ × 4″ × 6″ chassis
2	Type "N" female chassis connectors
2	Heathkit® #85-393-4 circuit board, plus associated parts (see text)
4	50k pot
2	120k, ½-W, 10% resistors
1	9-pin connector
10	rf beads

Misc. hardware as needed

Dual Wattmeter

1	3″ × 5″ × 8″ chassis
1	9-pin connector
2	RCA phono jacks
4	0.1-uF capacitors
2	1.54k, ½-W, 1% resistors
2	4.22k, ½-W, 1% resistors
2	0-50-uA meter movements
4	SPDT switches
4	Rubber feet
7	rf beads

Misc. hardware as needed

Vswr Meter

1	3″ × 5½″ × 6½″ chassis
1	SPST switch
1	Power cord
1	Fuse holder
1	.125 ASB Fuse
1	115-V-to-12.6-V transformer, 1.2-A secondary
4	Rubber feet
2	RCA phono plugs
1	0-1-mA meter movement
2	1N4003 diodes
2	Light-emitting diodes
5	1N4454 diodes
2	2N2222 transistors
1	2N2907 transistor
1	LM340T-12, +12-V voltage regulator
1	LM320T-12, −12-V voltage regulator
1	1558 dual op amp IC
2	LM108A op amp IC
2	LF356H op amp IC
1	4049 CMOS IC
1	4040 CMOS IC
1	4013 CMOS IC
2	1-mH coil
	Capacitors
2	100-uF, 20-V capacitors
6	0.1-uF capacitors
3	0.001-uF capacitors
	Resistors
2	680-Ohm, ¼-W, 10%
1	1k, ¼-W, 10%
1	6.8k, ¼-W, 10%
7	10k, ¼-W, 10%
7	15k, ¼-W, 10%
2	1M, ¼-W, 10%
2	10M, ¼-W, 10%
2	1.5k, ¼-W, 10%
1	10k pot (circuit board mount)
4	10k, ¼-W, 1%
9	14.32k, ¼-W, 1% (see text)
11	27.8k, ¼-W, 1% (see text)
2	205k, ¼-W, 1%

Misc. hardware as needed.

Use great care, when using this method, not to go through the paint to bare metal. All of the lettering was done by using rub-on letters.

The data for the vswr meter scale as shown in Photo G was obtained from the 200-Watt range data and the formula: vswr = $(1 + \sqrt{P_{ref}/P_{fwd}})/(1 - \sqrt{P_{ref}/P_{fwd}})$. The 20-Watt range data did not quite match the 200-Watt range data, so some error will exist when using the 20-Watt range to measure vswr.

Two pieces of equipment are needed to calibrate the power sensor and dual wattmeter: a 50-Ohm resistive load and a wattmeter of known accuracy. I chose not to incorporate Heath's method for calibrating their wattmeter circuit boards because of the availability of the rf calibration equipment at work. Thus, the parts Heath used were omitted from the power sensor circuit boards.

The forward-power wattmeter is calibrated first. Place the forward calibration switch to the on position. With enough rf power applied to give a meter deflection, adjust the trimmer cap on the forward Watts circuit board for a null on the FWD WATTS meter. Keep increasing the rf power and maintain the null.

Place the forward calibration switch to the off position and the forward range switch to the 20-Watt position. Apply 20 Watts as measured by the wattmeter of known accuracy and adjust the 20-Watt potentiometer for a full-scale deflection.

The 200-Watt scale was determined using a 200-Watt source, but one is not necessary to calibrate this range. Since most rigs will put out 100 Watts, I will use this as an example. Apply 100 Watts as measured by the wattmeter of known accuracy and adjust the 200-Watt potentiometer mounted on the circuit board for a 100-Watt indication. A 2000-Watt adjustment was incorporated in the wattmeter head in case I decide to add it on later.

Now reverse the wattmeter head in the line and adjust the reflected side exactly as the forward side. I found the most accurate results were obtained by calibrating the wattmeter at either 7 or 14 MHz.

Calibrate the vswr meter by using the circuit of Fig. 8. Apply 470 mV dc to both the forward and reflected inputs, which simulates a vswr of infinity. Then adjust the Infinity Set poten-

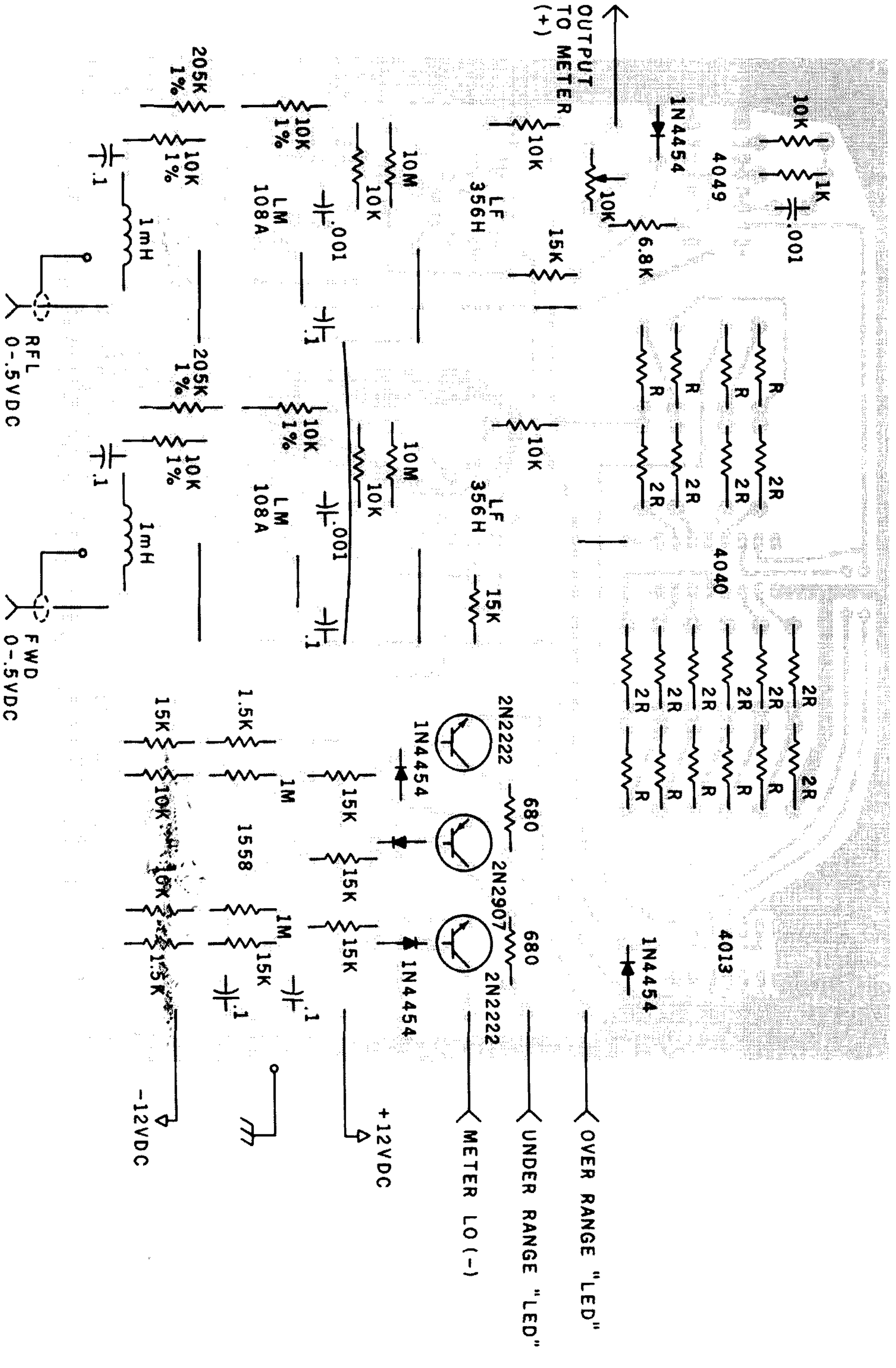


Fig. 7. Component layout of automatic vswr meter. All pin 1s of the integrated circuits have a tab etched to facilitate orientation.

tiometer in series with the vswr meter for full scale.

Operation Field Day

The dual wattmeter-automatic vswr meter combination was extensively tested during Field Day, 1979. The tent it was used in had a longwire and dipole for its antennas and a transmatch for tune-up. Changing frequencies was a snap. While applying low rf power, all the operator had to do was null the vswr with the transmatch and then peak the finals of the rig. Needless to say, the total number of contacts this time was higher than last. You really have no idea how easy tune-up can be until you have tried an automatic vswr meter.

Circuit boards for the automatic vswr meter are obtainable from me for $10 a copy. Also, any correspondence must include an SASE for a reply. Special thanks go to my brother, Carl WBØDFH, for getting me interested in amateur radio back in 1972, Ray WAØPMY, who took the photos, Dave, who helped calibrate the wattmeter ranges at work, and the Field Day gang of NØII/Ø who let me use one of the tents at the site for the acid test. ■

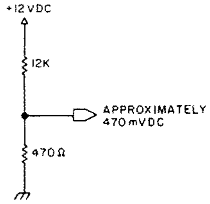


Fig. 8. Vswr meter calibration source.

References

1. David L. Fayman, "A Simple Computing SWR Meter," *QST*, July, 1973.
2. Hank Perras, "Broadband Power-Tracking VSWR Bridge," *Ham Radio*, August, 1979.
3. Staff, "Impedance and Other Ogres," *73*, February, 1979.

Welcome Back, Barry!

—the Scottsdale RC's most famous member

Photo A. When you work in Washington, it's pretty hard to attend meetings in Scottsdale. That's what Barry Goldwater K7UGA tells the Scottsdale Radio Club when attending his first meeting since the club was formed in 1958. In a stroke of good humor, the club had already decided that the Senator should be an honorary member, so they had made him one.

Martin W. Krey K7NZA
7037 E. Chaparral Rd.
Scottsdale AZ 85253

When Thomas Wolfe said, "You can't go home again," he wasn't talking about ham radio operators. Barry Goldwater proved that when he hit home base at the Scottsdale Radio Club for the first time in twenty years. Oldtimers with plenty of white around the ears couldn't remember the last time they saw K7UGA there in the flesh. But he's paid his dues and he's tossed in a portable power unit and other goodies whenever word of a club need leaked up to Ben-Nun-I-Kin (Navajo for "house on the hill"), which is where Barry hangs his hat when he's in town.

When word got around that ol' Barry Sun Dust (Navajo) would be at a meeting and would talk, well over a hundred club members and their guests from around the country packed the clubhouse to welcome him back. For his part, Senator Goldwater chipped in an off-the-cuff talk on a number of ham things that made his listeners hope for an encore somewhere down the line.

Speaking without notes, the Senator delivered a solid half hour of pertinent and zingy ham palaver that left no doubt in anyone's mind why he's been the number one speaker on college campuses for many years. His crackling and witty editorializing won repeated bursts of applause and two standing ovations from the Scottsdale hams before the evening was over.

Club vice president Dennis Reiley WB7PXP introduced Goldwater, and the Senator strode to the dais nattily dressed in gray striped pants and a gray tweed sports jacket. White hair curled gently down over his collar. A true westerner, he wore sleek tan cowboy boots. Over seventy, he's still as trim as he was a few years ago when he slipped into cockpits to fly Air Force jets, and only a slight limp bares evidence of his recent hip reconstruction surgery. And that famous one-sided Goldwater smile was still there.

K7UGA thanked the audience for its warm welcome and apologized for being "such a lousy club member."

"But I think I've got some pretty good excuses," he

added, "which is more than some people can say."

Barry waxed nostalgic for a time, much to the delight of the club. He told of getting into radio when a "wireless store" opened down on the old town ditch in Phoenix, and 6ABH, a mechanic at the Chevrolet garage, let him hold soldering lugs "so that he could pour solder on my fingers instead of his own."

About 1922, Barry became 6BPI and pounded brass on a crystal set.

"With a good crystal and a set of earphones, you could hear Los Angeles in Phoenix—if the wind was right," Barry said.

Goldwater laid claim to being one of the first of the disc jockeys, playing phonograph records late at night over the ham rig belonging to 6ABH, the auto mechanic.

"With just a loop of number 14 insulated wire around the oscillator transformer, we got a call from Mesa (15 miles away) saying they had heard the music," Barry said.

Goldwater said that he had helped build KXAD, the first broadcasting station in Arizona (now KTAR), which first went on the air with a home-brew 250-Watt transmitter. Garage mechanics were resourceful and imaginative in the twenties, so it was only natural that KXAD was constructed in, and first went on the air from, the old Dodge Garage on Phoenix's Jackson Street, now one of the old parts of that booming city.

Barry just missed being in on the development of air-ground communications when he became interested in flying in 1928.

"When you wanted to take off in an airplane in those days, you just took off," he said, "and when you wanted to land, you just landed. There weren't many more regulations than that."

There were inconveniences and possible dangers to such a flying arrangement, even though there weren't today's swarms of airplanes flying. The need for air-ground radio was obvious.

"I thought maybe I could figure out a way that you could talk out of an airplane to the ground," Barry said, "but a young fella named Herbert Hoover, Jr., kinda beat me to it, and I think his family still owns most of the basic patents on air-to-ground and ground-to-air radio."

Senator Goldwater said that he has continued his interest in radio without interruption since the 1920s, although he could not always be as active as he would have liked. Family business obligations and then the pressing demands of political involvement took their toll, and there were times when other hams didn't hear K7UGA's call on the air very much.

Goldwater noted that after twenty years in the Senate, he has finally been put on the Communications Subcommittee.

"That's quite an honor," Barry said, and he pointed out that it took him nine years to get on the Armed Services Committee and still another nine years before somebody asked him a question about it.

"That's the way your Congress is run," he said. "You can go to Washington with all the experience in the world, and the last thing you're going to be asked to do is use that experience."

He pointed out that he was the only member of the Armed Services Committee of either the Senate or the House who had flown a military aircraft.

"If I sound a little disheartening at times," he said, "I'm not trying to lead you on. I'm just trying to tell you the truth." Goldwater pointed out that one of his best friends from Tucson was appointed to the Federal Aviation Agency and the Civil Aeronautics Board, "and he wasn't quite sure which end of the airplane took off first. But he had some idea," Barry said, "and within two weeks he was chairman of that important group."

Senator Goldwater had high praise for Senator Ernest Hollings of South Carolina, who, he says, is a very, very fine Democrat. That's important to hams because Senator Hollings is head of the Communications Subcommittee.

"Senator Hollings is a very easy man for me to work with," Barry said. "He understands that I know a little bit about communications, and consequently he and I usually come to full agreement before anything comes up on the floor that we're going to act on."

This bodes well for the ham fraternity because, as Barry put it, "You don't find many people around with a background in communications. Consequently, you wind up with people who did something nice in a certain election sometime, and they become staff members."

At first glance, it would seem logical that someone as knowledgeable and as persuasive as Barry Goldwater might have considerable success in preserving, protecting, and perhaps even in gaining privileges for hams, but the job is not going to be easy.

"The major problem in communications as far as you are concerned and as far as every user of frequencies is concerned, except television and commercial radio, is that nobody believes there is any other frequency use than television and commercial radio," Barry said. "Consequently, when you get to talking about spectrum, they don't know what you're talking about, and when you get to talking about frequency usages, they can't quite understand you. One of the major problems that we have is finding people on this rule-making board who understand problems that you and I are running into as communicators."

The first problem the Senator chose to discuss was CB.

"You think maybe we have that whipped," he said. "Don't you believe it. There are 15 million CB users that we know about, and within two years every car that is sold will have a CB hooked into the stereo system. We'll someday be seeing 50 to 100 million Citizens Band radios, or, as they like to call it, family or business communicators, using the spectrums that we are not even thinking of now."

Goldwater went on to say that he didn't believe that this increase in number is going to cause any more trouble than it already has and that he is very interested and happy about the number of CB operators that are beginning to move over into the ham frequencies, "especially since they're beginning to make the ham examinations in some categories a little less difficult."

"That little problem that we run into with CB, like using one to five kilowatts in the basement and heard all over the world on two Watts, is something we can't control," Goldwater said, obviously disappointed.

Barry next brought up the problem of the deterioration of communications on the forty-meter band.

"That's a very fine frequency for long-range broadcast purposes," he said. "We are watching the almost complete domination of the band by foreign broadcasters, and more and more of our own broad-

casters want to get in on the forty-meter frequencies."

The Senator said the problem would be dealt with at WARC where we would see how many friends the amateur fraternity has around the world.

Barry struck a hopeful note when he pointed out that there are some good possibilities for frequencies that we haven't been able to get into yet.

"There are some frequencies that have been reserved for military and State Department use and foreign country use that are really not being used. Those frequencies are going to be explored," he said, "to the end that we may be able to come up with something more to offer the world amateur than it now looks like we might."

Barry's next concern was TVI, and he said that unless manufacturers of any equipment that puts out signals or emissions put equipment on it to clean it up, he and his staff are going to reintroduce a bill to require the FCC to force manufacturers to clean up their products. He pointed out it is very inexpensive to do so, costing only from fifty cents to five dollars per unit.

The Senator left no doubt that he hoped the manufacturers would see fit to end the TVI problem without being forced to. "Being a free enterpriser basically, I don't like to see the Federal Government telling anybody else in this country what they have to do," he said.

Goldwater's mood changed when he recalled what focussed attention on the TVI problem, and he couldn't help chuckling.

"That all came about by garage doors suddenly opening in Detroit," he said. "Nobody could figure it out, but one day somebody got smart and checked the harmonics on the Air National Guard, and sure enough, about the eighth harmonic would run the garage doors."

The Senator pointed out that Pan American Airways did emissions studies and "can tell you the frequency of damn near everything that goes into your home." He noted that the studies were done below Ajo and Gila Bend, Arizona, which he calls the largest frequency-free place in the United States.

Barry discussed briefly the rewriting of the Communications Act, a process that is presently causing concern among television and radio broadcasting station owners across the land. The House panel charged with redrafting the 1934 Communications Act is chaired by Rep. Lionel Van Deerlin, D-California, who hopes the job will be completed by the end of 1980. One major concern to broadcasters is the proposal by Senator Hollings to raise $80 million dollars by charging a broadcasting fee. Senator Hollings has said the fee will not apply to CB, ham radio, or other noncommercial operators, and as long as Barry Goldwater is working with Senator Hollings, it probably won't.

One of the problems that really irks Barry, although at seventy he's learned to accept human nature, is discourtesy on the amateur frequencies.

"We'll continue to have our problems with unsolicited interference by amateurs who do not violate regulations but just violate the common laws of decency," he said, "and there's not much we can do about it. I get mail stacked up to my ears on that."

The Senator then chose to elaborate on amateur testing, which he had touched on earlier. "I think we're going to see some rather drastic changes for some of us who have been in this service for so long," he said. "We'll have no code examinations with limitations on the use, we'll have no technical examinations where no technical knowledge is needed, and there is a very growing feeling that a person who wants to become an amateur radio operator doesn't necessarily have to be able to follow a schematic, particularly those damn things they have today. I can lay you out a Hartley circuit and do it blindfolded," Barry snapped, "but you throw a package of transistors in front of me and you're going to wind up with a new hair dryer or something."

The last thing Barry chose to discuss with his club members before giving them a chance to question him was the growing problem of non-ham citizens across the nation referring to what they call the "antenna blight" and urging planning and zoning commissions to help to limit or ban amateur radio and television antennas.

Barry has had his share of problems with the Paradise Valley zoning board over two of his antennas. One of them, which his AFA6BG (formerly AFA7UGA) station operators use for servicemen's phone patches on calls from Southeast Asia, tops out at eighty feet with a Collins 237B log periodic. Now designated a gateway station, Barry's station uses this same antenna for teleprinter traffic between the States and the Pacific islands, handling health and welfare messages. The other "problem" antenna is a Hy-Gain log periodic ninety feet up, used as a backup antenna.

"The California courts have ruled," Barry said, "that in effect, an amateur radio operator having an antenna is not misusing his property any more than is a person having a tennis court or a swimming pool. Those are things that are not needed for everyday living. I don't believe that they [the governing bodies] should be permitted to pass laws that can control the blue skies above your property.

"I'll never forget my answer at putting up those two monsters over at my house," said Barry. "The building inspector in Paradise Valley said, 'Do you have a building permit for those?' and I said, 'No.' He said 'They're gonna have to come down.' 'Well,' I said, 'You take 'em down. Each one of them's sitting in thirty-five tons of concrete, and you just have at it.' He's never come around."

With that, Senator Goldwater concluded his talk, but he stayed right up there at the dais, all seventy years of him, game leg and all, until every club member and guest had had his chance to ask questions and get pleasant, definitive answers. It was easy to see why William F. Buckley called Barry "the friendliest *man* in the history of the world."

One listener wanted to know about a microwave television signal coming off South Mountain, the source of all other television signals aimed at the Valley of the Sun.

"They've been saying things in the paper that anybody that receives their signals without paying for them is stealing their signals. Now, I was wondering how in the world you can steal something that they are putting out for anybody to pick up," said the man, who obviously enjoyed watching full-length movies with no commercial breaks and at no cost.

"Well, I don't think they can make that stand," said

Barry. "I pay a monthly charge for that stuff, and it's not bad. If you have Channel 4 frequency open, I don't know how they can stop you. How could they know you are using it?"

"We had one guy write to them for their monthly program guide," said the man, to the delight of the audience.

The Senator laughed. "You write to me and I'll send you one," he said. "We're very lucky here," he noted. "That's a very fine television company. They have good movies. There are some places back east that put out X-rated movies and all that junk."

Arturo Acquafondata WB7ATA stood up to thank Barry for having supported, in 1974, Senate Bill 93-505, "American Radio Operators, Aliens in U.S." Arturo had emigrated from near Rome, Italy, in 1970, but although skilled in electronics and radio, was unable to get an amateur license. When the Goldwater bill was passed, Arturo was able to get his Novice license after declaring his intention to become a U.S. citizen. He now has his amateur Extra class license.

"Well, that's very interesting, and I appreciate it," Barry said, and he went on to tell about how the bill for reciprocal licensing had come about. "I had a friend in Mexico City who wanted to put his son in the University of Arizona, so he drove his Cadillac up to Nogales. I don't know what he had in that car, but I can tell you it was a station and a half, and they wouldn't let him into the United States unless he took all the radio equipment out. He said, 'The hell with you. I'll go back to Mexico City.' He called me, and I introduced the bill for reciprocal licensing. We've got forty-nine or fifty countries who have agreed with us to have reciprocity—if we go to their countries, we get a license, and if they come to our country, they get a license. But we've never been able to get Mexico to sign up."

A California ham, obviously upset, complained about constant harassment on 7255 kHz and asked if there were anything that could be done about it.

Barry was familiar with the problem. "I've gotten letter after letter on that," he said. "I even have tapes, and I've listened to them myself. The problem is that there's no regulation that says you or I can control any frequency. So a man has a privilege. Even though you say, 'Keep this frequency clear. We're having an overseas phone patch,' he can keep on yakking and yakking as long as he doesn't use foul language or advertise a product or do anything that's contrary to established rules."

"There is one other Six that works around fourteen three hundred, and he gives us fits," continued Goldwater. "Fellas have even gone out and chopped off his antenna leads and it didn't stop him.

"All we have is sort of a gentlemanly rule-of-the-road not to interfere, and I swear it's getting so bad," Barry said, "that I'm even going back on CW to get a QSO going."

Another ham asked who the audience is on the foreign broadcast band and how large an audience it is. The Senator told him that his personal opinion was that the audience could not be large because of the \$300 to \$3000 cost of the equipment involved. He identified the audience as shortwave listeners and those who want to listen to Russian and Cuban broadcasts. He noted that some programs are aimed at building up trade in the broadcaster's own or other countries.

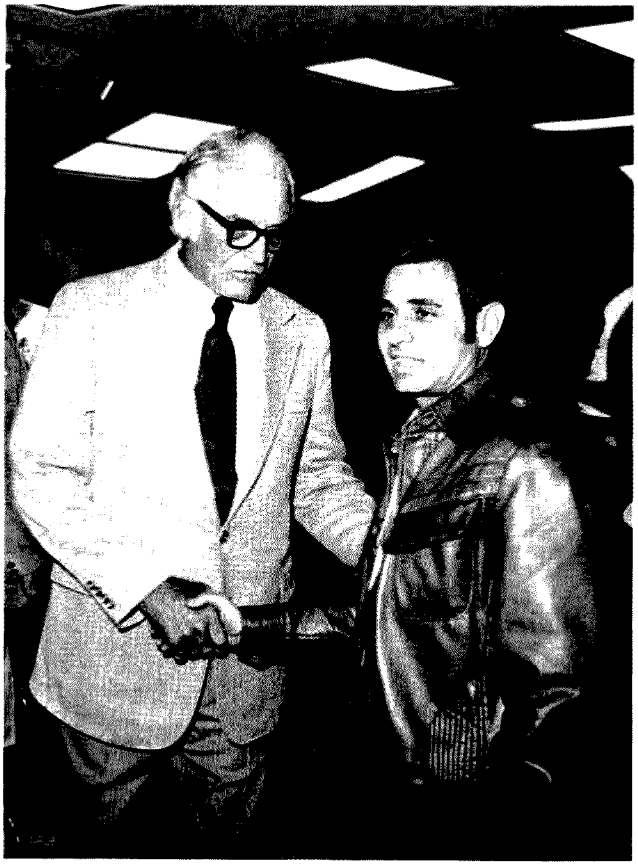


Photo B. Barry Goldwater congratulates Italian immigrant Arturo Acquafondata on his having worked his way up from Novice to Extra in just four years. Arturo had come to the United States in 1970, unable to speak English. He thanks K7UGA for having worked for the necessary reciprocal licensing legislation to make it possible for him to get a license before becoming a citizen.

A ham observed that he hadn't talked to anybody who had heard Barry on frequency lately and wondered if he was still active. Barry said he was hooked up in an apartment house in Washington and didn't have much of an antenna, but he has a Swan 200 and makes quite a few contacts.

"I'm a member of several repeater clubs back east," Barry said, "and I've got an antenna on top of the Senate Office Building and I work Pennsylvania on repeater frequencies. I had a rig in the car until some jerk stole it," he said.

Somebody wanted to know if Senator Goldwater's celebrity status caused any difficulty, and he said he usually has a pileup every time he gets on the air, but he enjoys it.

"Another fella and I wanted to see how many QSOs we could have on one frequency one day, and we got eighteen hundred in eight hours, really just one-second QSOs," Goldwater said. He noted that the pileups have caused Arthur Godfrey and Curt Lemay to quit, and King Hussein had a fit because he can't talk to anybody without a pileup.

Somebody wanted to know if Barry had calls stack up on him when he was working CW, and Barry said it even happened

there. "I get some jam-ups from overseas," he said. "I call CQ, and those Russians really come back. One sent me a QSL card asking for a picture of me and my family. I think the government wants it, not him."

No more hands shot up, so Barry invited the whole club out to Ben-Nun-I-Kin for a swim and a barbecue. "We can drink a little beer or booze and work the station," he said.

The whole club responded by standing and clapping, but it was more for the man than for the invitation, though they valued that very much, too.

Special punch and a lot of nifty little sweet things were served by Carol Reiley WB7UZK and her helpers, and this gave the club members second wind and a chance to bend the Senator's ear with a whole lot more ham radio questions. Barry One Salt (another Indian name) hung right in there until every last ham had been recognized and every question answered. Only then did he slip out the door and head for the home shack, leaving a lot of friends who hoped this would be the year he decided to quit working for the government in Washington and that he would get back to Arizona permanently so they could see him and hear him on the air a little more often.

But Barry's club members weren't through yet. They got in the last word at Arizona's Fort Tuthill Hamfest by joining with all the other hams of the Arizona Amateur Radio Council and naming Senator Goldwater Arizona's Ham of the Year. Barry accepted the award personally at Flagstaff, in August, and the big smile on his face let everyone know that he was home again and loved it. ■

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Return to Shangri-la

—a visit with 9N1MM

After a QSO in 1968, I was invited to drop in to see 9N1MM. It took 10 years to make it, when a trip to India just happened to allow a long weekend in Nepal. The Himalayas were covered with a heavy cloud layer, but DX was great.

It was not as long before my second visit to Shangri-la in the Kathmandu Valley of Nepal. In January of 1980, the second trip was another rewarding experience with worldwide DX—the easy way—from the "top of the world."

We really should know a little more about Nepal. It is a small kingdom situated between India and China, bordered by Pakistan to the west and Sikkirn to the east. These border countries are equally rare prefixes. Kathmandu is the ancient capital with 2000-year-old wooden temples. The site is the fabled Shangri-la, a rich green valley sheltered by the Himalayan mountain range.

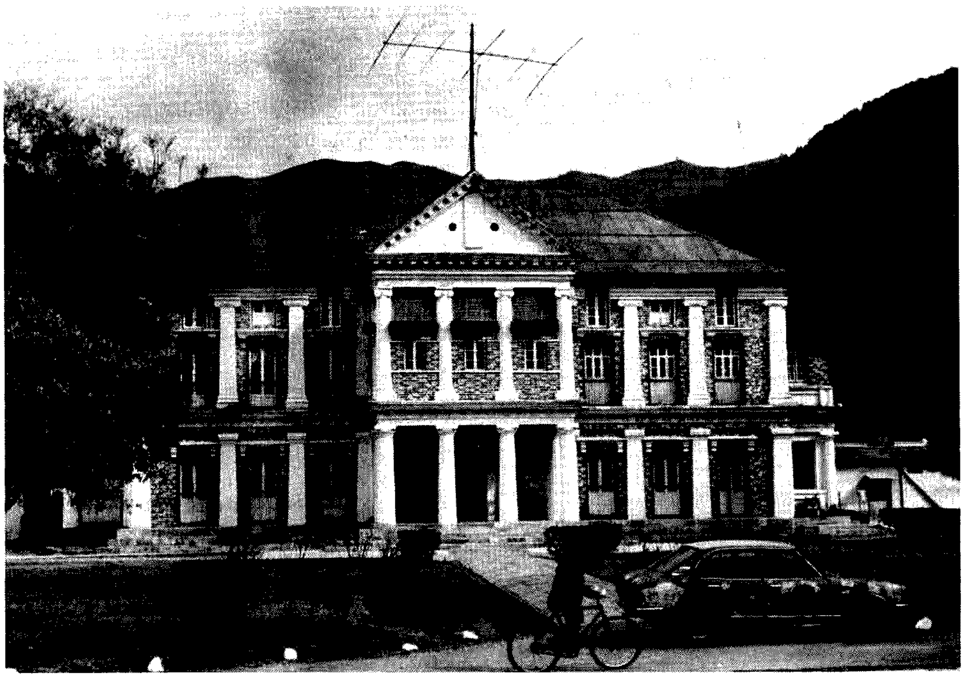

Photo A. Administration building of the Xavier School.

Political rumblings in nearby countries of access pointed to a wise decision *not* to take in gear. Father Moran, furthermore, remarked that his linear was once again in good shape and his own station would be at my disposal. Security checks at most airports are now more rigid than in bygone years. There was the possibility that a transceiver could be impounded by some eager-beaver customs clerk, despite proper documentation.

To get to Nepal, you need a visa from the royal government, obtained from the consulate in Washington DC or New York, and a round-trip ticket. The air approach can be via Bangkok, Thailand, or Delhi, India. Royal Nepalese Airlines

provides jet service and flies along either the Himalaya range or the Annapurna range, depending upon the approach, east or west. Both provide spectacular views. The Bangkok routing allows a 100-mile view with Mt. Everest in dead center as you approach the airport at Kathmandu. The landings are never without some turbulence.

After some brief customs formalities, Father Moran was there to greet me. Upon this, my second arrival in his country, he put out his hand and said, "Welcome back!" After registering at the hotel in the city, we drove the 8 miles to the Xavier School at Godawari.

The road is through ancient villages that reflect a biblical civilization. The houses are of mud-brick, animals are free to roam, women gather at wells, and chickens scatter in all directions; the clock seems to be set back 2000 years. The people are a happy lot and are all smiles.

Arriving at the school administration building (Photo A), a three-story brick structure where 9N1MM's QTH is located, the first thing that hits your eyes is a Thunderbird TH6-DXX on the roof, flanked by a triband vertical and 40- and 80-meter dipoles. Behind the building, you see the foothills of the Himalayas, and a closer examination reveals that the school is surrounded by hills on three sides; the opening of this horseshoe-shaped area points north towards the US.

The shack (Photo B) is on the second floor, and the main gear consists of Drake twins and a Drake linear. The linear is used only on 20 when conditions require it. Since the electric current is 230 volts ac, 50 Hz, it is stepped down and controlled by a monstrous variac. Generally, the line voltage reaching the twins is only 95 volts nominal, and drastic excursions force Father Moran to keep one eye on his ac voltmeter and his right hand on the variac. Sometimes he loses electricity for a few hours and can turn to a 4-kW generator.

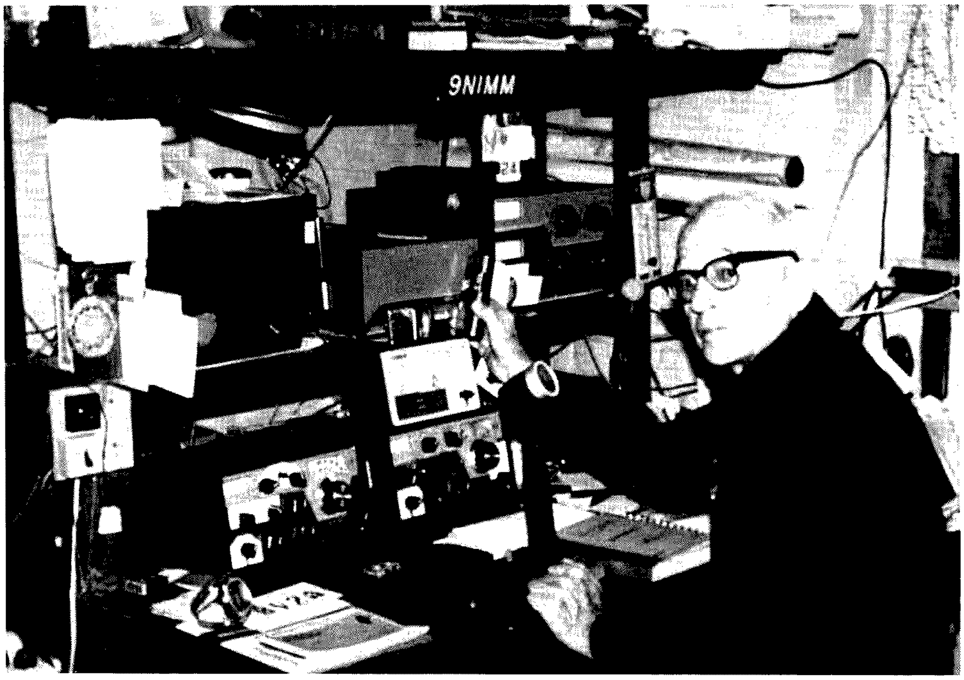

Photo B. Father Moran's QTH.

A Hammarlund SP6JX Super Pro is used for general listening. To the left of the main gear is a very elaborate tape library, tape recorders, and players of all descriptions. The shack is an old-fashioned ham shack, for it has one wall dedicated to QSL cards protected by cellophane holders. Many distinguished awards, plaques, and autographed photos of government leaders decorate another wall.

The moment has come . . . we sit at the operating table, warm up the gear, and get ready for high adventure . . . to be DX from a very rare DX location!

So, what is it like to operate from the roof of the world? What are the conditions on the bands? What can you hear? Let's tune the Super Pro—a receiver with a long wire—and note some readings.

- 160—noise, static, no signals, no LORAN, and, in fact, 160 is not available in Nepal . . . so scratch 160!
- 80—is used for local QSOs and you can hear Indian and Pakistani stations through the QRN.
- 40—is good for 800-1000 miles; it is limited to stations on the subcontinent of India or Siberia.
- 20—is active, brings in worldwide signals, and is, of course, the only worthwhile band.
- 15—is spotty and the receiver brings in reasonably long skip; it takes monitoring and plotting to pursue the operators specializing on 15.
- 10—has infrequent openings to Europe and to the US. Despite the peak of the 11-year cycle, it cannot be relied upon for definite schedules.

That brings us to the topic at hand: DX on 20! The modus operandi of Father Moran in a typical morning or evening session of DXing is a very careful monitoring of 20 from the low end in; he starts on 14,203 kHz. His morning session is between 8:00 and 9:00 am. There is dead silence for awhile and then a few Siberian stations are calling CQ. The beam is now heading towards the North Pole. This direction allows coverage of most of the US, and the band begins to liven up with the W4s. The boys from Florida are in first, and usually W4RHE breaks the barrier. Several W4s are worked and the W3s poke through. A powerful W3 that always thunders in is W3BL. After a few minutes of this "warmup," the W2s and W1s come in. Those with monstrous arrays together with full power stand out and lay in a solid signal.

K1GZL of New Hampshire is a steady entrant, and his 6-element quad simply pours his signal into the Kathmandu Valley. Another strong one is W1ZLG of Massachusetts. The barefoot transceiver boys with tribanders make it, too, but do get clobbered by the big guns. The big boys exchange their greetings and

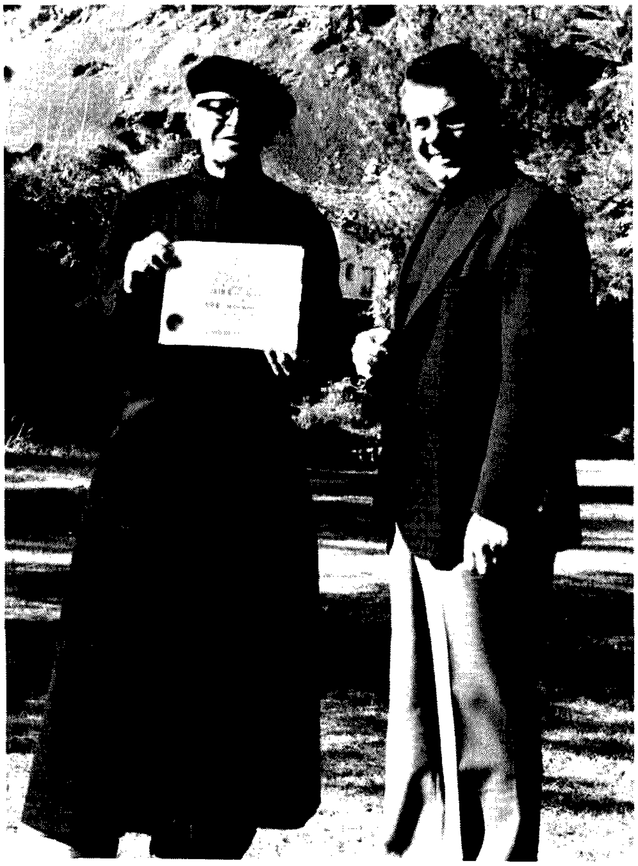

Photo C. Father Moran accepts the SOB (Sons of Boston) certificate from W1QMS.

then kindly move off frequency to give the others a break. There is a mixture-phenomenon of long and short path openings, and now the fun begins. More US districts come in: 8s and 9s and a few 6s plus HKs and YVs. The band is now wide open and the Siberians come in from the north (plus the woodpecker). Pandemonium breaks loose; "bedlam" is mild as a single-word description.

The S-meter now reaches 3—a healthy sign that 20 is alive and that we now can work all that we can hear. There is no pinning of the S-meter. Father Moran says only "Mickey Mouse" and copies the last letters of outstanding callers. There is a quick succession of perhaps 25 such log entries when the band suddenly shifts. Neither he nor I has ignored any callers or pretended not to hear; we peeled the clear signals off the top and attempted to reach the callers at the bottom of the layer (which never is exhausted). There are interruptions from many friends from all over the world, especially the Sea Net.

There are two distinct DX windows to the US in the day. They are 12 hours apart, and as many stations as possible are worked in these two brief openings. Once the last letters are distinctly copied, that station will be acknowledged. When in a pileup the copy is impossible, it becomes necessary to "up five." The first one to come through clearly is answered. This will continue until the band deteriorates . . . and this happens after an hour or so. The telltale signs of failing conditions are evidenced and the window begins to close. The path will reopen in 12 hours. With this assurance and a little patience, 9N1MM can be worked again.

True enough, we now know that with some perseverance and a good antenna system, all DXers can add 9N1MM to their worked list. A log copy is sent to QSL Manager N7BE once a week, and shortly thereafter the treasured QSLs are dispensed.

The "between hours" do provide DX possibilities to other areas of the world. There seems to be a permanent path to G-land. During one of the "between sessions," WA1EYK was heard working a W8. We called him frantically with no luck. He was the only W on at 2:15 pm, Nepal time. Later we discovered that we had forgotton to switch back to upper sideband!

I was by no means the first ham to visit 9N1MM. Gus Browning W4BPD, Armin Meyer W3ACE, and Wayne Green W2NSD/1, among others, have been there, as well as Lowell Thomas and a host of diplomats and movie stars. My host is an unusual man.

Marshall Moran was born in Chicago in 1906, and, as a boy, "played with spark gaps," like so many others. He built many an "oatmeal box" type of receiver, but, regretfully, did not become a licensed W9. He graduated from Loyola University and never lost sight of the wonders of wireless. He constructed various items of radio gear in the roaring twenties, in the evolutionary period of KDKA. He earned tuition money with these construction projects, in this golden era of radio constantly sparked by Hugo Gernsback, the dynamic radio publisher of *Short-Wave Craft*, *Radio-Craft*, and *Radio and Television*.

After graduation, he sailed to the East as Rev. Marshall Moran, SJ, to begin a lifetime career in education/administration on the vast subcontinent of India. He taught at Patna University, and in India became VU2SX in the days of AM. His first Nepal journey was to visit Tribhuvan University. He saw the needs of this northern land, and when Nepal opened its doors in 1951, he traded in the VU call to become 9N1MM. He founded the Xavier School for boys, as well as clinics which later turned into hospitals. Many institutions have him as an active member on their boards of directors. He is the communications link to and from Mt. Everest climbers and their outside world. One evening, SP6ABA, at base camp, relayed a report from the 1980 Polish Mt. Everest climbers. We were both on 75 lower sideband and then switched to 10 meters for a contact with SP5PWK in Warsaw. Fortunately, 10 meters was open to Europe.

On the last day of my visit, a special certificate (Photo C) was presented to Father Moran—a new certificate created by Dick K1RAW and Peter WB1DQC. It is the SOB certificate awarded to those who work members of the "Sons of Boston." Fr. Moran went right to his fellow priests and, flashing the new award, said, "Guess what? I'm now an official SOB!"

So there you have it . . . a rare prefix and unique propagation. The prefix is being supplied to the ham fraternity by the most famous mouse in the world—9N1 Mickey Mouse, the sole dispenser of Nepal QSLs.

If you need 9N1MM, listen patiently near 14,225 kHz during the DX windows. You will hear the activity . . . get in there and call . . . and after your QSO, may you also hear his closing words, "God Bless!"■

Direct Conversion Lives!

—excitingly simple receiver project

Mike van der Westhuizen ZS6UP
PO Box 13947
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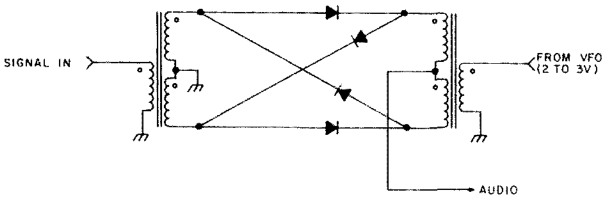


Fig. 1. Passive double-balanced mixer. Transformers are trifilar wound on toroids. Diodes are 1N914, 1N4148, etc.

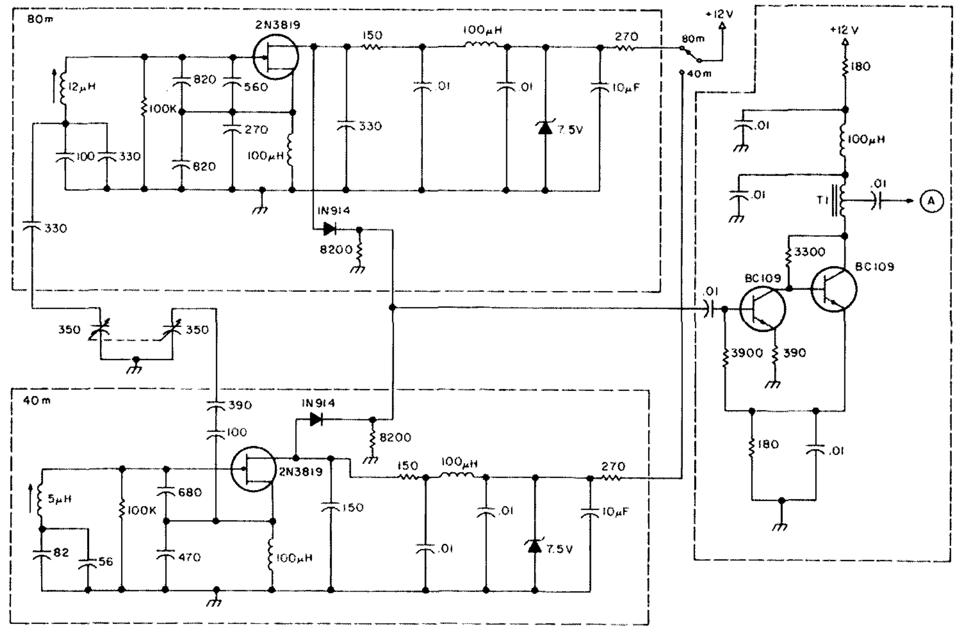


Fig. 2. 80m and 40m oscillators and buffer. The output parts of the oscillators and the buffer are the same as that of Rollema.[3] *For T1, see text.*

Ever since the Japanese started building receivers and transmitters for us, we hams who like to do something with our hands in the evenings were left with building accessories for the shack, QRP transmitters for CW, simple receivers, power supplies, etc. Even power supplies in the high-current range are nowadays probably cheaper to buy than to build.

One of the most interesting of the simple receivers is the D-C (Direct-Conversion) receiver in which the rf signal is converted directly to audio without any intermediate-frequency (i-f) amplification. Through the years, I have built quite a number of versions of the

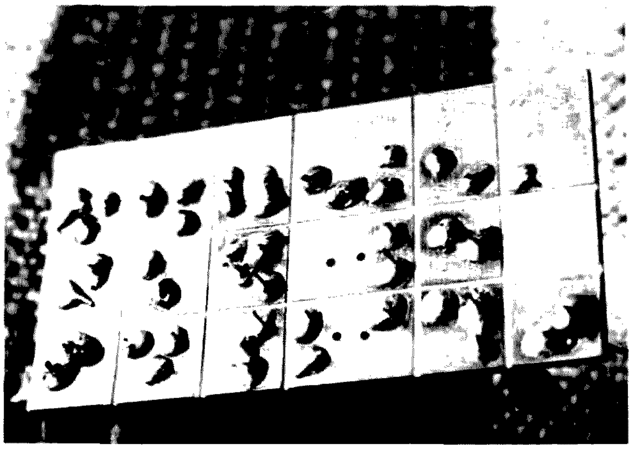


Photo A. Copper side of PC board. The grooves cut in the copper foil are made by an ordinary hacksaw.

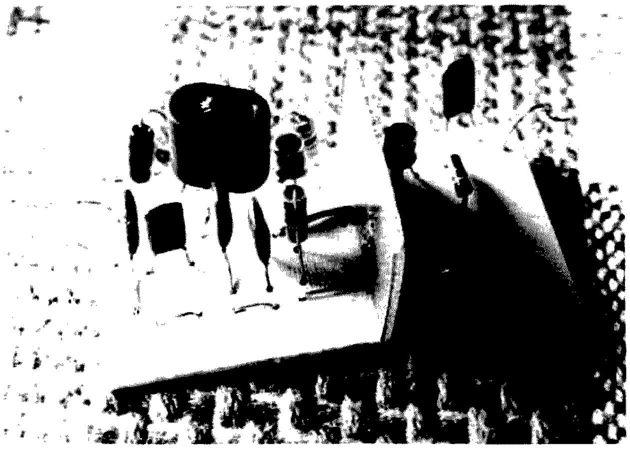


Photo B. Component side of PC board. The buffer module is shown here.

D-C receiver and in this article, I want to present my latest version, which I modestly think is not far from the ultimate, keeping in mind that simplicity is the key word. First, I shall give a few short notes about some parts of the D-C receiver and, thereafter, the complete circuit.

Mixer

The mixer is the most important part of the D-C receiver. My first experiments were all with single active mixers. The 6 dB of conversion gain was always very attractive to me, but with this kind of mixer, you nearly always get AM breakthrough from nearby commercial broadcast stations. This is particularly true of the 40m band, which in South Africa is from 7000 kHz to 7150 kHz; just above the latter figure, there are some strong AM stations.

I then moved to active balanced mixers, more or less like the one used by Rusgrove W1VD.[1] This cured most but not all of the AM breakthrough—you could still hear a little background music between the ham stations! My next move was to try double-balanced mixers using passive elements (4 diodes) approximately like the ones used by O'Grady WA5WWN[2] in a QRP transmitter (represented in Fig. 1).

In my experience, this mixer was the best of all that I tested, and no AM breakthrough was noticed. I was very pleased, when the article of Dick Rollema PAØSE[3] appeared, to see that he came to the same conclusion. PAØSE's article is an excellent one and must surely go down in history as a classic as far as D-C receivers are concerned. PAØSE went even one step further with the mixer and used a ready-made double-balanced mixer, the Anzac MD108. This mixer was unavailable in this country, so I immediately wrote to Anzac in the faraway USA; I was quite surprised when this friendly firm sent me one of their mixers. I tried it and the results were virtually the same as with the mixer in Fig. 1, but with one big advantage: The MD108 needs far less drive from the vfo—0.5 volts—not the 2 to 3 volts needed for the mixer in Fig. 1.

Front End

Builders of D-C receivers are always in doubt as to whether they must use some rf amplification before the mixer. With rf amplification, there is always the danger of worsening the selectivity and AM breakthrough. On the other hand, rf amplification really helps with weak stations in a quiet band. I put an rf amplifier in my receiver and took it out again several times. In the end, I reached a compromise: I put in a broadband rf ampli-

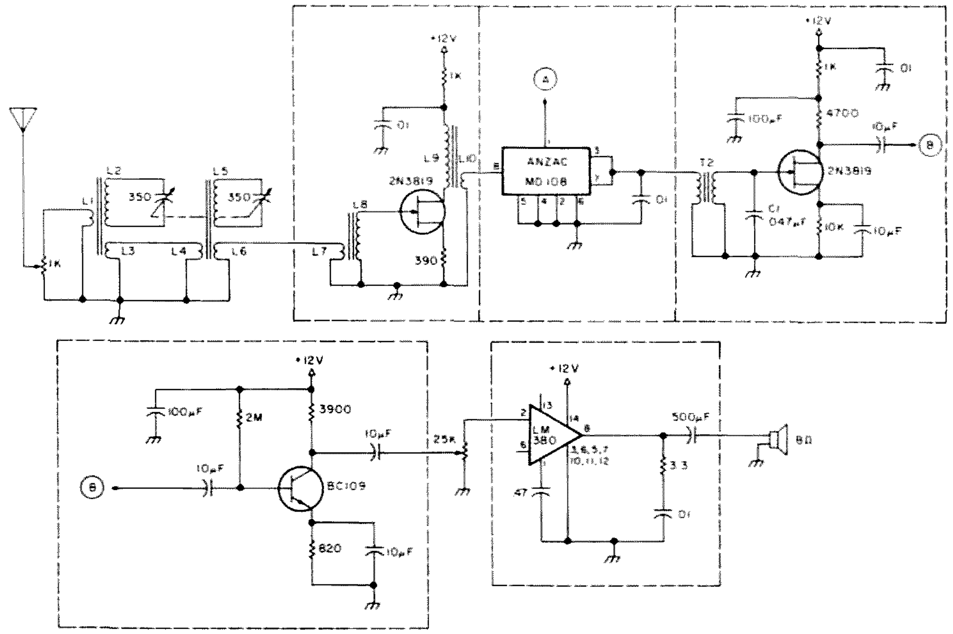


Fig. 3. Input, mixer, and audio parts of the D-C receiver. For L1 to L10 and T2, see text.

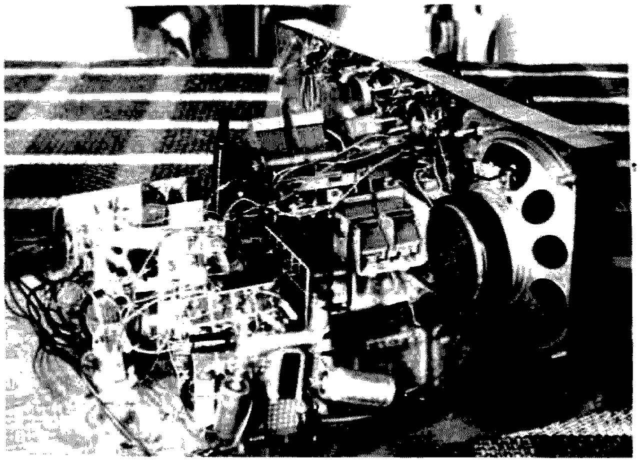


Photo C. Inside of the receiver. The modules are mounted vertically by means of Terry clamps.

Photo D. Front part of the receiver. The extra switches and sockets are for interfacing with a 5-Watt DSB transmitter.

fier with low amplification, but with a DPDT switch to disable the amplifier if I so wished. To avoid confusion, this switch is not shown in the circuit diagrams.

The complete circuit diagram of my 80m/40m receiver is shown in Figs. 2 and 3. Here are some notes about the circuit.

Audio Filters?

Purists will immediately ask: Where is the audio filter? I tried several audio filters and found out one thing very quickly: The input impedance of the filter must exactly match the output impedance of the preceding stage; the same applies for the output of the filter and the input of the succeeding stage. The other problem was that no cheap 88-mH inductances are available in this country. The best filter that I used had more or less the same effect as capacitor C1 in Fig. 3. So I chucked out the filter and used only this capacitor. I use my receiver only for SSB—perhaps if you want to use it mainly for CW, a filter is necessary.

Construction

My experience is that no two hams use the same construction methods, so here are a few sentences on my own construction method—which is far from ideal. May I say, first, that I am no sucker for miniaturization; with my construction method, you can't put the receiver in a cigarette box, etc.

I divided the receiver into eight parts as shown by dotted lines in Figs. 2 and 3 and built each part as a separate module. For each module, I used the square block method, which means cutting the copper side of a piece of PC board into squares and mounting the components on the squares. For later modules, I drilled holes through the board, mounted the components on the bare side, and soldered the leads on the copper side. This is illustrated in Photos A and B. Each module was mounted vertically with Terry clamps on the bottom of a homemade cabinet. Photo C shows the inside of the cabinet. The module method has the great advantage that you can change a component on a module or replace a module with another one with the greatest of ease.

A form of slow-motion drive for the tuning capacitor is essential. Lady Luck sometimes, just sometimes, smiles toward the building ham. Here it was my turn, and from the deepest part of my junk box, I dug up a very old slow-motion drive—but a beauty! You can't buy such things in South Africa. With this slow-motion drive, I cover the 80m band (3500-3800 kHz in South Africa) with 25 turns of the knob. It works out at 12 kHz per turn, which is just about ideal. If no slow-motion drive is available, a 20-pF variable capacitor can be put in parallel with the main one and used to fine-tune an SSB signal.

Photo D shows the front part of the receiver. The few extra switches and sockets are for interfacing with a small 5-Watt DSB transmitter.

Inductances L2 and L5 are wound on toroids. I shall give no details on the number of turns as I have no idea of the characteristics of the toroids I used—they are unmarked and came out of an unmarked cardboard box in the corner of a local radio shop. As always, it is best to use a gdo to determine resonance. Links L1, L3, L4, L6, L7, and L10 can be 5 or 10 turns to start with. L8 and L9 also are wound on toroids and can have an inductance of, say, 50 to 100 mH. Transformer T1 is described fully by Rollema. I won't repeat it here, except to say that it has a step-down voltage ratio of 3 to 1 and the secondary impedance is 50 Ohms. An ordinary toroid with the right turns ratio will probably work just as well.

Results

I was genuinely surprised with the performance of this receiver. To quote the words of Rusgrove, "A well-designed D-C receiver will provide a certain, pleasing clarity and depth of sound . . . signals seem to stand out against a nearly noiseless background." Also, the words of Rollema: "It is a real pleasure to operate the D-C receiver."

I did not have a calibrated signal generator to measure the sensitivity of this receiver, but it compared very well with my FT-301. Selectivity is just a little bit worse than that of the FT-301.

In conclusion, I have used my D-C receiver now for over a year and it still gives me a deep sense of satisfaction to tell the chap on the other side, "Equipment on this side is home-built, old man."■

References

1. J. Rusgrove W1VD, "A 20-meter High-Performance Direct-conversion Receiver," *QST*, April, 1978.
2. C. O'Grady WA5WWN, "Quazar QRP 40-meter DSB Transmitter," *73 Magazine*, January, 1970.
3. D. Rollema PA0SE, "Second Thoughts on the Direct-Conversion Receiver," *Ham Radio*, November, 1977.

Tim Daniel N8RK
73 Magazine Staff

Hams vs. Hurricane Allen
—73 aids St. Lucia relief efforts

Hurricane Allen: Weather scientists labeled it as the second worst storm ever recorded in the Atlantic. Television and newspaper reports kept everyone from South America to Canada fascinated and sometimes terrified as Allen weaved and bobbed across the Caribbean, leaving death and destruction in its wake. This story is a testament to the awesome force of a tropical storm as well as to the heroic role played by ham radio. While based on my first-hand experiences during an eight-day visit to the Caribbean island of Saint Lucia, this article belongs to hams everywhere.

Thanks to weather satellites and other space-age technology, Saint Lucia had plenty of warning that its 238-square-mile island was the first land in the storm's projected path. Preparations were made, and as darkness approached on Sunday, August 3, 1980, the 80-meter band was busy with chatter between Saint Lucia amateurs and hams on nearby islands. Shortly before 11:00 pm local time, the prime ministers on the islands closest to the hurricane's center issued final words urging calm. Then the power went off and a terrifying night began.

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D C 20523

AUG 27 1980

Mr. Wayne Green, Publisher
73 Magazine
Peterborough, New Hampshire 03458

Dear Mr. Green:

Our office is returning to normal after responding to the emergency needs of the Caribbean victims of Hurricane Allen. The U.S. Government through this office and the U.S. Embassy in Barbados has so far provided over $200,000 in emergency food, shelter materials and relief supplies. The U.S. Government has also committed an additional $400,000 to repair critical public buildings such as schools, and health facilities. I am enclosing our most recent situation report on St. Lucia so that you can see the type and amount of assistance provided by the U.S. Government and private sources.

One of the critical links in the U.S. Government's response to this disaster was the amateur radio network between St. Lucia and Barbados and between Miami and St. Lucia. My staff relied on the Ham radio reports for news of the situation and for information on current needs. Tim Daniel's efforts in support of the St. Lucian Ham operators was a major contribution and his observations upon his return provided us with valuable insights into the situation in St. Lucia. Your support of his efforts is commendable.

I am attaching a copy of my letter to George Naftzinger (W4 PPC) net control in Miami whose assistance in this disaster response effort was invaluable. Please convey our appreciation to all those on your staff and to the many amateur radio operators who participated in this important effort.

Sincerely yours,

Joe Mitchell

Joseph A. Mitchell
Director
Office of U.S. Foreign Disaster Assistance

Attachment: a/s

cc: George Naftzinger, Net Manager
International Assistance Net
11260 SW 176 Street
Miami, Florida 33157

Brian Cordray, Ham Club
COM/CPS, 705E, SA-18

Tim Daniel, 73 Magazine
Peterborough, N.H. 03458

Saint Lucia—Before

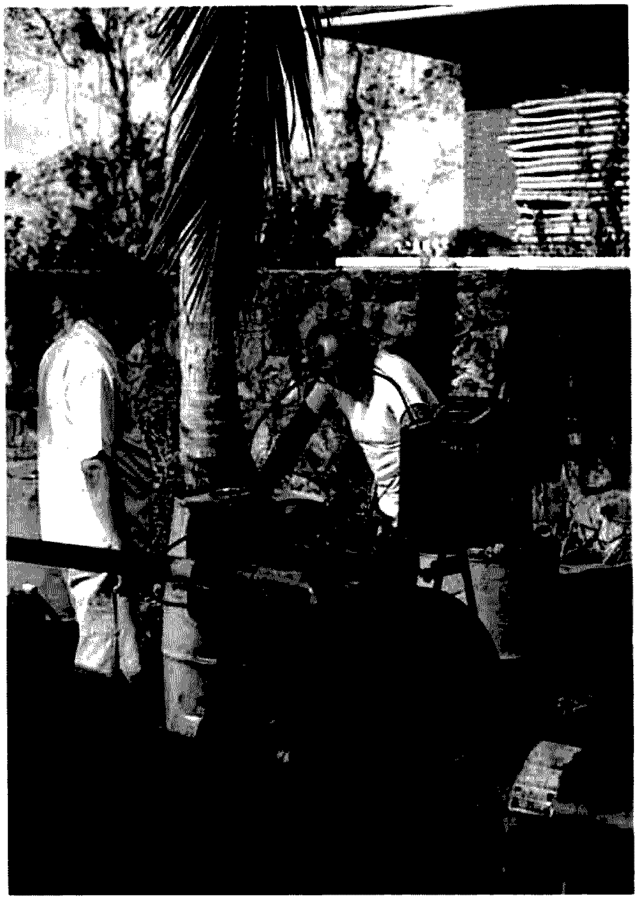
Prior to Hurricane Allen's strike, the people of Saint Lucia were quietly developing an island paradise. Banana and coconut production was on the increase and the government was starting to encourage light industry and commerce. Saint Lucia's spectacular mountain terrain and sandy beaches had long attracted thousands of tourists from Europe.

Although originally settled by the French, Saint Lucia spent 165 years as a British colony. On February 22, 1979, the 130,000 citizens of Saint Lucia formed an independent nation. Incidentally, on that day, amateur radio callsigns changed from a VP2L prefix to J6L. Another day that will be long remembered is August 4, 1980, when the fledgling nation assessed the results of Allen's fury.

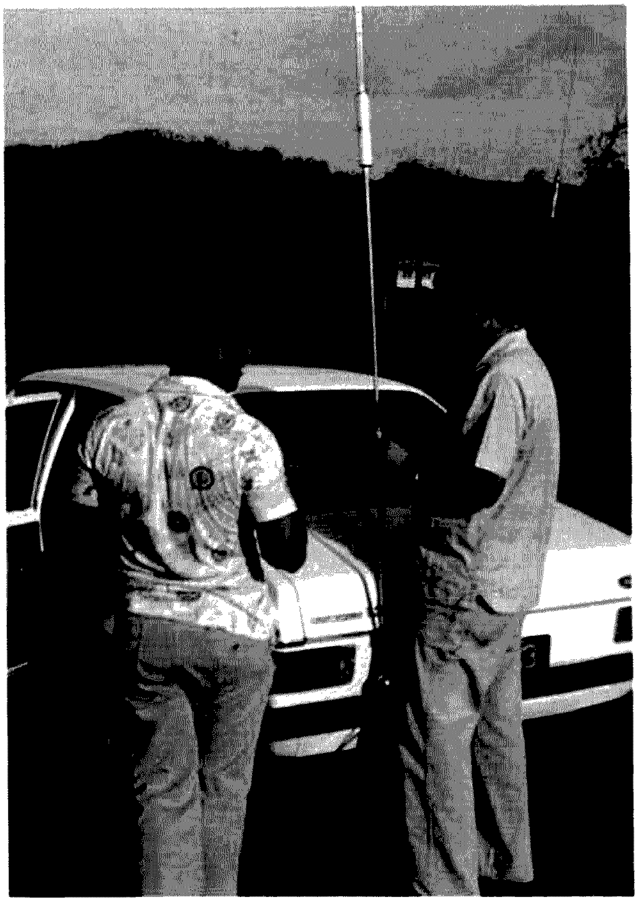
Saint Lucia—After

Words alone cannot adequately describe the damage suffered by Saint Lucia. Hurricane Allen did not discriminate—homes of the rich and the poor were flattened. Of three buildings standing sides by side, two would be left unmarred while the one in the middle would be missing its roof and windows. Everywhere you looked, trees were down and most if not all of the delicate banana crop was wiped out. Miles of power and telephone lines were left lying on the ground, leaving Saint Lucia in the dark with no way to communicate internally or with the rest of the world.

Perhaps the first voice to



Generators provided by Hess Oil Company helped to keep Don J6LJS on the air. St. Lucia Amateur Radio Club President Vic J6LDJ watched the refueling operation.



A roadside stop was necessary for J6LDJ (right) to change the antenna from 40 to 80 meters. The frequency switch was made every evening when the QRM rendered 40 meters useless.

announce Saint Lucia's plight was amateur radio station J6LJS. Operated by an American, Don Johnson, J6LJS used battery power to describe the situation on the 14.325-MHz Hurricane Information Net. While Don's house survived, the mast for his Cushcraft triband beam was pushed askew. Miraculously, the antenna was unscathed by the 160-mile-per-hour winds.

Wildly fluctuating line voltage had knocked Don's Kenwood TS-820 out of commission a few hours before the storm struck. Luckily, he was able to get back on the air after repairing the 820 with parts cannibalized from another rig. Disaster conditions demand the most of equipment; the ability to make emergency repairs is essential when the nearest service facility is thousands of miles away.

While J6LJS's terse reports alerted the rest of the world, other members of the Saint Lucia Amateur Radio club swung into action to provide internal communications.

Because of Saint Lucia's mountainous terrain, hams there were already experienced at operating a local network of 40 meters in the daytime, shifting to 80 meters at night. Stations would be needed at the various relief control points, the two airports, and eventually in the outlying cities and towns. This meant assembling gear, antennas, and batteries or generators while the roads were being cleared and damage assessed.

Enter 73 Magazine

Jeff DeTray, WB8BTH, *73 Magazine's* assistant publisher, had been following the progress of Hurricane Allen. Shortly after hearing the reports coming from Saint Lucia, he offered *73's* assistance in the form of HF gear and VHF commercial hand-held units. This announcement went out on the 14.325-MHz Hurricane Information Net on Monday morning. Among the Saint Lucians who were in the U.S when Allen struck was Tim James J6LT, a government information officer. Through Ham Robinson W4ZR, Tim kept abreast of the situation prior to Sunday night. Following the hurricane, J6LT began organizing equipment and a way to return to Saint Lucia.

When Tim and Ham contacted *73* on Tuesday, August 5, plans moved into high gear. Initially, we hoped to pack two complete HF stations and 10 hand-helds with chargers, sending them to J6LT in Miami on an afternoon flight from Boston. The appointed time to leave passed without the necessary confirmation from Miami. The gear was still in Peterborough, with several anxious staffers waiting by the phone. Shortly before 4:00 pm, *73* publisher Wayne Green W2NSD/1 decided the gear should be

hand carried to Saint Lucia and manpower assistance provided to the Saint Lucian operators. This left only a few hectic hours to plan and pack before I had to leave on a night flight to Miami.

After deplaning in Miami, I waited eagerly for the luggage to appear. Without those four metal suitcases marked "Emergency Communications Equipment," my trip would be in vain. Not to worry: Delta Airlines soon had all four cases in my hands. Next I had to find Tim J6LT. Later, Tim and I discussed the situation; he was tired and anxious to return home, but after some hurried arrangements, I had a ticket for a flight to Barbados, just a few miles short of Saint Lucia. While flying south, we both stole a few hours of sleep; neither of us knew what to expect when we arrived at our destination.

Arrival in Barbados meant another anxious wait for the luggage. One, two, three . . . four—safe and sound. Now on to Saint Lucia. It was Wednesday, August 6, two days after Allen had passed and the first commercial flights were going to the island on an irregular basis. While we waited as standby passengers on an island-hopping flight, I noticed that life proceeded "as usual" on Barbados. I was carrying radio gear in one hand and a small pack with food and fresh water in the other; the other passengers were headed for a different island paradise with tennis racquets and beach togs.

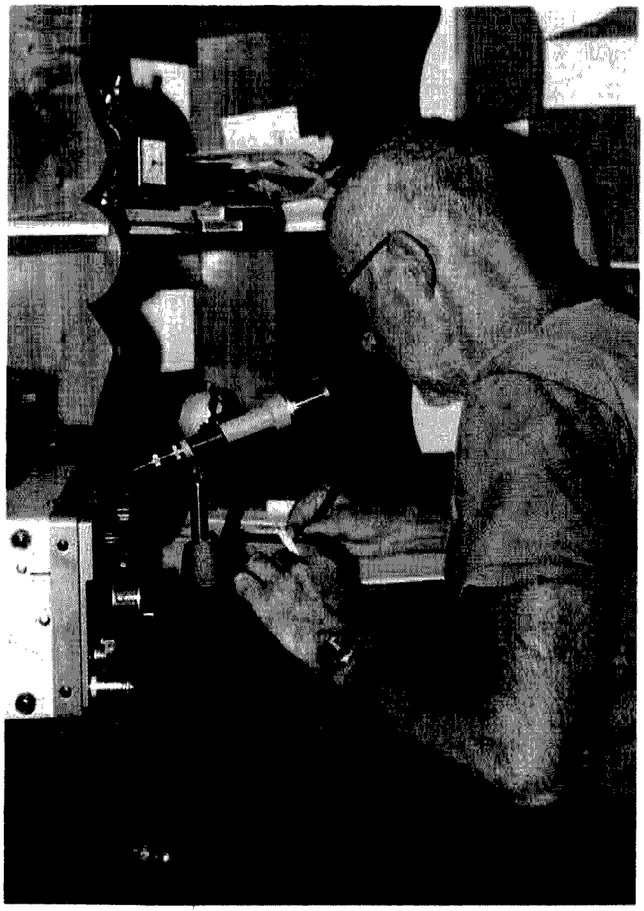
When the small prop plane taxied down the runway towards Saint Lucia, Martinique, and other islands to the north, Tim and I found ourselves lucky enough to be aboard. At the end of the half-hour flight, we got a bird's-eye view of Saint Lucia's western coastline. The broken trees, wrecked homes, and ravaged shoreline evidenced Allen's visit two days earlier.

The Vigie airport in Castries, Saint Lucia, was a beehive of activity as tourists struggled to go home and islanders returned, hoping to find their loved ones safe. We were waved through customs and I found myself on the sidewalk shaking hands with Vic J6LDJ, President of the Saint Lucia Amateur Radio Club.

Prisoners and Dipoles

The next few hours were busy as Vic and I visited different communications posts around Castries and discussed the best way to utilize my time and the *73* equipment. We visited the central police station, where a torrent of information was being processed. A makeshift HF station had been set up. To expand its capability, we replaced the 40-meter dipole with an all-band model I had brought along with the rigs. Since none of the hams present were avid tree climbers, an acrobatic prisoner from the jail was requested. He somewhat reluctantly climbed a nearby palm tree under the watchful eyes of his amateur jailers who sincerely hoped that no escape attempts would be made. The urgency of the situation somehow dissolved into humor as our unorthodox antenna party went about its business. The resulting aerial violated a number of the laws of dipole installation, but nonetheless it put out a good signal and was fondly named the "J6L Special."

The next stop was J6LJS's QTH. Located on a hill overlooking the airport and Castries harbor, there was plenty to observe as Don's home rivaled Grand Central Station at rush hour. In addition to amateur operation on 20 and 40, the newly-arrived U.S. Navy had chosen this spot as its communications post for shore parties. Amid the confusion, I met Don and his wife Mary J6LKT. They were busy trying to pass on health and welfare inquiries and keep track of the generators which kept the radios on the air as well as powered a refrigerator and lights.



Don J6LJS handled hundreds of pieces of traffic. In one week's time more than forty hours were logged on the International Assistance Net alone.

I got my first good look at the Caribbean landscape on an hour-long drive to Saint Lucia's other principle city, Vieux Fort. Located at the southern end of the island, Vieux Fort and the surrounding towns were clobbered by the full force of the storm. The accompanying photographs better illustrate the destruction than I can describe with words.

Vieux Fort's Hewanorra airport was of great interest to us since it would be the location where most of the relief supplies would eventually land. Joe J6LHV had set up a station there prior to Sunday. When emergency generators were running, he was able to provide the only link between the south and the rest of Saint Lucia. Two of the VHF rigs were left at the airfield so that Joe could keep in touch with the control tower when air traffic resumed. This link would prove to be vital in a few days.

Darkness caught up with Vic and me as we made a final stop at St. Jude's Hospital. Normally, Sister Mary Mark J6LBR would have been there. Instead, she was

Thousands of St. Lucians were left homeless and many moved in with friends or relatives. Others lived in temporary shelters.

in the U.S., making plans for a hurried return with medical supplies. In her place was Hogarth J6LCU. Later I was to see the remains of his home. Luckily he was able to get on the air with Sister Mark's station. A VHF link was established between the hospital and airport in hopes of relieving some of the traffic on the HF net.

The drive back to Castries was eerie as we passed through small towns lit only by a few candles and lanterns. Vic's TS-120 gave us company while we monitored the 80-meter net. Stations from up and down the Windward and Leeward Islands were checking in, helping to relay the heavy flow of health and welfare traffic. Vic and I listened closely as urgent traffic was passed to Barbados requesting a charter plane to evacuate a severely injured man. Questions flowed back and forth—would a stretcher fit in the plane, when would it arrive, and so forth. The amateurs involved did what they were best at, providing a communications link, which in turn allowed cooperating governments to save a man's life.

Vic dropped me off at J6LJS's QTH where I would spend the night. Don had just finished a three-hour stretch on the 14.303-MHz International Assistance Net, passing a long list of medical supplies requested by the Saint Lucian government. In exchange, he received a handful of health and welfare inquiries. The large gathering of Navy personnel, hams, and neighbors had begun to dissipate, and I had my first chance to sit and talk with someone who had been involved in the disaster from the start. The roar of two generators and a cool Caribbean breeze were our companions as we looked down on the pitch-black city of Castries. It seemed that conditions had worsened after the hurricane, perhaps as a result of the confusion and untamed efforts to organize relief. I had no objections when the time came to turn in; it was my first chance to go horizontal in 40 hours.

USS Patterson and Friends

No alarm clock was needed to wake me Thursday morning. Promptly at 6:00 am, Don was outside starting up the generator that powered his shack. Don's employer, Hess Oil Company, was providing the generators and fuel needed to run them 18 hours a day. Hess's construction site for a supertanker off-loading facility suffered severe damage, yet the company did not hesitate to let Don and other employees participate in the island's cleanup—with pay.

Another source of valuable aid was the United States Navy. The *USS Patterson*, out of Jacksonville, Florida, was near the affected area prior to the storm; early on Wednesday, it dropped anchor a few miles outside of Castries harbor. Originally, liberty shore leave was scheduled, but it was soon obvious that the sailors would not find their usual leisure pursuits available on the stricken island. Instead of enjoying R and R, the crew of the *Patterson* spent two days speeding Saint Lucia's recovery. Miles of broken water lines were fixed and electrical power was returned to parts of Castries days before it was expected.

Among the *Patterson's* crew was Vince WA4CDK. He was an invaluable aid at the J6LJS communications post. Vince was there to act as a relief operator when net sessions stretched on and on. He helped to troubleshoot various rigs that were brought to Don's QTH when the word went out that technical help was available. Vince's skilled operating style, the product of years of maritime mobile phone patching, was immensely helpful; everyone was sorry to see him and the *Patterson* head for home on Friday morning.

Another naval ship, under the British flag, was in the harbor near Vieux Fort. The *SS Glasgow* provided the island's only helicopter and helped to put the airport in Vieux Fort back into shape. Ham radio operators and naval operators worked together so that the ship's representative at relief central could communicate back to the harbor. Forty meters saved the day again, allowing the ship's resources to be put to the best use.

W4PPC and the 14.303 Net

By midday Thursday, the hams had basic intra-island communications established. Traffic to and from the U.S. was passed on the well-run International Assistance Net at 14.303 MHz. In contrast with other net operations on 20 meters, the Assistance Net Control, George W4PPC, ran things with a firm hand. Jamming and other forms of trouble

were practically nonexistent. A lot of credit is due W4PPC and his assistants. They made the thrice daily sessions bearable and very beneficial.

Turnaround time was often incredible. Traffic passed to the Office of Foreign Disaster Assistance in Washington via the 14.303 relay would be quickly evaluated and replies or inquiries could then be heard coming back to Saint Lucia via the American embassy in Barbados, only an hour or two after the request originated in Saint Lucia. The 40- and 80-meter nets allowed the U.S. AID officials in Saint Lucia to communicate with their headquarters in Barbados. When conditions permitted, a Barbados amateur would provide a phone patch, but we usually relied on verbal relays. Regardless of where they were, hams went out of their way to help.

The delicate banana crop, a mainstay of the local economy, was wiped out by the storm's wind.

The Health and Welfare Dilemma

Despite the good intentions of everyone involved, hundreds of health and welfare inquiries went unanswered. Perhaps the originating station failed to give enough information. A name with the address "Saint Lucia" is a bit hopeless when you consider the size of the island. Even those inquiries that had telephone numbers were not likely to receive quick replies. Until a week after the disaster, telephone service was almost nonexistent, and then it was restored only for a few areas around Castries. This meant that most welfare replies would have to be obtained by a personal visit. With gas being pumped by hand and the roads in disrepair, messages were piling up faster then they could ever be delivered.

In many disaster situations, health and welfare inquiries are processed by organizations such as the Red Cross. On Saint Lucia, individual radio operators did their best, with little official assistance available. The problem was further aggravated by the lack of any official channel for public information. Since the U.S. had no full-time representatives available, the State Department was unable to handle part of the flood of inquiries.

Even though official results were discouraging, hundreds of families did receive some comfort from informal replies provided by hams who had visited stricken areas. In an attempt to reach individuals in outlying areas, messages were broadcast on Radio Saint Lucia, the island's commercial AM station.

Allen left a peculiar pattern of destruction on St. Lucia's countryside.

The fishing village of Dennery, on the island's east coast, was battered by both winds and waves.

Stateside amateurs can be helpful when it comes time to pass health and welfare traffic if a few guidelines are remembered. First have the concerned party try official government and relief channels. If you want to pass an inquiry via an emergency net, do so only after all other traffic has been handled and follow the net control station's instructions to the letter. Be sure to have a complete name and address. Don't ask for property damage reports; those can be passed along later. Finally, be patient. The hams on the scene are probably spending every waking moment trying to aid the relief effort; they cannot provide individual replies without help. Asking the net to check the status of your inquiry or reoriginating it only consumes valuable time and creates an even larger backlog. Again, be patient; as noble as health and welfare traffic is, its only value is to those individuals who are far removed from the disaster.

This British naval officer from the Glasgow used ham radio to keep in touch with his ship. St. Lucia's hilly terrain made a VHF link impossible, so 40 meters was used.

All in a Day's Work

The frustrations encountered with health and welfare traffic were overshadowed by more immediate results involving aircraft. As the weekend of August 8-10 approached, Saint Lucia prepared for large shipments of supplies, some of them coming on C-130 transport planes originating in the United States. Before leaving the U.S., charters needed to know the status of airport communications, availability of fuel, and so forth. Questions and answers buzzed back and forth on 20 meters. Hams played a dramatic role by keeping the two airports in touch. At one point, air traffic was being passed from the Hewanorra tower to a station in the terminal via VHF. The message was then relayed to the airport on 40 meters. From the Vigie airport control tower, operators contacted a plane on the ground that had the frequencies needed to talk to a plane landing at Hewanorra airport.

Politics

The amateur radio operators on Saint Lucia knew how disaster communications were supposed to be run. They had done their homework, holding a Simulated Emergency Test and informing the government of their capabilities. This preparation and planning soon became a distant memory when the real disaster called. The young government of Saint Lucia

AMATEUR RADIO OPERATIONS AT NATIONAL HURRICANE CENTER

By Julio Ripoll WD4JNS

On Sunday, August 3, 1980, Miami was having a nice, sunny, clear day, but elsewhere in the Caribbean a tropical storm named Allen had turned into a hurricane destined to kill over 90 people and cause heavy damage to the islands of St. Lucia, Haiti, and Jamaica, and end up in Texas.

Shortly after Allen had become a hurricane, the official Amateur Radio Station at the National Hurricane Center was activated by Dade County E. C. Andy Clark W4IYT. The equipment that was provided by the University of Miami Amateur Radio Society was promptly in place and operating, sending the latest hurricane advisories to the affected areas on the hurricane net, "14.325 MHz," and receiving weather reports from the islands for use by the forecasters.

The station was in operation approximately 130 manned hours. During those hours, many messages were logged. For example, when Hurricane Allen passed over St. Lucia Island, we were the only link between NHC and their weather bureau. Throughout that night, Ham Robinson W4ZR relayed important weather information from 80 meters to NHC over 2 meters. Also, the first reports of the damage caused by Allen, which gave NHC forecasters first-hand information on the strength of Allen, were received at NHC.

Weather information was also received from remote locations in the affected area, such as Jamaica, Haiti, Cuba, Caymans, Cozumel, Cancum, Yucatan, and many marine mobiles. In all, we handled 90 radiograms and logged 20 pages of NHC from the affected area.

One important QSO happened when the Brownsville Weather Center lost all power and had communications problems with NHC. At that time, Dr. Joseph Pelissier, hurricane forecaster for the NHC, spoke with Dr. Richard Hagen, director of the Brownsville Weather Center, who also had a ham radio station on emergency power. They discussed the strange behavior of Allen's eye and why it had stalled 2 hours just off the Texas coast. Many other important QSOs occurred, too numerous to mention.

The operation of this station was not only necessary for the Caribbean Islands to be able to get the latest information, but it also helped here at home by bringing the local ham community together behind a purpose, getting more PR than ever before, acknowledging the value of ham radio, and giving us a good reputation.

Some of the PR we got was from TV channels 4, 6, 7, 10, and 51, NBC National, *Time* magazine, *Miami Herald, Miami News*, WPLN, WLRN, WNWNS, WGBS, and others.

All of the forecasters expressed their gratitude to us for our operations, which they rated **A+**. Dr. Neil Frank, Director of NCH sent this message:

> "ATTENTION ALL HAMS WHO WORKED DURING HURRICANE ALLEN:
> Thanks for a great job. Without your help many people in the islands would not have received our warnings. We look forward to working with you during future hurricanes.
> 73 Dr. Neil Frank"

I would personally like to extend my sincere thanks to those who operated or helped with the Amateur Radio Operations at the National Hurricane Center, the APRSC, Dr. Frank Merceret WB4BBH, Andy Clark W4IYT, Rick Silverston WD4JJI, Ham Robinson W4ZR, and the FM Association 16/76RPT—without all of their help, this operation would have been impossible.

Recently Dade County ARPSC Planning Committee reached an agreement to provide Emergency Communications to and from the NOAA Hq. in Miami. Here Julio Ripoll WD4JNS, NOAA Station Coordinator, poses with Dr. Neil Frank, Director of the National Hurricane Center during a lull in Hurricane Allen. The NOAA station will be active during all future hurricanes with Dr. Frank's blessings.

Reprinted from *Florida Skip*.

desperately needed the help of amateur radio, but was not always able to recognize its limitations. The resulting confusion emphasized the need for individual hams to be patient and flexible.

For the most part, hams acted as communicators. Our job was to relay messages. The decisions about what supplies were needed and where they were to go was the responsibility of relief officials; we merely passed the word on. The head-over-heels drive to revive the island resulted in some hasty judgments. As amateurs, we had to insist that official traffic was separated from rumor and that whenever possible, messages were signed with a name and title.

Despite the rumors, political conflict, and intrigue, amateur radio served as a responsible and reliable medium.

People

Slowly, Saint Lucia dug itself out. A multi-national effort provided tons of food and supplies while individuals did their best to rebuild damaged homes and return to work. Of course, there were a few opportunists who played on the hurricane's visit to make some quick money, but they stood apart from the vast majority that quietly endured carrying water, eating canned food, and watching out for friends and neighbors.

Each night, a few more lights shone in Castries, and in a week's time, ham radio operators found themselves serving as a backup while regular lines of communication were restored. It will be a long time before Saint Lucia returns to normal. The expensive task of rebuilding homes, schools, and industry was secondary

It was like Christmas in August when a shipment of ham gear held in customs before the storm was released. Some of the equipment was damaged by rain that flooded the customs storage shed. 73's Tim Daniel N8RK is at right.

to the possibility of food shortages and the threat of typhoid and cholera, not to mention the hurricane's long-term effects on Saint Lucia's agrarian economy.

Coming Home

One morning I woke up missing the usual chugging sound of the generator starting. Commercial power had been restored to J6LJS's home. Later that day, the International Assistance Net was reduced to one session and local amateurs began to return to work. It was time for me to return to my job at *73's* office in Peterborough. My departure was not without complications, but when Wednesday, August 12, came, I was headed for home.

For me, the Saint Lucia operation was an education as effective as any classroom course. The exposure to the unique Caribbean lifestyle was an experience in itself. Occasional angry outbursts, personality conflicts, and bureaucratic frustrations, while fresh in my mind, are of minimal importance. Hindsight, of course, offers many lessons for next time, but let's not be too hasty about forgetting the unqualified success that amateur radio had this time.

As I said in the beginning, this article belongs to hams everywhere. As much as I would like to give individual recognition and thanks, I'm afraid I would miss someone. Hurricane Allen was the season's first major tropical storm. Are you ready for what is ahead? ■

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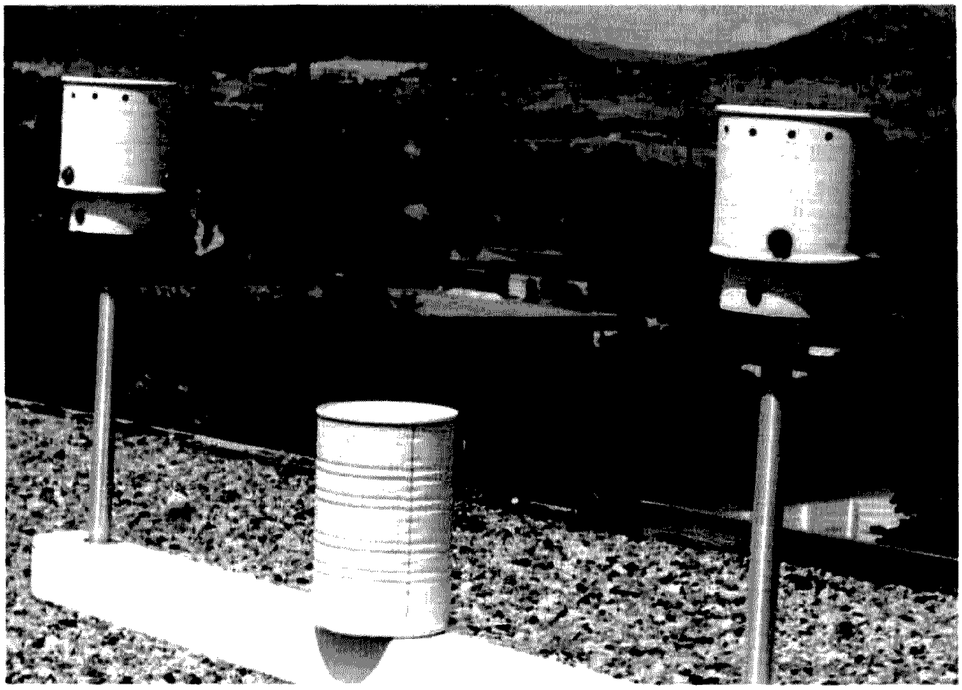
Tune In the Wind

—a do-it-yourself hot-wire anemometer

The force of the wind is a constant threat to many amateur radio station antenna installations. When amateurs are alerted in advance to the forces of nature outside of the shack, however, they can crank down towers or feather beam elements into the wind and save many hours of labor and expensive antenna repair.

An easily-constructed wind-measuring instrument with no moving parts is the hot-wire anemometer, which continuously provides a visual indication of wind speed and, therefore, can give early warning of threatening increases in wind speed. An alarm circuit may be incorporated easily.

There are a number of different anemometer types, including the commonly-seen cup anemometer and the pendulum type first developed in the 17th century. The hot-wire anemometer is known scientifically as the cooling-power anemometer; it utilizes the principle that a heated wire is cooled as a function of the air speed past it. In commercially made instruments, a thin platinum wire is heated to approximately 1000 degrees Celsius so that its temperature is independent of ambient thermal fluctuations. Two different methods of indication can be employed. Either the current necessary to maintain the given hot-wire temperature or the resistance variation of the wire is measured. Extremely low wind speeds can be measured with this instrument and it can be constructed with wide parameters of sensitivity, response time, and physical complexity.



Details of Construction

A simple, balanced-bridge circuit comprises the electronic portion of the amateur station hot-wire anemometer, with a physical shroud over the sensing

elements to reduce the sensitivity of the instrument for outdoor wind-speed measurement. As shown in Fig. 1, the two halves of the balanced bridge that form the sensing elements are made from two identical rf chokes. My version, shown here, utilized two 2.5-mH rf chokes wound with copper wire on paper tubes, the type used in vacuum-tube circuitry. (The wire must be one of the pure metals.) They measured 45-Ohms dc resistance and were rated at a current of 250 mA, although only 100 mA flow in each choke. The rf chokes were constructed of two pi-wound sections.

The power supply need not be filtered; it delivers between 8.6- and 9.0-volts full-wave direct current. A transformer rated at 12 volts, 300 mA is sufficient. The voltage across each 45-Ohm choke is 4.5 volts; the current, therefore, is 100 mA in each choke.

Certainly, other values of rf chokes or other coils could be used and different voltages applied. A current through each coil of 100 mA is optimum for the physical shroud dimensions described. Care should be taken to keep current ratings about half of the maximum specified for the coil selected since they will remain heated indefinitely. The instrument should not be turned on and off for the taking of readings since a long warm-up time is necessary before the entire rooftop sensing units reach thermal equilibrium and permit accurate indications.

The device is constructed in two parts, with an interconnecting three-wire cable for the rooftop sensing units which house the two rf chokes and the remote (inside the shack) meter display and power supply which are housed in a small metal box. Screwdriver-type potentiometers are mounted in the metal box since they can be set at the time of calibration and will not be changed except for recalibration at quite long intervals.

Care must be taken in connecting the three-wire cable (22 gauge is adequate) to the rooftop sensing unit so that symmetry is maintained between the two halves of the bridge inside the cans and down to the roofline. A center tin can be seen in the photographs, in the middle of the sensing unit assembly, where electrical connections are made to the three-wire cable. The wire connections must be soldered since a socket doesn't withstand weather very long without becoming a poor connection.

The sensing elements should be mounted about 60 cm apart (see the photograph and Fig. 1). The assembly must be well into the open, away from chimneys, tree branches, and other wind-interference objects, if reliable wind-speed readings are to be obtained.

Four tin cans serve as wind shrouds for the two halves of the sensing unit, each pair of cans fixed to a round wooden disk atop the end of a 30-cm length of 2-cm aluminum tubing. I had a lathe for the construction work, but this was more a convenience, making the job neater; it is not necessary. Availability of materials may dictate sizes of cans and spacing between the two halves of the sensing assembly, but the critical matter is to ensure that the two halves of the sensing unit assembly are exactly the same—except for the ventilation of the inner can on one side of the bridge. Additionally, all wiring about the roofline must be the same with respect to the two halves of the bridge circuit, including wire sizes, lengths, and solder connections. (Obviously, the three-wire cable obviates such concerns since symmetry is already accomplished within the cable itself.)

Looking for a moment at

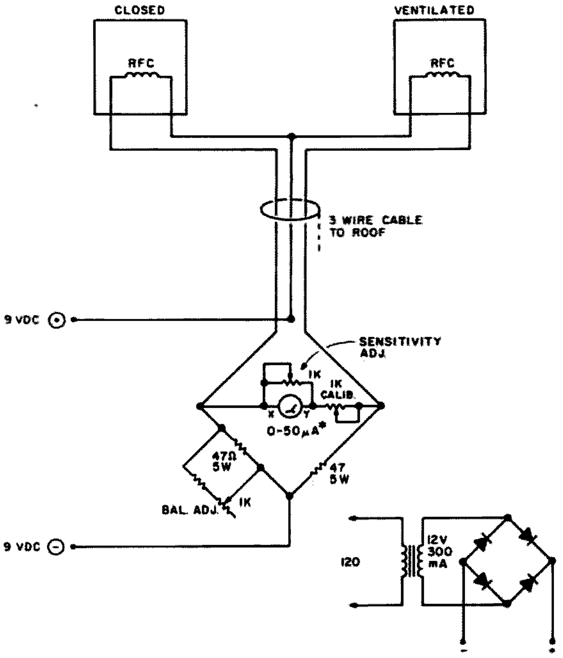


*Fig. 1. Some pots can be replaced by fixed resistors once testing and calibration are done. *Other meter movements could be used. A zero-to-50-μA movement was selected for a 50-mph, full-scale reading.*

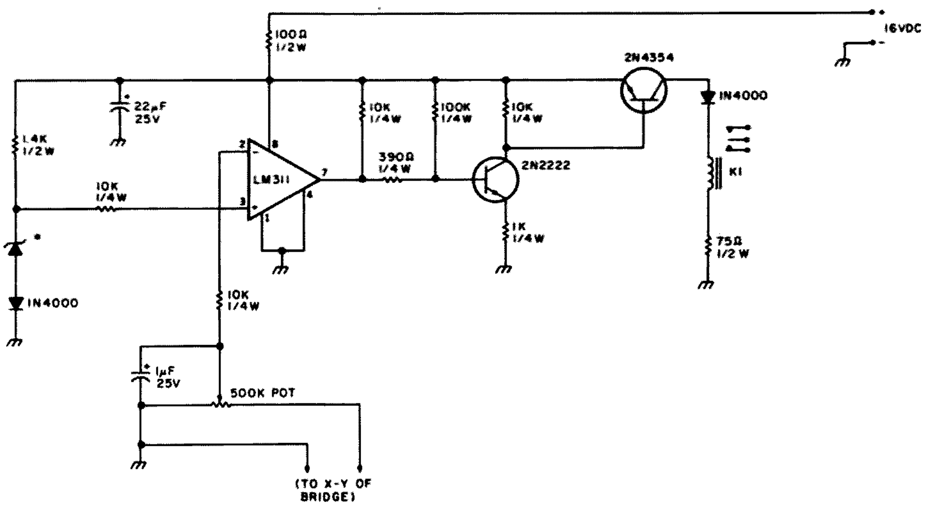


*Fig. 2. For reverse relay action on sensed X-Y voltage, reverse pins 2 and 3 of LM311. *The zener was selected as suitable for reference.*

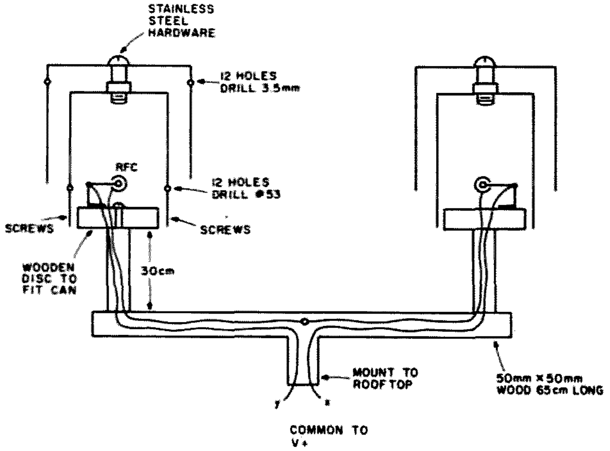


Fig. 3. A diagram of the assembled anemometer.

one half of the sensing unit: The smaller can is an ordinary soup can 65 mm in diameter and 100 mm in length. Only one end is removed, and that end faces down and is mounted onto a wooden disk made to fit snugly into it. A larger tin can with a diameter about 12 mm greater and about 20 to 35 mm shorter is mounted over the soup can and coupled to it with stainless steel bolts so as to provide about 7 or 8 mm of air space between the walls and top end of the soup can.

The ventilated soup can has 12 holes drilled into it around the lower portion, with holes equally spaced at 30-degree intervals and about 30 to 35 mm up from the bottom lip. A number 53 drill is used, resulting in holes with a diameter of 0.0595 inches (1.51 mm).

The distance up from the lower lip of the inside can may need to be adjusted to accommodate placement of the rf choke; the holes are opposite the centerline of the rf choke which is mounted in a horizontal position with a fiber, standoff solder terminal. The larger can has 12 holes in it also, but only 15 mm from the upper end—the one with the end still intact. Both of the outer cans are vented, unlike the inner cans of which only the can on one side is vented. These holes are drilled in the outer can at 30-degree intervals, with a 3.5- to 4.0-mm drill. These larger holes in the outer can are not quite as critical as the small #53-drill holes in the inner can. The outer can shields the inner rf-choke-containing can from heating as a result of solar radiation.

All surfaces of the tin cans, inside and out, are painted with two coats of glossy white paint, as is the wooden and aluminum structure forming the remainder of the rooftop assembly. Both sets of holes in the tin cans affect the instrument's sensitivity, the #53 holes being the most important in this regard. The outer can's edge extends down to no more than 7 or 8 mm above the #53 holes in the inner can so as not to obstruct airflow into the small holes and across the rf choke.

Response Time and Sensitivity

Copper and other pure metals have a high temperature coefficient of resistance and are cooled by the wind, thus effecting an upset of the bridge's balance. The temperature coefficient of resistance is the ratio of the change of resistance in a wire due to a change of temperature of one degree Celsius to its resistance at zero degrees Celsius. (See Table 1.)

An important feature of the hot-wire type of anemometer is its *extreme* sensitivity and design-controllable response time. The option of a 90-second time constant (response time) results in "average" wind-speed readings and a reasonably steady meter reading. For a longer time constant, simply select coils with more mass in their copper windings (higher current rating) or add insulation such as by potting with epoxy. To shorten the time constant, use less massive and less compactly-wound coils, producing more exposure to air.

For a change in the sensitivity, change the hole sizes in the inner can—make larger holes for more sensitivity and smaller ones for less sensitivity. Alternatively, *increase* the temperature at which the rf chokes are balanced for greater sensitivity. The easiest way to do this is to increase the voltage—provided the current rating of the selected coils is not exceeded.

Other Design Possibilities

Instead of using rf chokes for the sensing elements, it would be possible to build a faster-time-constant version by utilizing the base and filament structure from inside a 25- or 60-Watt, 120-volt incandescent bulb (using two identical such units) by merely removing the glass envelope carefully and preserving the delicate integrity of the innards. As can be seen from the table of temperature coefficients of metals, tungsten has the largest value of temperature coefficient. This is not to imply that there is any problem getting enough sensitivity; actually, the biggest problem, using the two rf chokes, is reducing the sensitivity to a reasonable level. The eventual choice of #53 drill holes in the ventilated can came as quite a surprise to me, after beginning the experimental work with 6-mm holes.

An audible or flashing-light alarm could be obtained by incorporating a voltage comparator to respond to the differential between points X and Y in the bridge circuit. An appropriate circuit utilizing the LM311 is shown in Fig. 2. (This same circuit works well as an automatic battery-charging sensing circuit for storage cells (or gel/cells) with a relay shutting off the charging circuit when a preset level is reached on the charged cells.)

As noted in the article, the cooling-power anemometer is highly flexible and can be designed with wide parameters of characteristics and specifications. With respect to the time constant, the following is for particularly interested readers: Time constant is a mathematical e folding constant. That is, the time constant is the time required to go within 1/e (1/e = .37) of the true reading. Therefore, if the reading is within 1/e of true wind speed, indication will be 63 percent of true wind speed. If you wait one more time constant, you will come within $1/e^2$ (the reciprocal of e squared) or approximately 85 percent of true wind speed. Obviously, the more time constants allowed in the design, the closer the instrument reads to the true wind speed. Stated differently, the time constant of the anemometer is simply the time required for the voltage to move to $1 - 1/e$ of the true wind speed.

Alignment and Adjustment

The two sensors of the rooftop assembly should be oriented so that the predominant wind direction passes between the two sensors. My version of the device was calibrated and adjusted by strapping it onto the roof of an automobile which was then driven over a circular course so as to cancel out variations in wind direction with respect to the sensor assembly. This bridge circuit is balanced with 45-Ohm rf chokes and 47-Ohm resistors since only the adjacent legs of the bridge (rf chokes with themselves and resistors with themselves) have to match. Quad matching of bridge components is not necessary in this particular configuration.

Wind-proof antennas are difficult to build and maintain as many amateurs, including the author,[2] can testify. The hot-wire anemometer is a helpful and easily-constructed instrument which can increase your chances of avoiding wind-damaged antenna installations.

Platinum	0.003
Gold	0.0034
Silver	0.0038
Copper (hard drawn)	0.00382
Aluminum	0.0039
Copper (annealed)	0.00393
Tungsten (drawn)	0.0045

Table 1. Temperature coefficients for various metals at 20 degrees Celsius.[1]

I wish to thank Edward Argyle, formerly VE7AAV, for his original idea and his early experimental work developing this amateur application of the cooling-power anemometer. ■

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1. *Handbook of Chemistry and Physics*, 55th edition, 1975, C.R.C. Press, Inc.
2. "A Wind-Proof 20m Beam," D. Hembling VE7DKR, *73 Magazine*, November, 1974.

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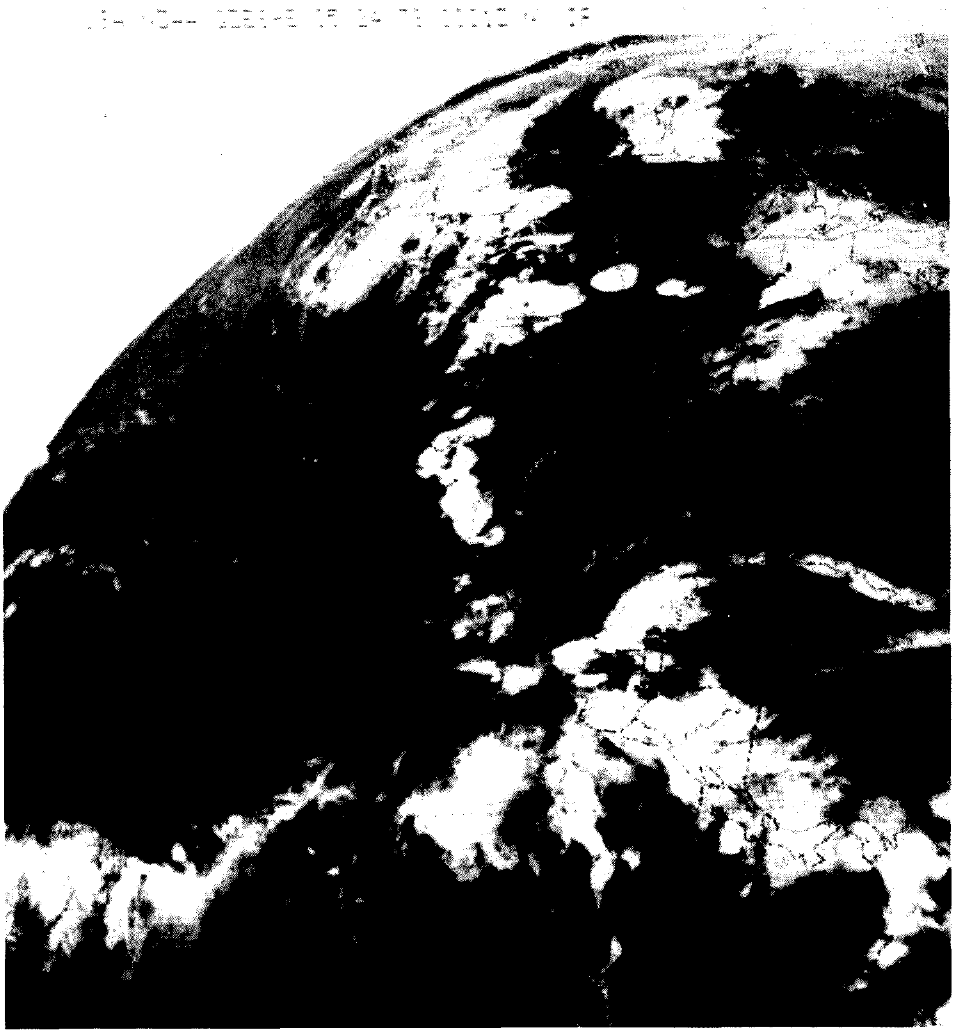

Fig. 1. A single GOES frame as reproduced on the FX-1P photographic facsimile recorder. This frame, representing evening infrared imagery, covers most of North America.

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There are two major approaches to displaying weather satellite pictures—CRT systems where the image is read out slowly on the face of a television-like picture tube and recorded on Polaroid™ or roll film, and facsimile (fax) systems where the image is printed directly onto some sort of recording paper. CRT systems lend themselves to multi-mode service and present few mechanical problems in construction but have the disadvantage of either using expensive Polaroid film with its small print format or, if roll film is used, a time delay involved in film processing and printing. Fax systems require some considerable mechanical work to get them working right, but they can provide a good-sized image at comparatively low cost.

Perhaps the best approach in terms of quality is the photographic facsimile recorder in which the image is printed directly on a

piece of paper using a modulated light source. Picture quality can be very high with this option but you pay for the quality with some operational problems. The paper must be loaded and printed under darkroom safelight conditions and one must maintain a stock of processing chemicals to handle the exposed photographic paper.

My first photographic facsimile system (described in the September and October, 1975, issues of *73* and in the first edition of the *Weather Satellite Handbook*), was a hybrid unit using both tubes and solid-state devices with the mechanics constructed of readily available hardware items. This unit worked very well and I have lost track of the number of times it has been duplicated by various operators.

In preparing for the second edition of the satellite handbook, I undertook the redesign of the photofax system to convert it completely to solid-state technology with an updated and improved set of mechanics. It was desired to make the unit compatible with GOES WEFAX transmissions while at the same time permitting modifications for the new series of TIROS/NOAA polar orbiting weather satellites. The project was completely successful, as shown in Fig. 1 where a typical GOES WEFAX frame is represented.

For some time, however, I have been looking for suitable alternatives to photographic paper as a recording medium. What was needed was a direct-printout medium that would produce a print directly without the need for paper processing or darkroom operations.

One promising avenue involved various kinds of electrosensitive papers of

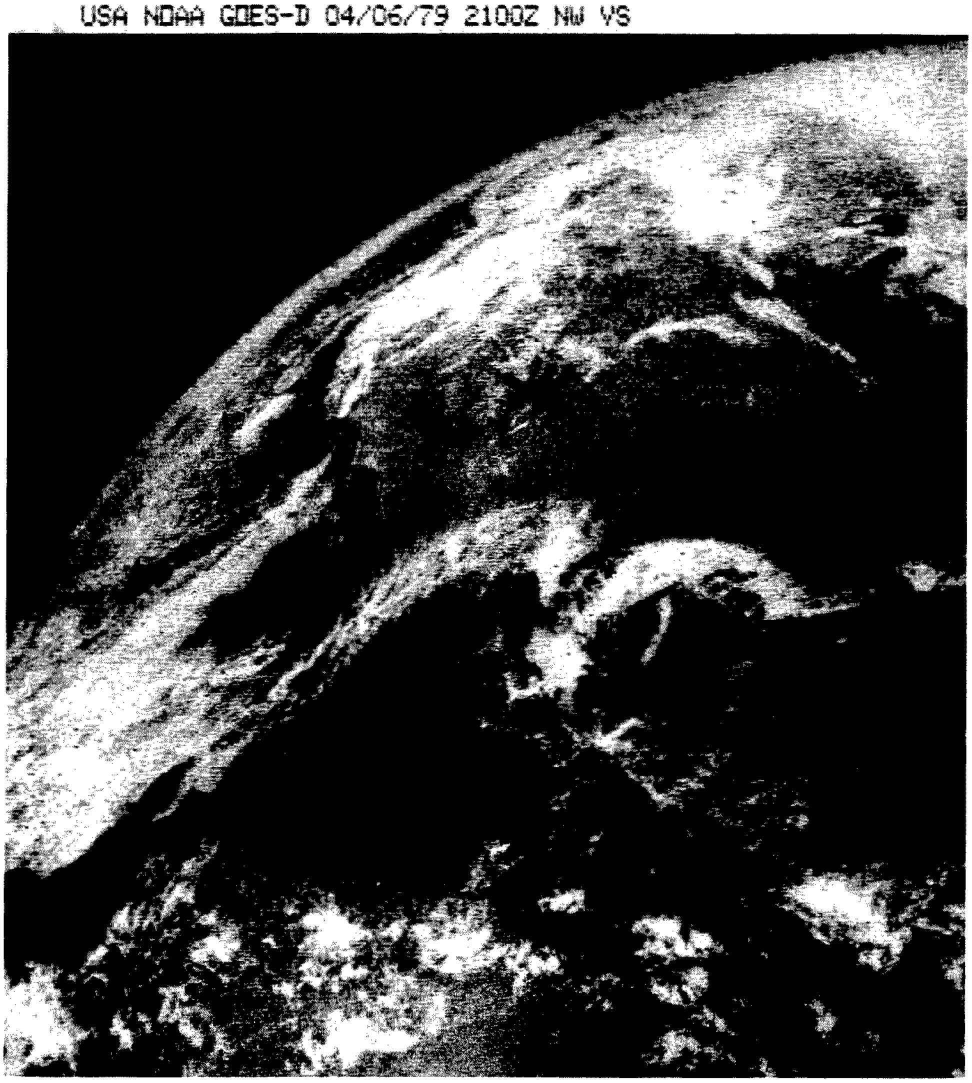

Fig. 2. An example of visible light imagery (GOES D, a replacement for GOES E) printed on the FX-2E direct-printing fax recorder. GOES D had drifted several degrees north of the equator when this picture was acquired and the downlink signal was noticeably noisy. Despite this, the machine printed a quite acceptable picture.

the type used in the ubiquitous Western Union Deskfax machines. These papers incorporate a black base layer with a white surface coating. A printing voltage is applied to the paper surface by a wire stylus, and beyond a certain threshold voltage (usually 35-40 V) the white surface coating begins to burn away. The higher the voltage, the more the white layer is removed, producing a darker and darker trace. At about 240 V, all of the surface will burn away, leaving a completely black trace.

Although many satellite experimenters have used the Deskfax approach, the results usually leave something to be desired. The original Deskfax units are designed to transmit printed messages, and the video circuits will not produce a reasonable gray scale without meticulous adjustment. The papers that are commonly sold with the machines also leave something to be desired in terms of gray-scale fidelity. Considerable progress has been made, however, in the formulation of such electrosensitive papers, and after spending considerable time on the test bench, a modified version of the photofax circuit was developed that will print pictures of photographic quality on a paper marketed by Xerox™ for use with their Telecopier™ phone-line office fax systems.

Fig. 2 shows the results obtained with the new paper. Comparing the picture with that of Fig. 1 indicates that indeed it is possible to obtain photographic quality with a direct-printing paper.

Fig. 3. FX-2E direct printout of a near-overhead pass in the Great Lakes area. This TIROS N visible-light imagery was acquired on 16 March 1979 (orbit #2177), and shows the Great Lakes, southern Canada, and most of the eastern US. A line of snow from a recent storm angles across the lower peninsula of Michigan while the ice breakup has already begun in Lake Superior. The lower Great Lakes are essentially ice-free. Lake Nippagon, directly north of Lake Superior, is still frozen and snow-covered, as is James Bay at the upper margin just right of center. This pass was received using the omni-directional VHF antenna described in chapter 2 of the Weather Satellite Handbook.

The advantages of this kind of system are many. The paper, unlike direct printing papers used in electrolytic fax recorders, is dry and requires no special storage conditions—you treat it simply like ordinary office bond. The paper is not light-sensitive, so it can be handled under normal room lighting conditions, thus simplifying satellite station operations. The picture prints out directly, and the image is available immediately without the need for any sort of processing. The image is a true black and white rendition—as opposed to the sepia tones commonly achieved with electrolytic papers—and the image will not fade or discolor when displayed or stored. All in all, a most satisfactory system for GOES WEFAX image display!

As an added bonus, it is quite possible to use the basic fax system with minor modification for display of the new TIROS N polar orbiting satellite imagery as shown in Fig. 3.

The direct printing fax recorder, designated as model FX-2E, will be described here, and in parts II and III of this article, the mechanical and electronics assembly details will be presented, along with complete alignment and operation instructions. All of the information needed to reproduce the unit will be included, as will details on use with the TIROS satellites. As an added bonus, if you want a photographic rather than direct-printing recorder, modifications in that direction also will be described. The FX-2E is marketed commercially by METSAT Products so that circuit boards and fax mechanics sets are available for those desiring to bypass that part of the project. For those who don't want to build at all, wired and tested FX-2E units also are available.

Video Format

I have described the GOES WEFAX video format in an earlier article in *73* (November, 1978), so I will not go into extensive detail. Basically, we are dealing with an amplitude-modulated video tone in which minimum amplitude (approximately 4%) corresponds to black and full amplitude (98-100%) corresponds to white. Video is transmitted at the rate of 4 lines/second (240 lines/minute) for 200 seconds, resulting in an 800-line picture. The FX-2E is capable of fully resolving this picture detail with a 6.75-inch-square picture format.

The TIROS video standards are similar with regard to the subcarrier modulation and compatible in terms of line rate. In the TIROS format, however, we are dealing with a 240-line/minute format involving alternate lines of visible and infrared (IR) data. IR subcarrier levels tend to stay so close to 100% that if daylight displays are printed, you do not need to blank the unwanted data lines. If you print a daylight pass, you will get simply the visible light display.

Two different transmission modes are used at night. In one of these, the visible channel is black and

it is necessary to blank out the alternate lines of visible data to display the IR. In the other mode, the visible channel segment is filled with IR data, and in such a case, the IR can be displayed without line blanking. More on this subject later.

Principles of Operation

Fig. 4 shows a simplified diagram of a drum-type facsimile system. The recording paper is wrapped around a drum which is rotated at 240 rpm to provide the line scanning. This 240-rpm rate must be controlled precisely if the picture is to stay in sync, so a synchronous motor is used for the drum drive with the motor drive signal locked to the satellite subcarrier using a phase-locked loop IC with digital frequency dividers. The printing voltage is applied to the paper by a wire stylus. Vertical scanning is provided by moving the stylus carriage assembly along the length of the drum at a controlled rate using a threaded rod driven by another synchronous motor. The traverse rate is dependent on the drum diameter and the drive rod thread pitch. With the system to be described, a 40-rpm motor is used for WEFAX display while a 20-rpm motor is used for TIROS pictures. The speed requirements of the traverse drive are not nearly as critical as those for the drum, so the traverse motor may be driven from ac mains.

Circuit Functions

Figs. 5-9 comprise the schematic for the active circuits for the FX-2E. Most of the active components are on the large, main control circuit board and carry part designations below 100 (R15, C26, U10, etc.). Mainframe components carry part designations from 200 to 299 (T201, etc.).

Video circuits. Incoming video enters at J201 (VIDEO IN) and is applied across the WHITE SET control (R201). This functions as the video gain control, setting peak signal levels in the video chain. U1 functions as an active bandpass filter centered on the 2400-Hz subcarrier frequency with unity gain and a bandwidth of about 1600 Hz. Despite its simplicity, the circuit does a very good job of reducing the effect of noise located outside of the video passband. U2 is an audio power amplifier which provides a power boost for the video detector. T101 is an output transformer driven through the 8-Ohm winding by U2 and provides a voltage step-up to drive the full-wave video detector consisting of D1-D4. The video detector drives the print control transistor, Q1.

To understand the operation of the printing circuit, keep in mind that stylus voltages below 35 V will not affect the paper, producing white, while a voltage of about 240 V (at our drum speed) will burn away all of the surface coating to produce black. Intermediate voltages in the range of 40-240 V will produce intermediate gray-scale tones. The collector load resistors and zener diodes for Q1 establish this voltage range. With minimum subcarrier amplitude (black), there is little drive for Q1 from the detector so that the voltage at the junction of R10 and R9 is limited to 240 V by D5 and D6, two series-connected 120-V zener diodes. With full subcarrier amplitude, Q1 is driven hard by the detector and is essentially fully "on."

The voltage at the junction of R9 and R10 is then a function of the values chosen for the resistors. They have been chosen so that with full drive we get about 30 V. It is impractical to derive the printing voltage

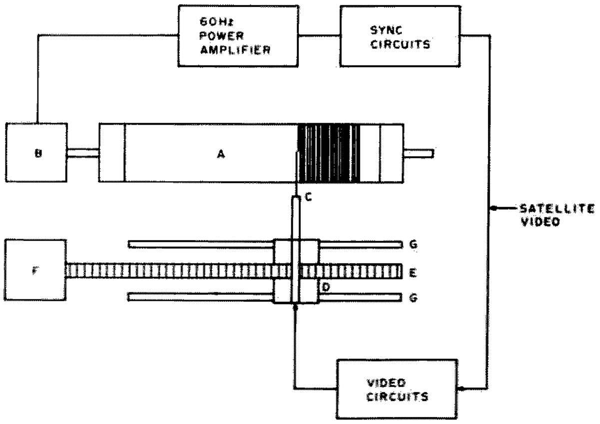

Fig. 4. Diagrammatic representation of the direct-readout fax system. The electrosensitive paper (A) is wrapped around a drum which is rotated at the 240-rpm line rate by a synchronous motor (B). Sync circuits, driven by the video signal, provide a precision 60-Hz reference to the power amplifier which provides the operating voltage for the drum motor. The video circuits provide a stylus (C) with the proper marking voltage. The stylus is supported by a carriage (D) that moves along the drum at a controlled rate established by a threaded drive rod (E) and a traverse motor (F). The carriage is supported in a track (G) to provide smooth scanning for the stylus.

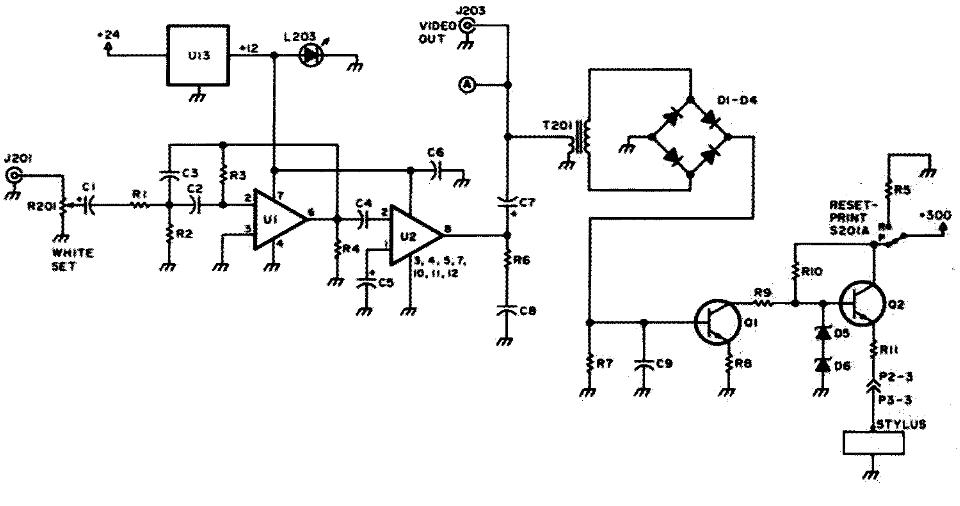

Fig. 5. Video circuits. Parts values for Figs. 5 through 9 can be found at the end of the article. Parts numbered 1-99 are on the main circuit board, 101-199 are on the drum amplifier board, 201-299 are on the mainframe, and 301-399 are on the recorder mechanics assembly.

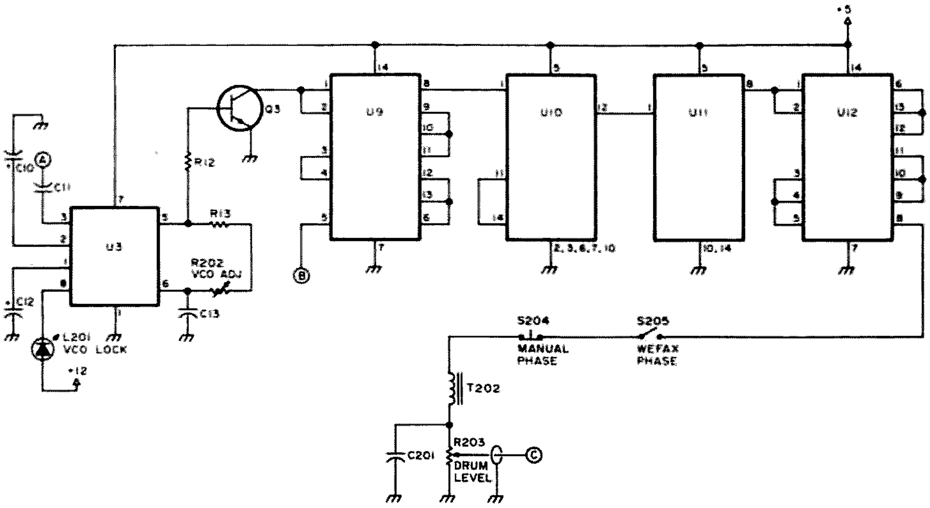

Fig. 6. Phase lock and sync circuits.

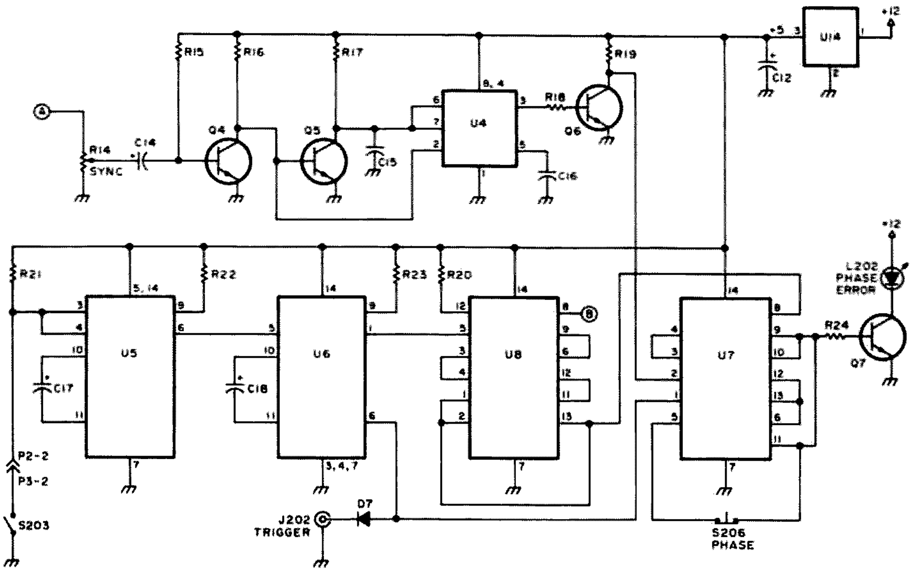

Fig. 7. Phase-control circuits.

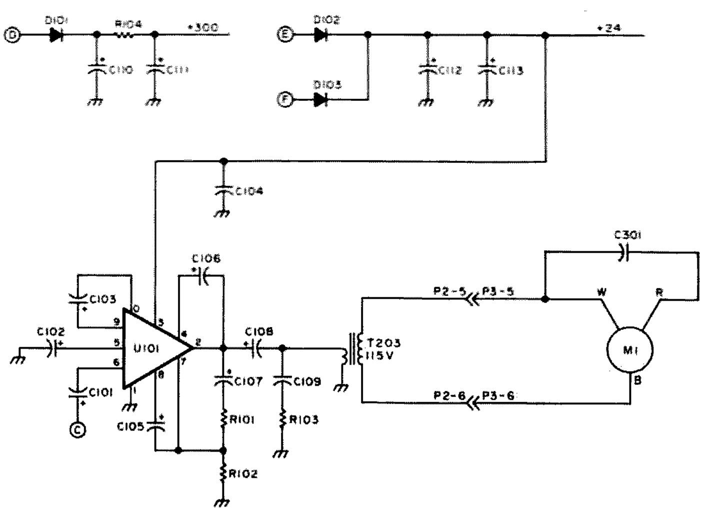

Fig. 8. Drum Amplifier circuit.

directly from the collector circuit of Q1 since the print voltage would be affected by the voltage drop induced by the stylus current—up to 40-45 mA. We get around this by applying the control voltage developed at the junction of R9 and R10 to the base of Q2. Q2 is effectively functioning as a pass transistor regulator, tracking the voltage variations at its base. The voltage at the emitter of Q2 is essentially the same as that at the base (less the small collector-emitter voltage drop), but with the advantage that the print voltage is no longer current-dependent. S201 is a DPDT switch to energize both the traverse motor and stylus when printing or just the traverse motor when resetting the system.

Sync circuits. The basis of the sync system is a phase-locked loop circuit locked to the 2400-Hz subcarrier. This permits the 60-Hz drum drive signal to be derived via digital frequency division. This approach has the advantage that the recorder will handle the speed variations in tape-recorded signals as effectively as it does "live" signals directly from the satellite. An NE567 tone decoder IC is used to provide the phase-locked function. This chip has an advantage over the more commonly used 565 chip in that a control transistor in the 567 can be used to provide an unambiguous indication that the chip is locked to the subcarrier. The internal vco of the 567 is set to free-run at 2400 Hz using the VCO ADJ control (R202). A sample of the subcarrier signal is routed to the 567 (U3) via C11 and the internal vco locks to and tracks the subcarrier signal. The 567 was not designed to provide direct interfacing with the vco, but this is achieved using Q3 as a buffer.

When the vco locks to the subcarrier, an internal control transistor pulls low and lights the vco lock lamp (L201). If L201 fails to light—due, for example, to using someone else's tape that is considerably off the correct speed—R202 can be adjusted until a lock is indicated by L201. The 2400-Hz signal from Q3 is routed through a series of phase-control gates, U9, to be discussed shortly, and on to the frequency dividers, U10 and U11. U10 provides a division of 10, while U11 divides by 4; this results in a 60-Hz output from U11. This 60-Hz signal is buffered by a series of NAND gates (U12) and then sent through the motor control switches (S204 and S205) to an LC filter consisting of T202 and C201. This combination is resonant at 60 Hz and shapes the square-wave signal from U12 to an approximation of a sine wave needed for the motor amplifier (U13).

T3 can be any small choke between about 5 and 15 H. Its resistance is not important as it does not handle any significant power. The value of C201 is dependent upon the choke value you obtain. Table 1 lists several small choke values and the corresponding values for C201 to resonate the combination at 60 Hz. Standard value mylar™ capacitors can be paralleled to yield nonstandard values where required.

The 60-Hz waveform is then applied across the DRUM LEVEL control, R203, and on to the drum amplifier, U101. U101 is a 10-Watt hybrid power amplifier module which drives the 6.3-volt windings of a 6.3-V/1.2-A filament transformer, T203. T203 provides the step-up to 115 V required for operation of the drum motor. R203 provides a means of setting the output from T203 to precisely 115-V ac under load. This is not particularly critical, as the motor will usually hold sync over a 100-140-V range. This motor amplifier circuit is superior to most others which have been described in that it is quite efficient and thus produces little heat. The chip does not require a heat sink or cooling fan for proper operation.

T202 (H)	C201 (μF)
5	1.41
6	1.17
7	1.00
8	0.88
9	0.78
10	0.70
11	0.64
12	0.59
13	0.54
14	0.50
15	0.47

Table 1.

Phasing circuits. Although the sync circuits ensure that the drum operates at the correct speed, they are not sufficient to ensure that the start of a video line corresponds to the point where the printing stylus crosses the left edge of the paper. When these two factors do not coincide, the picture is said to be "out of phase" and would have to be cut and reassembled. To properly phase the picture, we need to do several things:

1) Detect the start of a line of video;

2) Detect the point in time where the stylus passes the paper edge;

3) Throw the drum slightly out of sync, wait until 1) and 2) coincide, and, finally, when they do, snap the drum back into sync.

Detecting the start of a video line is relatively easy, as a phasing interval pre-

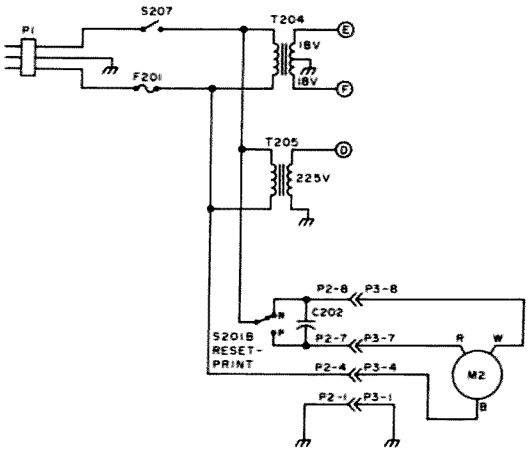

Fig. 9. Miscellaneous mainframe wiring.

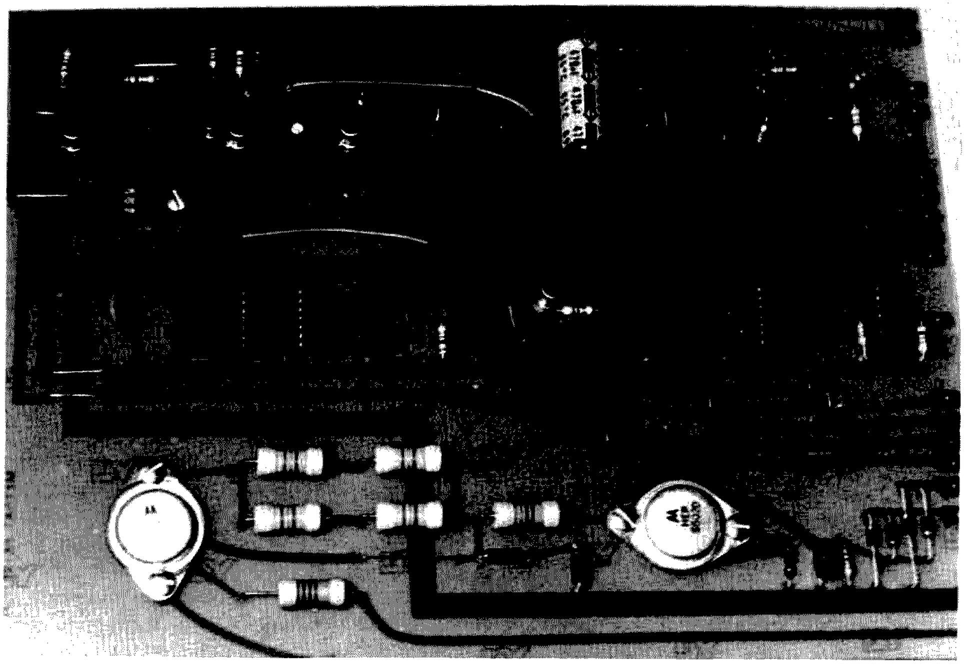

Fig. 10. A photograph of the main video circuit board in the METSAT version of the fax system. Parts located on this board carry parts designations below 100 on all schematics. The upper group of components, from left to right, includes the sync detector circuits with the 5-V regulator below, the NE567 phase-locked loop, the LM380 power amplifier, and the 741 video input filter. The center row of components includes the drum-trigger monostables, the various control gates, and the frequency-divider chips. The lower group of components includes the high-voltage transistors and the video detector diodes.

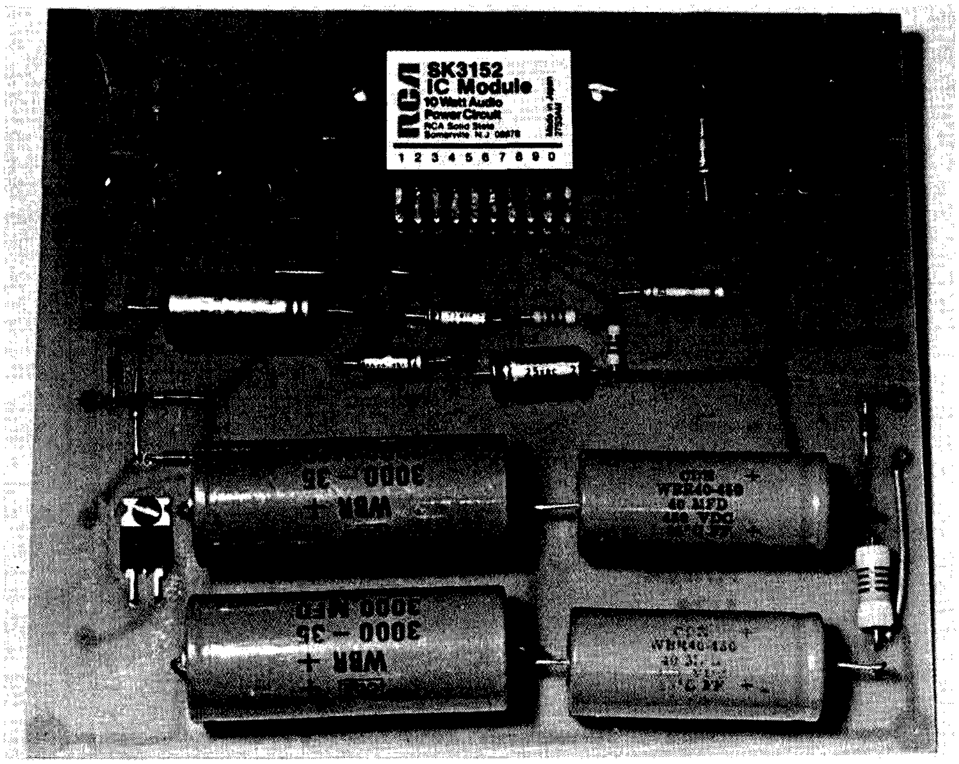

Fig. 11. The power supply and drum amplifier board in the METSAT version of the fax circuit. The upper half of the board contains the circuits associated with the RCA SK3152 drum amplifier, while the lower half contains the LV and HV power supply components. Components on this board carry parts designations from 100 through 199.

cedes each WEFAX frame during which white-level video is transmitted, interrupted by black-level intervals of 10-12 ms which correspond to the start of each line of video. Detection of these phasing pulses is accomplished by Q4, Q5, U4, and Q6. They comprise a missing pulse detector that generates a logic high at the collector of Q6 for the duration of the phasing pulse.

The drum position indication is provided by a small magnet on the drum which passes a reed switch once during each revolution. The position of the magnet and switch is such that the switch closes just as the stylus starts its scan of the paper. This switch closure is debounced by a long-period (over 100-ms) single-shot (U5) which, when triggered, also triggers a short-period (10-ms) single-shot (U6) which provides the drum sync pulse. The phasing and drum sync pulses are monitored by U7A, which produces a logic low whenever the drum- and line-sync pulses coincide.

The previous discussion has shown how the phase-sensing circuits work—now let's look at the matter of control. If you think back to the sync discussion, you will remember that the 2400-Hz vco signal was routed through U9 prior to entering the frequency-divider network. U9B is the critical point, for whether or not the 2400-Hz signal gets through U9 is dependent upon the state of pin 5 of U9B. If that pin is high, the signal is gated through, while if it is low, the signal flow is stopped. Normally, U8 will hold that pin high, but if the PHASE switch (S206) is pressed for a moment, gates U7B and C lock up so that a low appears at the output of U7D. This toggles U8 which is wired as an SPDT switch. While before a high was gated through U8 to control U9B, we now gate through the $\overline{Q}$ output of the trigger single shot (U6). This signal is high except for the 10-ms drum trigger interval when it goes low.

This 10-ms low is applied to U9B through U8 and introduces a 10-ms counting error in the gating of the 2400-Hz vco signal, throwing the drum slightly out of sync (it slows down). Note also that the logic state of U7 which initiated this chain of events also causes L202, the PHASE ERROR lamp, to light, providing a visual indicator that the drum is now running out of sync. As the drum is running slightly more slowly than it should, the drum and phase pulses should begin to occur closer and closer together. When they coincide, as determined by a low at the output of U7A, U7B and C snap back to their original state, turning off the PHASE ERROR lamp and producing a high at the output of U7D. This high toggles U8 so that a continuous high is now applied to pin 5 of U9B and the drum returns to proper sync, this time with the drum in the proper phase relationship.

As can be seen, drum phasing with WEFAX signals is essentially automatic—you press the PHASE switch once and the circuits take care of the details. This automatic feature will not work with TIROS imagery since there is no phasing interval with simple black-level pulses for the phase pulse detector to operate on. It would have been possible to design a second pulse detector for TIROS—to detect 7 pulses of 832-Hz modulation for the start of IR lines or 7 pulses of 1040 Hz for visible lines—that could be switched in in place of the WEFAX detector, but this would have increased the complexity of the circuit.

Still another detector would have been required for 240-line transmissions from the Soviet METEOR polar orbiters. Instead, it was decided to use another approach for phasing with polar orbiters. For these spacecraft, an oscilloscope (or even a CRT satellite monitor) is triggered by the drum trigger pulse at J202, with subcarrier video at J203 applied to the vertical input. The display is initiated by the drum trigger pulse and the position of the line sync pulse is easily noted on the scope. Phasing is accomplished by repeatedly pressing S204 for short intervals while observing the display. When the position of the satellite sync pulse matches the left edge of the display, the picture is properly phased.

Power supplies. Only two basic supplies are required. One provides +24 V for the

Parts List

Semiconductors	
U1	LM741CN
U2	LM380N
U3	NE567
U4	NE555
U5,U6	SN74121N
U7,U8,U9,U12	SN7400N
U10	SN7490N
U11	SN7493N
U13	LM340T-12
U14	LM340T-5
U101	SK3152 (RCA)
Q1,Q2	S5020 (MOT)
Q3,Q4,Q6,Q7	2N2219
Q5	2N2907A
D1,D2,D3,D4,D101, D102,D103,D7	1N4007
D5,D6	120-V, 5-W, 10% zener
Resistors (¼-W, 5% unless noted)	
R1,R4	10k
R2	2200
R3,R17	20k
R5	not used
R6,R103	4.7
R7,R16,R19,R20,R21	1000
R8	100
R9	3300 2-W, 10%
R10	47k 4-W, 10% (four 47k 2-W, 10% in series/parallel)
R11,R104	2200 2-W, 10%
R12,R18,R24	470
R13,R23	1500
R14	10k linear taper PC pot (SYNC LEVEL)
R15	470k
R22	15k
R101	3000
R102	47
R201	10k audio taper pot (WHITE SET)
E202	5k linear taper pot (VCO ADJ)
R203	10k audio taper pot (DRUM LEVEL)
Capacitors (D = disc ceramic, M = dipped mylar™, T = tantalum, A = aluminum)	
C1,C5,C14	1-µF, 35-V T
C2,C3,C4,C13	0.01-µF, 50-V M
C6,C8,C16,C104	0.1-µF, 50-V D
C7	470-µF, 16-V A
C9,C15,C109	0.047-µF, 50-V M
C10,C11	2.2-µF, 35-V T
C12,C101	4.7-µF, 35-V T
C17,C18	10-µF, 25-V T
C102	220-µF, 25-V A
C103	10-µF, 25-V A
C105	47-µF, 25-V A
C106,C107	22-µF, 25-V A
C108	1000-µF, 25-V A
C110,C111	40-µF, 450-V A
C112,C113	3300-µF, 35-V A
C201	see text
C202	Starting capacitor supplied with CA motor
C301	Starting capacitor supplied with GA motor
Transformers	
T201	Output transformer (1-4k:8 Ohm)
T202	5-15-H choke (see text)
T203	6.3-V, 1.2-A filament transformer
T204	18-V, 2-A power transformer
T205	225-V, 50-mA power transformer
Indicator Lamps (12-V-15-V LED or incandescent panel lamps)	
L201	VCO LOCK
L202	PHASE ERROR
L203	POWER
Switches	
S201	DPDT toggle (RESET/PRINT)(must have center "off")
S203	NO magnetic reed switch (drum phase sensor)
S204	NC push-button (MANUAL PHASE)
S205	SPST toggle (DRUM)
S206	NC push-button (WEFAX PHASE)
S207	SPST (POWER)
Miscellaneous	
J201,J202,J203	Switchcraft 3501FR phono jacks
P1	3-wire ac power cord and plug
P2	Cinch-Jones S-308-AB
P3	Cinch-Jones P-308-CCT
M1	Type GA synchronous motor, 240 rpm (HURST)
M2	Type CA synchronous motor, 40 rpm for WEFAX, 20 rpm for TIROS (HURST)
F201	½-A, type 3AG fuse and holder.

As an aid to those who want to save some time on the project, METSAT Products, Box 142, Mason MI 48854, has the following parts available: (1) FX-2E board set—a set of two drilled and plated circuit boards, $70.00; (2) FX-2E minikit—the drilled and plated boards, plus a complete set of machined fax mechanics, including the drum and fax motors. The unit is partially assembled and requires about 15 minutes of additional assembly time, $500.00; and (3) Wired and tested FX-2E units—contact METSAT for current prices.

drum amplifier, and with IC regulators, provides the +12 V and +5 V required by the other circuits. The 24-V supply need not be regulated, and if an 18-V transformer is used, the unregulated output can be used, eliminating the 24-V regulator components. If your unregulated output is greater than 25-28 V, however, the circuit should be included to protect the amplifier module and to ease the strain on the other IC regulators. The second supply is for the unregulated 300-350 V required for the printing circuit.

Parts. A complete parts list for the electronic components is included. The large mail-order supply houses are your best bet for everything except the RCA power module (U101) and the two high-voltage transistors. Substitutions for the latter two items are limited—we want a collector voltage limit of 400 V or more and at least 50 W of dissipation to keep things cool and stable. The transistors specified are rated to 125 Watts! No real high-frequency response is required. GE manufactures a plug-in replacement for the RCA module if the latter cannot be obtained locally. It should do just as well, although I have never used it. The 2N2219 transistors can be replaced by any general-purpose NPN silicon device.

Electronics Assembly

The schematic diagrams are based on the METSAT Products version of the FX-2E in which the electronic circuits are contained on two main circuit boards. These boards, which come with the kit version of the fax mechanics, greatly simplify assembly. The two boards are shown in Figs. 10 and 11 and may provide you with some ideas for circuit layout. The circuits can

be combined on a single large board or can be further subdivided into a series of smaller boards. The latter approach was used in the prototype and greatly facilitated its evolution from a strictly photographic fax system to its present form, as new circuit ideas could be tested readily and easily. You can develop your own PC layouts, wire the circuits on perfboard, or even purchase the boards separately if you so desire. In all cases, layout is not critical, but you should place the high-voltage components so that you are unlikely to come into contact with them while taking readings or making adjustments on the low-voltage circuits. The use of sockets is suggested. As you wire up the circuits, do not insert the 8- or 14-pin ICs at this time.

Packaging. An instrument enclosure houses all of the electronics components in the METSAT version and you can use any cabinet that will house your particular circuit layout. All of the controls and indicators, with the exception of the drum-level control, should be located on the front panel. The drum-level control is located internally wherever space is available. The rear apron contains the ac cable, fuse, video input, and the sockets for the drum, traverse, and control cables. If you are building a version for TIROS/NOAA or METEOR, the trigger and video out jacks also should be located on the rear apron. Needless to say, all wiring should be checked several times prior to powering up. In part II, we'll tackle the mechanical aspect of construction, probably the most difficult part of the system. Meanwhile, get started on the electronics. ■

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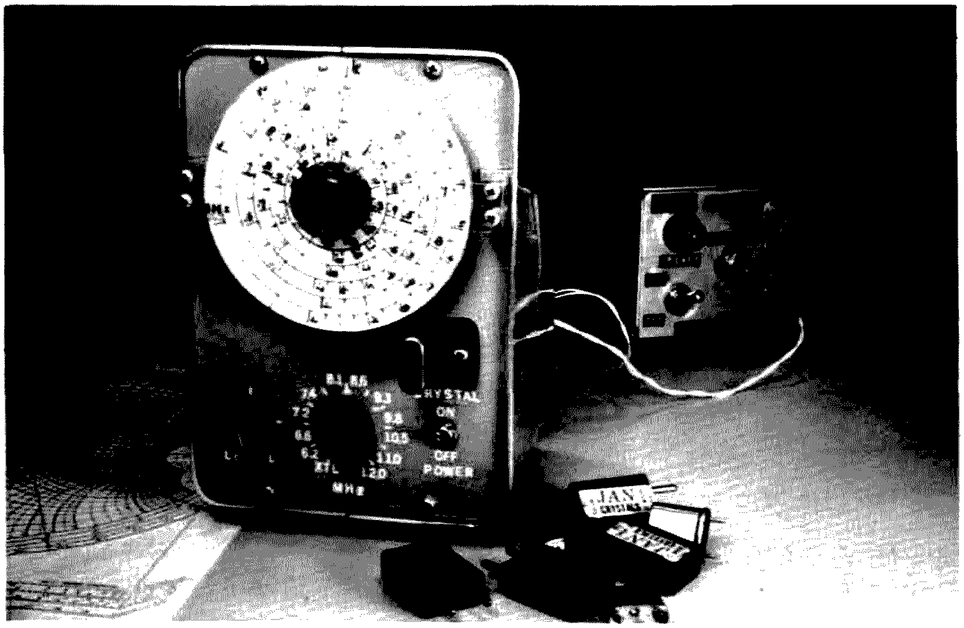
Breadboard Signal Generator

—sell your H-P stock once you build this project

This signal generator will not start a panic selling of Hewlett-Packard stock on the New York Exchange, but it will give the operator excellent stability and signal purity, with convenient operation and versatility comparable to commercial test equipment. It has a continuously adjustable frequency range of 6.2 through 12.1 MHz. The dial resolution at center range is 30 degrees per 100 kHz, and its power output is 30 mW (1.5 V across 75 Ohms). It is equipped with front-panel quartz-crystal sockets that will accept FT-243 and HC/6U holders. These crystals can be made to oscillate separately or in conjunction with the vfo, creating sum and difference frequencies at its output. The input power requirement is very low (12 V dc regulated), with a current drain of 30 mA.

The circuit has three transistor stages. Q1, a MOSFET, is in a series-tuned Colpitts oscillator circuit. Q2, another MOSFET, is in the buffer that also doubles as a Pierce crystal oscillator. Q3, a bipolar, is in the emitter-follower output circuit. Using MOSFET transistors, with their very high input impedances, makes it easy to isolate the tuned-circuit elements from the generator's output. They did not have to be dual-gate types, but the many low-cost deals offered by Poly Paks inspired this action.



The wideband signal generator.

I have not heard anyone describe (in plain English) how the series-tuned Colpitts oscillator works since I left the US Navy Radio School. What I learned there has been a great help to me through the years. I believe that what the ancient mariner taught me was correct, for transistors as well as for tubes. This information should be passed along to others. So, if you will refer to the schematic (Fig. 1), I will start the story.

When the range switch is in the 6.2-6.6 MHz position, just after the power switch

is closed, Q1 begins to conduct. The current, flowing through its channel from drain to source, causes a large voltage drop across L7 and R3 (positive at the Q1 end of L7). This potential will cause a current flow that will divide, charging C3 to ground, C2 through L1, and the parallel combination of C4/C5. This path causes L1 to have an expanding magnetic field, and there is a positive potential at its C2 end. This potential charges C1 through R1, and the voltage drop across it will increase in the positive direction. R1 is connected to the gates of Q1, so this positive voltage will open its channel wider, and the increased conduction makes the voltage drop across L7 and R3 rise. This process continues at a time rate controlled by the LC time constant of the circuit elements, until Q1 reaches the conduction limit set by the R3 bias. At this time, all the capacitors are fully charged and no more current flows through L1. The magnetic field around L1 will collapse, and the flux lines cutting the turns will develop a potential opposite to the charging one. All of the capacitors begin to discharge at the LC time-constant rate, storing the energy to be released by L1's flux. This will mean that the current through R1 has reversed, and at a magnitude great enough to create a negative potential enough to pinch off Q1. This process continues until all the field has collapsed, after which Q1 returns to the conducting state. The current is now increased by the oppositely charged capacitors of the tank circuit, L1/C2/C3/C4/C5. The amount is directly proportional to the circuit Q and will add more energy to L1's field. This means that when the field collapse cycle begins again, Q1 will quickly be pinched off and oscillations will continue, with only spurts of energy being supplied by the transistor. The ac tank circuit signal across C3 is tapped for a useful output.

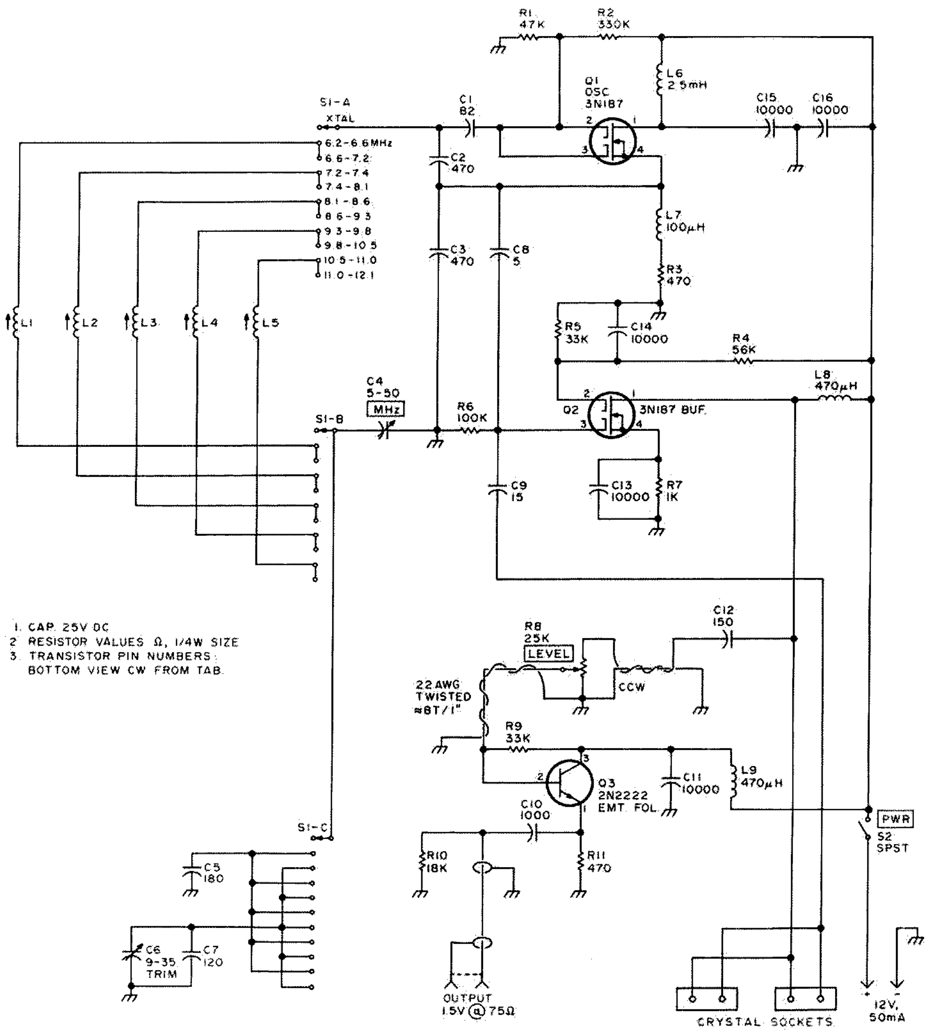


Table 1. Coil data.

Coil	Turns Close-wound	Wire Size (AWG, Enam.)	Freq. (MHz)
L1	40	28	6.2-7.2
L2	35	28	7.2-8.1
L3	27	28	8.1-9.3
L4	26	24	9.3-10.5
L5	18	24	10.5-12.1

Forms ¼ × ¾ (63 × 190 mm) ceramic slug-tuned

Fig. 1. Schematic of the signal generator.

The MOSFET buffer, Q2, is a class A amplifier that is lightly coupled to the oscillator by C8. It also has leads connecting the drain and gate to a pair of quartz-crystal sockets. When the range switch, S1, is in the XTAL position and a crystal is in one of the sockets, Q2 becomes a Pierce oscillator. The LEVEL control, R8, should be fully CW in this mode so that an ideal impedance match is present for oscillations to begin. The oscillator will operate when the crystals are within the range of 2 to 15 MHz. When the range switch is in any other position, the signals of the two oscillators mix and the output of the signal generator will contain the vfo, the crystal, their sum, and their difference frequencies.

The buffer output is fed to the bipolar emitter-follower, Q3, through potentiometer LEVEL control, R8. A homemade transmission line of twisted 22 AWG insulated wire carries the signal into and away from this control. This type of level control will reduce the generator output to almost zero, eliminating the need for a complicated attenuator for most test work.

To allow for versatile experiments and changes, all of the electronic circuits are constructed on a piece of perforated board containing .064" diameter holes spaced .25" apart. It measures 4" × 5.5" (9.8 × 13.5 cm), and all

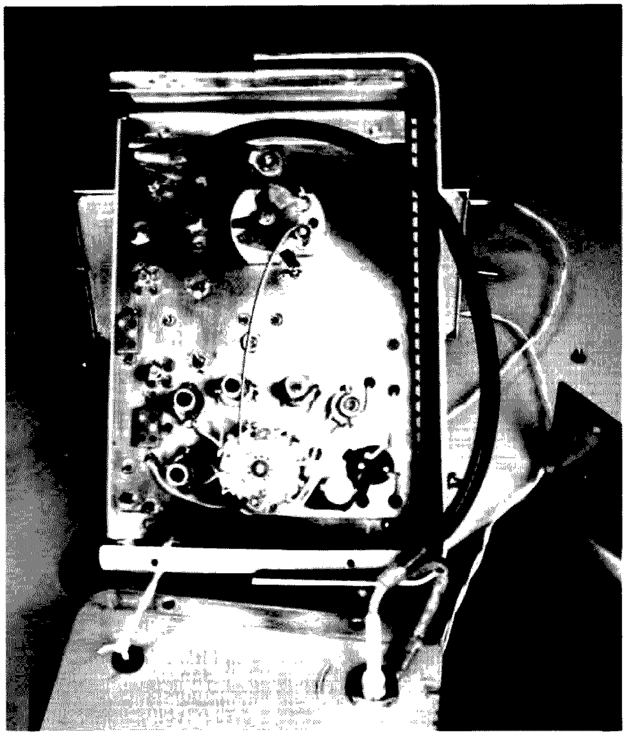


Fig. 2. Back and side removed showing parts placement and wiring.

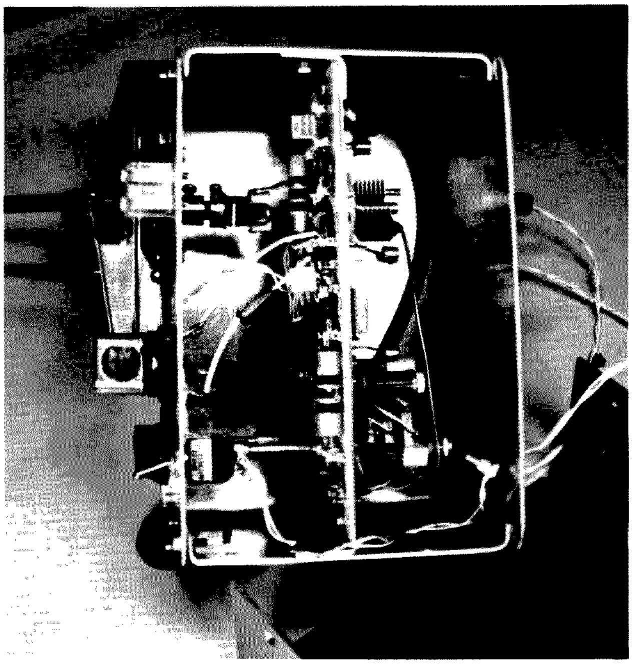


Fig. 3. Right-side cover removed. "U" channels, top and bottom, fasten the circuit board to the cabinet front, back, and sides. A flexible coupler connects the C4 shaft to dial. S1 and R8 are hard coupled to knobs.

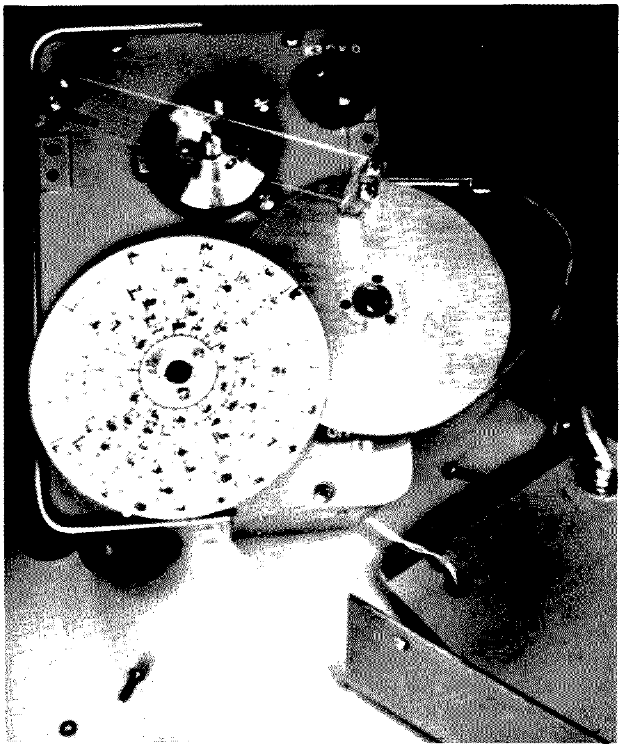


Fig. 4. Aluminum disc, scale, and index separated from the 36mm vernier dial.

the components are soldered to push-in terminals. As can be seen in Fig. 2, the back side of the board is covered with a piece of .032" (.8mm) thick brass or copper sheeting which has clearance holes drilled where the terminals project through it. The ground terminals are soldered to this sheet, holding it in place and making it a very rigid assembly. The range switch, S1, is located near the bottom center with the coils (L1-L5 described in Table 1) soldered to terminals around it. Q1 is just above the coils to the left, and the trim capacitor (C6) is next to the level potentiometer (R8) on the right. To the left, the next transistor up is Q2, followed by Q3. Centered near the top is the tuning capacitor, C4. Fig. 3 shows how the crystal sockets are connected to the circuit board and the details of the aluminum case built around the breadboard-type electronic assembly. Fig. 4 shows how a large scale is fastened to the 36mm vernier dial. An aluminum disc, 3.4" (8.6 cm) in diameter, backs up a lacquered, heavy paper dial which has six concentric circles and a center line inked on it. An index of plastic, scribed through the center, extends across the whole dial. This will allow 12 scales to be marked on the dial, 6 on each half. The disc and paper scales are fastened to the vernier dial with the same screws used to hold the original scale in place. When soldering the MOSFET transistors into place, be sure to short all the leads to the case with a piece of foil or you will zap the gates. It would be better to use sockets and then plug the MOSFETs safely into them.

After the unit is wired and power applied, you should check for an output. If none is present or it is at an unexpected frequency, troubleshoot the problem using Table 2 in order to isolate the malfunction. When the output is found to be normal, set the range switch to the 8.1-8.6 MHz position, rotate the dial fully CCW (C4 plates open), and adjust L3 until the signal measures 8.6 MHz. Reset the switch to the 8.6-9.3 MHz position, rotate the

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The Odd Couple

—CASEY/1 tackles OSCAR's telemetry

I was one of those reactionary hams—you know the type: writing to *73 Magazine* complaining about those damn computer articles in an amateur radio publication. But computer madness finally caught up with me, and a TRS-80 named CASEY/1 is now in the den, its luminescent READY a constant taunt to the neophyte programmer.

After three weeks of working with the excellent instruction manual that comes with the machine and several nights of concerted game playing, I started looking for a way to put CASEY/1 to work, and copying OSCAR 8's telemetry one night gave me an idea.

This program decodes the satellite's telemetry channel readings, giving the user information on how OSCAR 8 is doing. Although Radio Shack Level I BASIC is used, the program will run on any BASIC machine with minor modifications as needed; 1,187 bytes of memory are required. Channel one calculations are straightforward. A no-current reading is registered if the count is 100, 101, or 102. If the count is in the 90s, the satellite is approaching sunlight, and counts less than 90 indicate that OSCAR 8 is out of the Earth's shadow.

The calculations for channels two and three are self-explanatory. For channels four and five, I have added a Fahrenheit conversion for those of us who have yet to jump onto the metric bandwagon.

For channel six, when OSCAR 8 is in Mode J, the program calculates power output. In Mode A, input to the power amplifier stages can be derived whenever the satellite is in the Earth's shadow by multiplying current (channel 2) and voltage (channel 3). Three Watts are then subtracted for resting power consumption. With the satellite in the sunlight, current can flow directly from the solar panels to the transponder, and a faulty reading can result.

OSCAR newcomers should note that the first number of each telemetry frame is the channel number, so a 101 becomes an 01 when you are entering it into the program.

Copying OSCAR 8 telemetry is a lot more interesting with this program since it converts those frames into current, usable information. But don't forget to pass those readings on to the ARRL, which has assumed day-to-day responsibility over OSCAR 8, so that AMSAT could concentrate on the upcoming Phase III series. It is only through this constant monitoring that the amateur satellites consistently have outperformed commercial satellites launched with them.

Information needed for this program was gleaned from a pre-launch article by W3PK and G3ZCZ in the AMSAT *Newsletter*[1] and an excellent article in a recent *QST*. ■

```
 5 REM AMSAT OSCAR 8 TELEMETRY PROGRAM
 6 REM DE WA9LRI RICH CASEY  7809.04
 9 CLS
10 P."           AMSAT OSCAR 8 TELEMETRY PROGRAM"
20P.:P.:P."ENTER TELEMETRY READINGS AS REQUESTED:"
30 IN."1";A
40 IN."2";B
50 IN."3";C
60 IN."4";D
70 IN."5";E
80 IN."6";F
99 CLS

100 REM CHANNEL ONE CALCULATIONS
110 G=7.15*(101-A)
120 P."THE TOTAL SOLAR ARRAY CURRENT IS ";G;" MA."
130 IF (G=Ø)*(A>89)P."THE SATELLITE IS IN THE EARTH'S SHADOW.":G.200
150 P."THE SATELLITE IS CURRENTLY IN THE SUNLIGHT."

200 REM CHANNEL TWO CALCULATIONS
210 H=57*(B-50)
230 P.:P."THE BATTERY CURRENT IS ";H;" MA."
250 IF B>50 P."THE BATTERY ABOARD AO8 IS CHARGING."
260 IF B<50 P."THE BATTERY ABOARD AO8 IS DISCHARGING"

300 REM CHANNEL THREE CALCULATIONS
310 I=(.1*c)+8.25
330 P.:P."THE BATTERY VOLTAGE IS ";I;" VOLTS."

400 REM CHANNEL FOUR CALCULATIONS
405 J=95.8-1.48*D
410 M=(9/5)*J+32
415 P.
420 P."THE BASEPLATE TEMPERATURE IN DEGREES IS ";J;" C, ";M;" F."

500 REM CHANNEL FIVE CALCULATIONS
505 K=95.8-(1.48*E)
510 N=(9/5)*K+32
520 P.:P."THE BATTERY TEMPERATURE IN DEGREES IS ";K;" C, ";N;" F."

600 REM CHANNEL SIX CALCULATIONS
605 IF F<3 THEN F=Ø
608 P.
610 IF F=Ø GOSUB 1000
630 IF F>Ø P."THE POWER OUTPUT IN MODE J IS ";L;" MW."
999 END

1ØØØ REM MODE A POWER CALCULATIONS
1ØØ1 P=((.001*H)*I)-3
1ØØ3 IF (G=Ø)+(A>89) THEN 1Ø1Ø
1ØØ5 P."POWER READING CANNOT BE TAKEN WHILE AO8 IS IN SUNLIGHT."
1Ø1Ø P."THE MODE A TRANSMITTER INPUT POWER IS ";ABS(P);" WATTS."
1Ø2Ø RETURN
```

Program listing.

References

1. "The AMSAT-OSCAR D Spacecraft," W3PK and G3ZCZ, AMSAT *Newsletter*, December, 1977.
2. "OSCAR 8 Has A Message For You," W9KDR and WB2CHO, *QST*, July, 1978.

PL Tones from a KIM-1

—a real time wasting project

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If you need a PL encoder for your base station VHF or UHF FM transceiver and own a KIM-1 microcomputer, then you need look no further than your KIM-1. The program in this article will generate a square-wave tone anywhere in the range of 191 Hz to 66 Hz. This program resides in page 0 of memory and will take only a few minutes to put in the computer. The square-wave output is found on PA0.

This program simply wastes the precise amount of time necessary for tone generation by executing a large number of machine cycles before toggling the PA0 output. The precise frequency being generated is determined by the values in the locations labeled X1 and X2. These locations can range in value from 00 to FF in hexadecimal notation.

To generate a tone in the range of 191 Hz to 98 Hz, use formula 1 as shown in Table 1. To generate a tone in the range of 98 Hz to 66 Hz, use formula 2. The values calculated should be used for X1 or X2, depending on the formula used. These values are approximations only and should be fine tuned on the air or with a very good frequency counter.

The circuit shown in the figure is used to clean up and attenuate the audio tone generated at PA0. R2 should be adjusted in value to provide the proper amount of deviation of the transmitter. The connection from R2 should be made at the deviation control and not in the microphone circuit.

You will find that this encoder program works quite well, especially when considering the capability of changing tones just by changing two numbers in the program. I hope you have as much fun using this program as I have had in writing it.■

```
0000  A9 01       LDA #$01     SET UP PAØ FOR OUTPUT
0002  8D 01 17    STA 1701
0005  A9 FF       LDA #$FF     FIRST DELAY LOOP
0007  85 D0       STA 00D0
0009  C6 D0       DEC 00D0
000B  F0 03       BEQ 0010
000D  4C 09 00    JMP 0009
0010  A9 C0       LDA #$C0     SECOND DELAY LOOP (VARIABLE X1)
0012  85 D0       STA 00D0
0014  C6 D0       DEC 00D0
0016  F0 03       BEQ 001B
0018  4C 14 00    JMP 0014
001B  A9 01       LDA #$01     THIRD DELAY LOOP (VARIABLE X2)
001D  85 D0       STA 00D0
001F  C6 D0       DEC 00D0
0021  F0 03       BEQ 0026
0023  4C 1F 00    JMP 001F
0026  EE 00 17    INC 1700     TOGGLE PAØ
0029  4C 05 00    JMP 0005     RETURN TO FIRST DELAY LOOP

Note: The program with variables X1 and X2 set as shown will
      generate a 110.9-Hz tone.
```

Program listing.

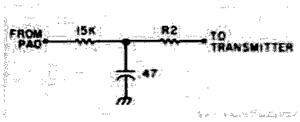

Fig. 1. PL interface.

1. First calculate the number of machine cycles required to generate the tone by the following formula: N (number of machine cycles) = $10^6/f$ (freq. of tone in Hz).
2. If the frequency is between 191 Hz and 98 Hz, then X2 = 01; calculate the value of X1 using formula 1: X1 = N − 5174/20. Convert the result obtained for X1 to hexadecimal notation and insert the values for X1 and X2 in memory.
3. If the frequency is between 98 Hz and 66 Hz, then X1 = FF; calculate the value of X2 using formula 2: X2 = N − 10274/20. Convert the result obtained for X2 to hexadecimal notation and insert the values for X1 and X2 in memory.

Table 1. Calculating tone frequency.

Super Duper for Field Day

—system keeps the computer in a safe place

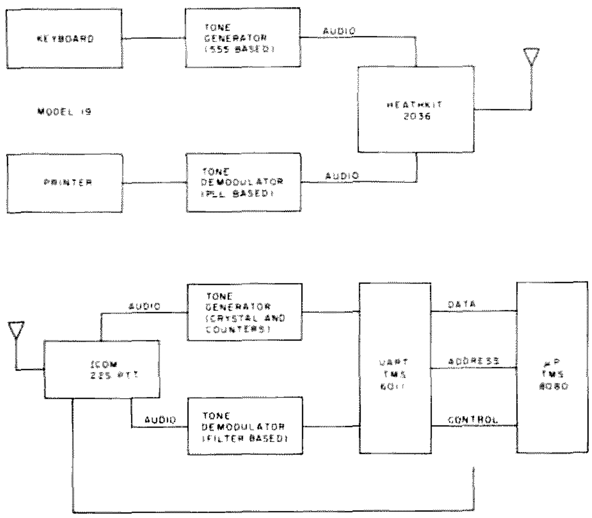

Fig. 1. Block diagram, equipment used.

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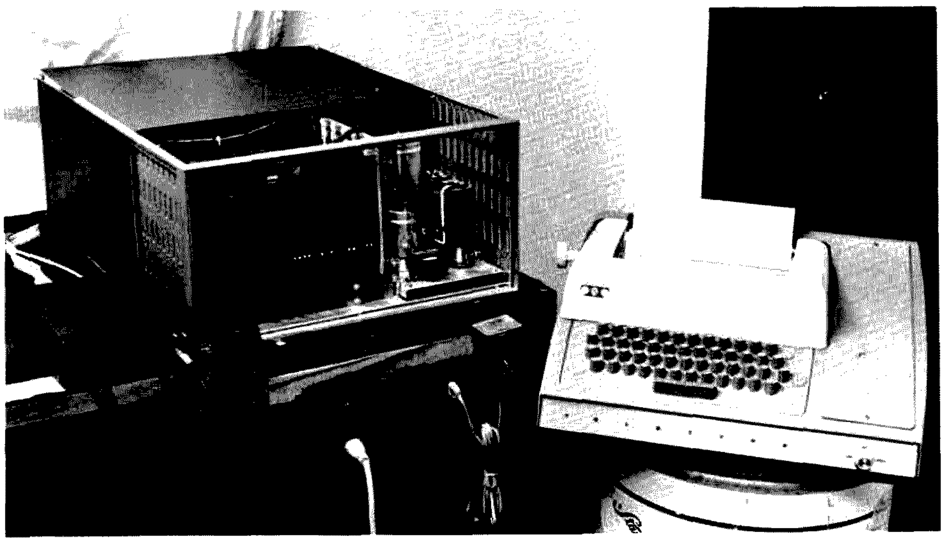
Did you have enough of those dupe sheets last Field Day? Want to know a way to never have a dupe sheet bother you again, no matter how many new prefixes the FCC adds? Got someone in the club who has an 8080-based processor that keeps asking for some way to help? If you get resounding yeses to such questions at your Field Day reviews, then read on! Here is a stepping-stone towards automating the drudgery of Field Day.



Described here is a remote automatic (except for IDing) dupe checker that was used recently for Field Day at K5OJI, Texins ARC. The trial system consisted of a Model 19 teleprinter on the FD site, a two-meter RTTY simplex radio link, and an 8080-based processor with 20K of RAM at the other end. With no modifications, this is enough for about 2000 contacts. Although the search-and-store routines are somewhat of a brute force approach, this setup will say GO/NO-GO before your regular dupe operator can find the right square to look in!

All commands are a single letter followed by the call in question and are terminated by a carriage return. The commands are:

1) C—check list for previous occurrence of call; report back GO/NO-GO for contact.

2) L—log call; report successful entry into table or prior presence.

3) R—remove call (oops, we didn't get him), report removal complete, or nothing by that call to remove.

4) B—band change; confirm band table now in use.

5) D—dummy; no return. Since all data sent to and received from the FD site is copied on the processor console, this command allows the FD crew to leave messages at the computer (see detailed description of program).

Look at the block diagram. Except for the interfacing around the processor, it is a standard simplex RTTY link. Any working RTTY equipment will do just fine.

System Requirements

Before describing the end result, it is worth reviewing the constraints such a typical system must operate under.

1) Remote intelligence. This system has a radio link because of one of the common components of Field Day—generators. Questions such as: Would you plug your Altair and precious floppies into an ac line that swings between 90 and 150 V ac and between 50 and 70 Hz?, or Where is your data when the lights go out?, point towards remoting the smarts. The ideal FD terminal is, however, a processor-driven video display operating from PROM. A Model 19 is too noisy for CW operators.

2) Data speed and format. As of this writing, the only mode to transmit data is half duplex Baudot code at its various slow speeds. No ASCII and no speeds above 100 wpm.

3) Speed. Since the data-link speed is slow, any foot-dragging in table lookup is unacceptable. The worked callsigns must be speedily accessed, i.e., kept in main memory or maybe in floppy files. This program uses main memory.

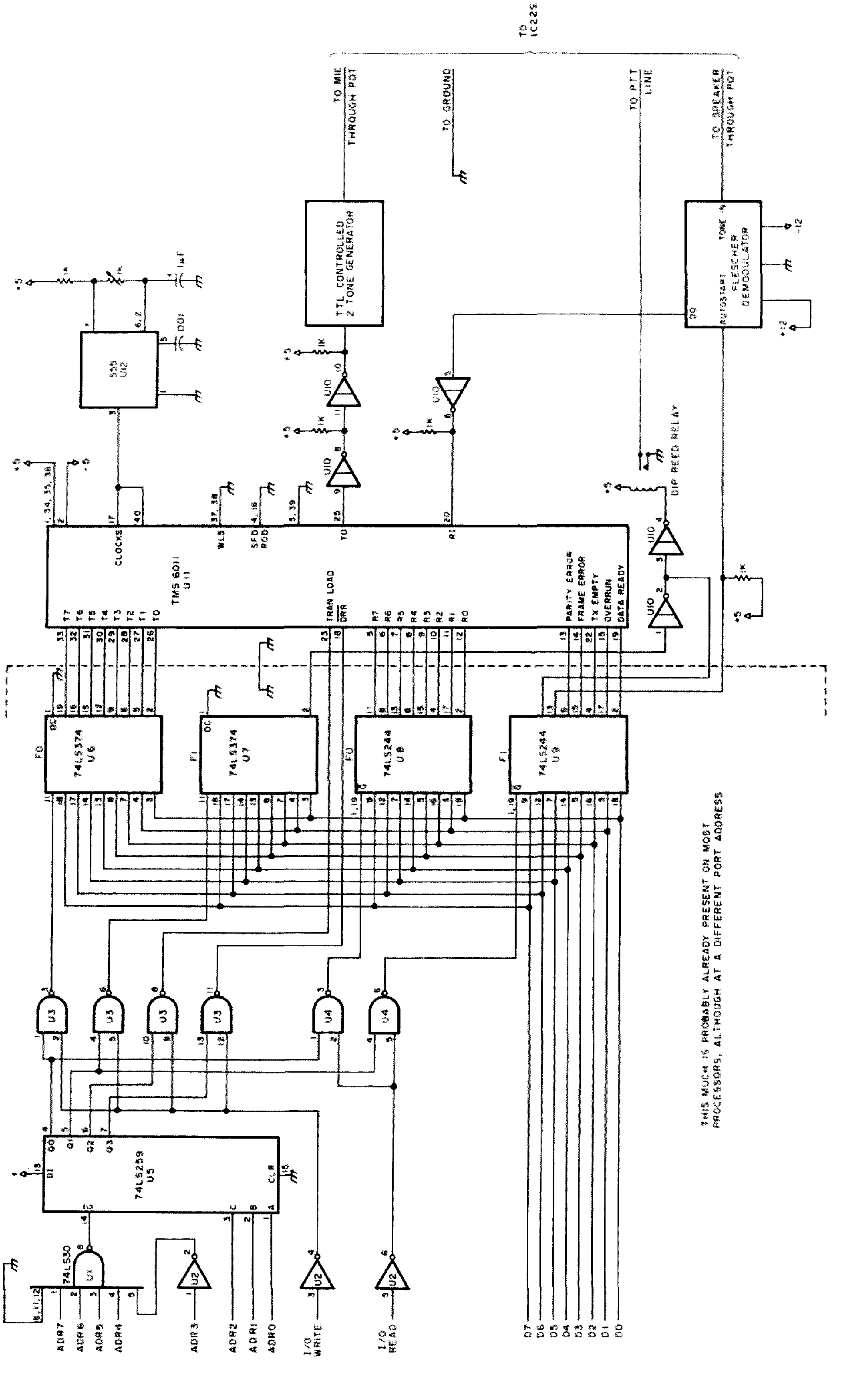


Fig. 2. Schematic: dupe checker tie-in to processor.

Hardware Discussion

The interface to the computer is done through four output ports and two input ports. At output port 0F0H, the computer transmits data to the UART. The data is 5-level Baudot code. One bit of output port 0F1H is used to control the reed relay that turns on the transmitter. On output ports 0F2H and 0F3H, only the decoded strobes are used to pulse the UART for the data-ready reset and for loading the transmitter buffer register.

Input port 0F0H is used to input the data from the

Program listing.

```
ASSM 0100 7000

0100            0001 *
0100            0002 * FIELD DAY LOGGING SYSTEM:
0100            0003 *  PART 1 - DUPLICATE CHECKING
0100            0004 *
0100            0005 *  24 JUN 1978,  BY DAVE HEIN
0100            0006 *
0100            0007 *
0100            0008 * USES A BAUDO CONVERSION ROUTINE BY
0100            0009 *  JIM SZOT
0100            0010 *
0100            0011 *  PORTS:
0100            0012 *   F0=BAUDO DATA (IN AND OUT)
0100            0013 *   F1=BAUDO STATUS (IN)
0100            0014 *   F1=TRANSMIT CONTROL (OUT)
0100            0015 *   F2STR=UART LOAD
0100            0016 *   F3STR=UART DRR-
0100 C3 0A 04   0017  JMP START
0103            0018 *
0103            0019 * EQUATES
0103            0020 CONST EQU 01H
0103            0021 RTYST EQU 0F1H
0103            0022 RTYLA EQU 0F0H
0103            0023 TRANP EQU 0F1H
0103            0024 SPCE  EQU 20H
0103            0025 CR    EQU 0DH
0103            0026 LF    EQU 0AH
0103            0027 ERR   EQU 00H
0103            0028 FOUR  EQU 04H
0103            0029 TTYDA EQU 00H
0103            0030 TTYST EQU 01H
0103            0031 AUTO  EQU 20H
0103            0032 LISEH EQU 4CH  LIST END HIGH
0103            0033 LISEL EQU 00H  LIST END LOW
0103            0034 *
0103            0035 *
0103            0036 * SUBROUTINES FIRST:
0103            0037 *
0103            0038 * SUBROUTINES BORROWED FROM MONITOR
0103            0039 * INCLUDED TO MAKE PGM SELF SUFFICIENT
0103            0040 *
0103            0041 * MOVEC=UTILITY TABLE MOVE ROUTINE
0103            0042 * DE=SOURCE BEGIN, BC=SOURCE END
0103            0043 * HL=DESTINATION START
0103 D5         0044 MOVEC PUSH DE
0104 C5         0045  PUSH BC
0105 E5         0046  PUSH HL
0106 2B         0047  DCX HL
0107 CD 38 01   0048  CALL HILO  CARRY=1 IF HL>DE
010A DA 1A 01   0049  JC MOVEU   IF SO, MOVE UP
010D C1         0050 MOVED POP BC IF NOT MOVE DOWN
010E D1         0051  POP DE
010F E1         0052  POP HL
0110 7E         0053 MV0 MOV A,M   GET A BYTE
0111 02         0054  STAX BC    MOV TO NEW AREA
0112 03         0055  INX BC
0113 CD 38 01   0056  CALL HILO  DONE?
0116 D2 10 01   0057  JNC MV0
0119 C9         0058  RET
011A C1         0059 MOVEU POP BC
011B D1         0060  POP DE
011C E1         0061  POP HL
011D E5         0062  PUSH HL
011E 2B         0063  DCX HL
011F CD 38 01   0064  CALL HILO  CREATE LENGTH
0122 2A 04 00   0065  LHLD FOUR
0125 09         0066  DAD BC  END OF MOVED TABLE
0126 E5         0067  PUSH HL
0127 C1         0068  POP BC  XCHG TO BC
0128 E1         0069  POP HL
0129 EB         0070  XCHG
012A 7E         0071 MV1 MOV A,M
012B 02         0072  STAX BC
012C 0B         0073  DCX BC
012D 2B         0074  DCX HL
012E 2B         0075  DCX HL  HL BUMPED IN HILO
012F CD 38 01   0076  CALL HILO
0132 DA 2A 01   0077  JC MV1
0135 7E         0078  MOV A,M  HL=DE
0136 02         0079  STAX BC
0137 C9         0080  RET
0138            0081 *
0138 23         0082 HILO INX HL  COMPARE HL,DE
0139 7C         0083  MOV A,H  IS HL=0?
013A B5         0084  ORA L
013B 37         0085  STC
013C C8         0086  RZ
013D 7B         0087  MOV A,E
013E 95         0088  SUB L  DE-HL
013F 32 04 00   0089  STA FOUR  SAVE RESULT
0142 7A         0090  MOV A,D
0143 9C         0091  SBB H
0144 32 05 00   0092  STA FOUR+1
0147 C9         0093  RET
0148            0094 *
0148 C5         0095 CRLF PUSH BC  CONSOLE CRLF
0149 0E 0D      0096  MVI C,CR
014B CD 55 01   0097  CALL CO
014E 0E 0A      0098  MVI C,LF
0150 CD 55 01   0099  CALL CO
0153 C1         0100  POP BC
0154 C9         0101  RET
0155            0102 *
0155 DB 01      0103 CO IN TTYST  CONSOLE OUTPUT
0157 E6 04      0104  ANI 04H
0159 CA 55 01   0105  JZ CO
015C 79         0106  MOV A,C
015D D3 00      0107  OUT TTYDA
015F C9         0108  RET
0160            0109 *
0160 C5         0110 DELAY PUSH BC
0161 06 54      0111  MVI B,54H
0163 05         0112 DL0 DCR B
0164 C2 63 01   0113  JNZ DL0
0167 C1         0114  POP BC
0168 C9         0115  RET
0169            0116 *
0169            0117 * SUBROUTINES PARTICULAR TO THIS TASK
0169            0118 *
0169            0119 * TOASC:  BAUDO TO ASCII TO CONSOLE
0169 FE 1B      0120 TOASC CPI 1BH
016B CA 9A 01   0121  JZ FIGSH
016E FE 1F      0122  CPI 1FH
0170 CA 92 01   0123  JZ LTRSH
0173 57         0124  MOV D,A SAVE A
0174 3A B1 02   0125  LDA LTRF  GET LETTER FLAG
0177 B2         0126  ORA D   OR TOGETHER
0178 21 39 02   0127  LXI HL,CVST7
017B 06 00      0128  MVI B,0
017D 4F         0129  MOV C,A
017E 09         0130  DAD BC
017F 4E         0131  MOV C,M
0180 79         0132  MOV A,C
0181 FE 0A      0133  CPI LF
0183 CA 8E 01   0134  JZ SKIP
0186 FE 0D      0135  CPI CR
0188 CC 48 01   0136  CZ CRLF
018B CD 55 01   0137  CALL CO
018E 79         0138 SKIP MOV A,C  LTR SHFT ON SPCE
018F FE 20      0139  CPI SPCE
0191 C0         0140  RNZ
0192 57         0141 LTRSH MOV D,A  SAVE A
0193 3E 00      0142  MVI A,0
0195 32 B1 02   0143  STA LTRF  SET SHIFT FOR LTRS
0198 7A         0144  MOV A,D  RESTORE A
0199 C9         0145  RET
019A 57         0146 FIGSH MOV D,A  SAVE BAUDO
019B 3E 20      0147  MVI A,20H  SET FIGS FLAG
019D 32 B1 02   0148  STA LTRF
01A0 7A         0149  MOV A,D  RESTORE FOR ASCII IGNORE
01A1 C9         0150  RET
01A2            0151 *
01A2            0152 * TOBAO:  ASCII TO BAUDO TO RADIO
01A2            0153 *
01A2 5F         0154 TOBAO MOV E,A  SAVE ASCII
01A3 FE 07      0155  CPI 07H
01A5 CA F8 01   0156  JZ SBELL
01A8 FE 0A      0157  CPI 0AH
01AA CA 00 02   0158  JZ SLF
01AD FE 0D      0159  CPI CR
01AF CA 05 02   0160  JZ SCR
01B2 FE 20      0161  CPI SPCE  SPECIAL ASCII
01B4 CA 0A 02   0162  JZ SSP
01B7 FE 00      0163  CPI 00H
01B9 CA 0F 02   0164  JZ SNUL
01BC FE 5B      0165  CPI 5BH  CHECK FOR INVALIDS
01BE D0         0166  RNC
01BF FE 41      0167  CPI 41H
01C1 D2 D8 01   0168  JNC SALPH
01C4 FE 21      0169  CPI 21H
01C6 D8         0170  RC
01C7 CD 1A 02   0171 SFIGS CALL FIGST  MAKE SURE IN FIGS
01CA 7B         0172  MOV A,E
01CB 21 92 02   0173  LXI HL,C7T5F  LOOK UP BAUDO CODE
01CE D6 21      0174  SUI 21H
01D0 06 00      0175  MVI B,0
01D2 4F         0176  MOV C,A
01D3 09         0177  DAD BC  TABLE LOOKUP
01D4 4E         0178  MOV C,M
01D5 C3 16 02   0179  JMP FINBO  XMIT IT
01D8 3A B2 02   0180 SALPH LDA LTRSF  CHECK SHIFT FLAG
01DB FE 20      0181  CPI 20H
```

UART that's coming in from the radio. The system status, including the autostart indicator, comes in on port 0F1H. Other more dedicated hookup methods surely are as viable, but this accessory is currently plugged into the general I/O board of the target processor.

The schematic provided will not work directly on an S-100-based processor. The target machine is a homebrew 8080-based machine with an 8228 system controller for decoding the status signals. The main purpose of the schematic is to back up the listing, i.e., to show what the program was working with.

Program Explanation

Lines 019-033: These are the necessary equates of names to numbers. Included are I/O ports, common ASCII characters, buffer areas (FOUR), and the end of the call table area (in two parts to make end checks easier). The call table area starts at the end of the object for the program and ends at LISEH, LISEL.

Lines 041-093: MOVEC is the callable part of the move monitor command used in the target processor. It opens or closes holes in the call table to add or remove calls from the table. When moving up the rest of the table to create a hole in the list, the move is done from the end to the beginning to avoid filling the memory with the same callsign. When squeezing a

```
01EA 7B          0187 NSH2 MOV A,E  RESTORE ASCII IN A
01EB 21 78 02    0188  LXI HL,C7T5L  TABLE LOOKUP
01EE D6 41       0189  SUI 41H  LOW GROUP
01F0 06 00       0190  MVI B,0
01F2 4F          0191  MOV C,A
01F3 09          0192  DAD BC
01F4 4E          0193  MOV C,M  GET CODE
01F5 C3 16 02    0194  JMP FINBO  XMIT IT
01F8 CD 1A 02    0195 SBELL CALL FIGST  IN FIGS?
01FB 0E 05       0196  MVI C,5  BAUDO BELL
01FD C3 16 02    0197  JMP FINBO
0200 0E 02       0198 SLF MVI C,2  BLF
0202 C3 16 02    0199  JMP FINBO
0205 0E 08       0200 SCR MVI C,8  BCR
0207 C3 16 02    0201  JMP FINBO
020A 0E 04       0202 SSP MVI C,4  BSPCE
020C C3 16 02    0203  JMP FINBO
020F 0E 00       0204 SNUL MVI C,0
0211 CD 2C 02    0205 SHOUT CALL IOOUT  SEND IT THEN
0214 0E 1F       0206  MVI C,1FH  LTRS CODE
0216 CD 2C 02    0207 FINBO CALL IOOUT  SEND IT THEN
0219 C9          0208  RET
021A 3A B2 02    0209 FIGST LDA LTRSF  FIGS MODE?
021D FE 00       0210  CPI 00H
021F C8          0211  RZ
0220 3E 00       0212  MVI A,0
0222 32 B2 02    0213  STA LTRSF  ZERO FLAG
0225 0E 1B       0214  MVI C,1BH  AND XMIT FIGS
0227 CD 2C 02    0215  CALL IOOUT
022A 7B          0216  MOV A,E  RESTORE ASCII
022B C9          0217  RET
022C DB F1       0218 IOOUT IN RTYST
022E E6 04       0219  ANI 04H
0230 CA 2C 02    0220  JZ IOOUT
0233 79          0221  MOV A,C
0234 D3 F0       0222  OUT RTYDA
0236 D3 F2       0223  OUT 0F2H  STROBE TBRL
0238 C9          0224  RET
0239             0225 *
0239             0226 * LOOKUP TABLES
0239             0227 *
0239             0228 CVST7 EQU $  ASCII TO BAUDO
0239 00          0229  DB 00
023A 45          0230  DB 'E'
023B 0A          0231  DB LF
023C 41          0232  DB 'A'
023D 20          0233  DB SPCE
023E 53 49       0234  DW 'IS'
0240 55          0235  DB 'U'
0241 0D          0236  DB CR
0242 44 52       0237  DW 'RD'
0244 4A 4E       0238  DW 'NJ'
0246 46 43       0239  DW 'CF'
0248 4B 54       0240  DW 'TK'
024A 5A 4C       0241  DW 'LZ'
024C 57 48       0242  DW 'HW'
024E 59 50       0243  DW 'PY'
0250 51 4F       0244  DW 'OQ'
0252 42 47       0245  DW 'GB'
0254 00          0246  DB ERR
0255 4D 58       0247  DW 'XM'
0257 56          0248  DB 'V'
0258 00          0249  DB ERR
0259 00          0250  DB 0
025A 33          0251  DB '3'
025B 0A          0252  DB LF
025C 2D 20       0253  DW ' -'
025E 07          0254  DB 07H BELL
025F 38 37       0255  DW '78'
0261 0D          0256  DB CR
0262 24 34       0257  DW '4$'
0264 27          0258  DB 27H
0265 2C 21       0259  DW '!,'
0267 3A 28       0260  DW '(:'
0269 35 22       0261  DW '"5'
026B 29 32       0262  DW '2)'
026D 23 36       0263  DW '6#'
026F 30 31       0264  DW '10'
0271 39 3F       0265  DW '?9'
0273 26          0266  DB '&'
0274 00          0267  DB ERR
0275 2E 3B       0268  DW ';.'
0277 00          0269  DB ERR
0278             0270 C7T5L EQU $ ASCII TO BAUDO (LETTERS)
0278 03          0271  DB 3  A
0279 19          0272  DB 25
027A 0E          0273  DB 14

0280 06          0279  DB 6
0281 0B          0280  DB 11
0282 0F          0281  DB 15
0283 12          0282  DB 18
0284 1C          0283  DB 28
0285 0C          0284  DB 12
0286 18          0285  DB 24
0287 16          0286  DB 22
0288 17          0287  DB 23
0289 0A          0288  DB 10
028A 05          0289  DB 5
028B 10          0290  DB 16
028C 07          0291  DB 7
028D 1E          0292  DB 30
028E 13          0293  DB 19
028F 1D          0294  DB 29
0290 15          0295  DB 21
0291 11          0296  DB 17 Z
0292             0297 C7T5F EQU $  ASCII TO BAUDO (FIGS)
0292 0D          0298  DB 13 !
0293 11          0299  DB 17 "
0294 14          0300  DB 20 #
0295 09          0301  DB 9  $
0296 00          0302  DB 00 %-NULL
0297 1A          0303  DB 26 &
0298 0B          0304  DB 11 '
0299 0F          0305  DB 15 (
029A 12          0306  DB 18 )
029B 00          0307  DB 00 *-NUL
029C 00          0308  DB 00 +-NULL
029D 0C          0309  DB 12 ,
029E 03          0310  DB 3  -
029F 1C          0311  DB 28 .
02A0 1D          0312  DB 29 /
02A1 16          0313  DB 22 0
02A2 17          0314  DB 23 1
02A3 13          0315  DB 19 2
02A4 01          0316  DB 1  3
02A5 0A          0317  DB 10 4
02A6 10          0318  DB 16 5
02A7 15          0319  DB 21 6
02A8 07          0320  DB 7  7
02A9 06          0321  DB 6  8
02AA 18          0322  DB 24 9
02AB 0E          0323  DB 14 :
02AC 1E          0324  DB 30 ;
02AD 00          0325  DB 00 <-NULL
02AE 00          0326  DB 00 =-NULL
02AF 00          0327  DB 00 >-NULL
02B0 19          0328  DB 25 ?
02B1 00          0329 LTRF DB 00  INIT TO LTRS
02B2 00          0330 LTRSF DB 00  INIT TO LTRS
02B3             0331 *
02B3 3E FF       0332 TOFF MVI A,0FFH
02B5 D3 F1       0333  OUT TRAMP
02B7 C9          0334  RET
02B8             0335 *
02B8 DB F1       0336 TON IN RTYST
02BA E6 40       0337  ANI 40H
02BC C0          0338  RNZ  ALREADY ON
02BD 3E FE       0339  MVI A,0FEH
02BF D3 F1       0340  OUT TRAMP
02C1 CD C5 02    0341  CALL DLY2
02C4 C9          0342  RET
02C5             0343 *
02C5 C5          0344 DLY2 PUSH BC  4 X .25 SEC
02C6 06 04       0345  MVI B,4
02C8 C5          0346 DLY2L PUSH BC
02C9 CD D3 02    0347  CALL DLY1
02CC C1          0348  POP BC
02CD 05          0349  DCR B
02CE C2 CB 02    0350  JNZ DLY2L
02D1 C1          0351  POP BC  RESTORE ORIG BC
02D2 C9          0352  RET
02D3             0353 *
02D3 06 FA       0354 DLY1 MVI B,250  .25 SEC
02D5 CD 60 01    0355 DLY1L CALL DELAY
02D8 05          0356  DCR B
02D9 C2 D5 02    0357  JNZ DLY1L
02DC C9          0358  RET
02DD             0359 *
02DD 00          0360 B1 NOP
02DE 00          0361  NOP
02DF 00          0362  NOP PATCH JUMP
02E0 DB F1       0363  IN RTYST
02E2 E6 20       0364  ANI AUTO
02E4 C2 0A 04    0365  JNZ START
```

call out of the buffer, the move starts at the beginning of the table. HILO is a subroutine used to compare register pairs HL and DE to see if the move is over. In performing the comparison, HILO computes the difference (saved at FOUR), a feature useful in calculating where to start on a move up, or to end a move down.

Lines 095-108: These two routines are used to put a CRLF on the target machine's console device between commands. All data sent on the radio channel is echoed to the console device through the CO routine for monitoring purposes.

Lines 110-115: DELAY is used to hold up the answer for a specified time after the RTTY tones leave the air. This gives the operator (or machine) at the FD site time to throw the T-R switch.

Lines 119-150: TOASC is the Baudot-to-ASCII character converter. This uses a table lookup (CV5T7, 228-269) with a LTRS-FIGS flag called LTRF. The Baudot code and the flag value are added to the table start address to indirectly get the ASCII code. This routine unshifts on space automatically.

Lines 154-224: TOBAO converts ASCII to Baudot and sends the character out to the UART. Because any character converted has no use if not transmitted, this

```
02F2 C2 0A 04      0371  JNZ STARI
02F5 DB F0         0372  IN RTYDA
02F7 D3 F3         0373  OUT 0F3H  STROBE DRR-
02F9 E6 1F         0374  ANI 1FH
02FB CD 69 01      0375  CALL TOASC  RETURNED IN A
02FE FE 1F         0376  CPI 1FH  DO NOT RTN FIGS
0300 CA D0 02      0377  JZ B1  BUT TOASC NEEDS IT
0303 FE 1B         0378  CPI 1BH
0305 CA DD 02      0379  JZ B1  FIGS NEITHER
0308 C9            0380  RET
0309               0381 •
0309 DB F1         0382 BMESS IN RTYST  B=CHARS,HL=START
030B E6 20         0383  ANI AUTO
030D CA 09 03      0384  JZ BMESS
0310 CD B8 02      0385  CALL TON
0313 7E            0386 BLP MOV A,M
0314 E5            0387  PUSH HL
0315 C5            0388  PUSH BC
0316 4F            0389  MOV C,A
0317 CD 55 01      0390  CALL CO
031A 79            0391  MOV A,C
031B CD A2 01      0392  CALL TOBAO  CONVERT AND SEND
031E C1            0393  POP BC
031F E1            0394  POP HL
0320 05            0395  DCR B
0321 C8            0396  RZ  REMEMBER TO TOFF
0322 23            0397  INX HL
0323 C3 13 03      0398  JMP BLP
0326               0399 •
0326 7E            0400 COMP MOV A,M  B LONG,HL MASTER,DE COPY
0327 FE 00         0401  CPI 0  NOT EQ, AND ZEROS COUNTED
0329 CC 38 03      0402  CZ INRZ
032C 1A            0403  LDAX DE
032D BE            0404  CMP M
032E C4 41 03      0405  CNZ INRNE
0331 13            0406  INX DE
0332 23            0407  INX HL
0333 05            0408  DCR B
0334 C2 26 03      0409  JNZ COMP
0337 C8            0410  RZ
0338 3A 40 03      0411 INRZ LDA ZEROS
033B 3C            0412  INR A
033C 32 40 03      0413  STA ZEROS
033F C9            0414  RET
0340 00            0415 ZEROS DB 0
0341 3A 49 03      0416 INRNE LDA NOTEQ
0344 3C            0417  INR A
0345 32 49 03      0418  STA NOTEQ
0348 C9            0419  RET
0349 00            0420 NOTEQ DB 0
034A               0421 •
034A 3E 00         0422 SRCH MVI A,0
034C 32 40 03      0423  STA ZEROS
034F 32 49 03      0424  STA NOTEQ
0352 C5            0425  PUSH BC  B=STRING LENGTH
0353 CD 26 03      0426  CALL COMP  HL=LIST OF STRINGS
0356 C1            0427  POP BC     DE=FIXED STRING
0357 2B            0428  DCX HL  RETURNS CY IF GOT TO NEXT BOUNDARY
0358 2B            0429  DCX HL  RETURNS Z  IF STRING FOUND
0359 2B            0430  DCX HL  REGS POINT TO BEGIN
035A 2B            0431  DCX HL   OF LAST COMPARE
035B 2B            0432  DCX HL
035C 2B            0433  DCX HL
035D 1B            0434  DCX DE
035E 1B            0435  DCX DE
035F 1B            0436  DCX DE
0360 1B            0437  DCX DE
0361 1B            0438  DCX DE
0362 1B            0439  DCX DE
0363 3A 40 03      0440  LDA ZEROS
0366 B7            0441  ORA A
0367 CA 6C 03      0442  JZ SRCH1  NO ZEROS ON HL STRING
036A 37            0443  STC   YES THERE ARE
036B C9            0444  RET
036C 3A 49 03      0445 SRCH1 LDA NOTEQ
036F B7            0446  ORA A
0370 C8            0447  RZ  RET IF ALL 6 CHARS EQ
0371 CD 77 03      0448  CALL AD6HL
0374 C3 4A 03      0449  JMP SRCH
0377               0450 •
0377 23            0451 AD6HL INX HL
0378 23            0452  INX HL
0379 23            0453  INX HL
037A 23            0454  INX HL
037B 23            0455  INX HL
037C 23            0456  INX HL
037D C9            0457  RET
```

```
0385 CD DD 02      0463  CALL B1  QUITS IF AUTO LEAV
0388 C1            0464  POP BC
0389 E1            0465  POP HL
038A FE 2E         0466  CPI '.'  RUBOUT CHAR
038C C2 9A 03      0467  JNZ CHK8
038F 2B            0468  DCX HL
0390 04            0469  INR B  BACK UP ONE CHAR
0391 78            0470  MOV A,B
0392 FE 07         0471  CPI 07H  WIPE OUT COMMAND TOO?
0394 CA 0A 04      0472  JZ STARI  CLEAN OFF STACK
0397 C3 83 03      0473  JMP CHK3
039A FE 0D         0474 CHK8 CPI CR
039C C2 A6 03      0475  JNZ CHK5 NOT CR
039F 78            0476  MOV A,B  IS IT CR AT 1ST CHAR
03A0 FE 06         0477  CPI 06H  IF SO RETURN
03A2 C8            0478  RZ  BUFFER UNTOUCHED
03A3 C3 AD 03      0479  JMP CHK1
03A6 77            0480 CHK5 MOV M,A
03A7 23            0481  INX HL
03A8 05            0482  DCR B
03A9 C8            0483  RZ
03AA C3 83 03      0484  JMP CHK3
03AD 3E 20         0485 CHK1 MVI A,' '
03AF 77            0486  MOV M,A  ON CR FILL REST OF BUFFER
03B0 23            0487  INX HL
03B1 05            0488  DCR B
03B2 C8            0489  RZ
03B3 C3 AD 03      0490  JMP CHK1
03B6               0491 •
03B6               0492 • DATA WORDS
03B6               0493 •
03B6 5A 5A         0494 CBUF DW 'ZZ'  INITIALIZE CHARACTER BUFFER
03B8 5A 5A         0495  DW 'ZZ'
03BA 5A 5A         0496  DW 'ZZ'
03BC 60 05         0497 CLIST DW DTAB+6  INITIALIZE TO BAND=A
03BE 0D            0498 ASTR DB CR
03BF 00            0499  DB 0  FOR TTY
03C0 0A            0500  DB LF
03C1 0D            0501  DB CR
03C2 20 44         0502  DW 'D '
03C4 55 50         0503  DW 'PU'
03C6 20            0504  DB ' '
03C7 0D            0505 BSTR DB CR
03C8 00            0506  DB 0  FOR TTY
03C9 0A            0507  DB LF
03CA 0D            0508  DB CR
03CB 20 4F         0509  DW 'O '
03CD 4B 20         0510  DW ' K'
03CF 0D            0511 CSTR DB CR
03D0 00            0512  DB 0  FOR TTY
03D1 0A            0513  DB LF
03D2 0D            0514  DB CR
03D3 20 4E         0515  DW 'N '
03D5 4F 54         0516  DW 'TO'
03D7 20 49         0517  DW 'I '
03D9 4E 20         0518  DW ' N'
03DB 4C 49         0519  DW 'IL'
03DD 53 54         0520  DW 'TS'
03DF 2E 20         0521  DW ' .'
03E1 0D            0522 DSTR DB CR
03E2 00            0523  DB 0  FOR TTY
03E3 0A            0524  DB LF
03E4 0D            0525  DB CR
03E5 20 42         0526  DW 'B '
03E7 41 4E         0527  DW 'NA'
03E9 44 3D         0528  DW '=D'
03EB 0D            0529 ESTR DB CR
03EC 00            0530  DB 0  FOR TTY
03ED 0A            0531  DB LF
03EE 0D            0532  DB CR
03EF 20 4E         0533  DW 'N '
03F1 4F 20         0534  DW ' O'
03F3 42 41         0535  DW 'AB'
03F5 4E 44         0536  DW 'DN'
03F7 3D            0537  DB '='
03F8 0D            0538 FSTR DB CR
03F9 00            0539  DB 0  FOR TTY
03FA 0A            0540  DB LF
03FB 0D            0541  DB CR
03FC 41 4C         0542  DW 'LA'
03FE 52 45         0543  DW 'ER'
0400 41 44         0544  DW 'DA'
0402 59 20         0545  DW ' Y'
0404 54 48         0546  DW 'HT'
0406 45 52         0547  DW 'RE'
0408 45 20         0548  DW ' E'
040A               0549 GSTR EQU $
```

routine assumes the radio is in transmit and proceeds to send the characters as they are converted. The conversion uses a separate two-part table, half for FIGS (C7T5F) and half for LTRS (C7T5L). There also is a separate shift flag for this conversion called LTRSF.

Using two tables is admittedly not memory-efficient, but the tables are not that big and the program runs faster with a direct lookup each way. Running fast makes it easier later to add more tasks or features without incurring timing conflicts.

Lines 228-330: These are the tables themselves, requiring 78H words. At the end are the two flags for LTRS and FIGS for conversion each way.

Lines 332-334: TOFF sends all ones to the port controlling the transmitter. A one turns the transmitter off (see schematic).

Lines 336-342: TON sends a low to the bit of the port that turns the transmitter on, then calls a delay routine that causes one second of tone before any text is sent. This is only to ensure that the receiving end has time to set up. If your receiving end is manual, you may want to lengthen it by changing the MVI B,X in line 345 to four times the number of seconds necessary.

Lines 354-358: These are nested delay routines that tie up the processor for certain periods of time decre-

```
40A                   0550 *
40A                   0551 *
40A                   0552 *  MAIN PARSER--LOGER
40A                   0553 *
40A                   0554 *
40A 31 00 01          0555 STARI LXI SP,0100H  RESTART STACK
40D 3E 00             0556  MVI A,00H
40F 32 B1 02          0557  STA LTRF START IN LETTERS
412 32 B2 02          0558  STA LTRSF
415 CD B3 02          0559 START CALL TOFF
418 CD DD 02          0560  CALL BI
41B FE 43             0561  CPI 'C'
41D CA 37 04          0562  JZ CHECK
420 FE 4C             0563  CPI 'L'
422 CA 6F 04          0564  JZ LOG
425 FE 42             0565  CPI 'B'
427 CA A9 04          0566  JZ BAND
42A FE 44             0567  CPI 'D'
42C CA E7 04          0568  JZ DUMMY
42F FE 52             0569  CPI 'R'
431 CA ED 04          0570  JZ REMOV
434 C3 15 04          0571  JMP START
437                   0572 *
437 CD 7E 03          0573 CHECK CALL FBUF
43A 21 B6 03          0574  LXI HL,CBUF
43D EB                0575  XCHG  TO DE
43E 2A BC 03          0576  LHLD CLIST
441 06 06             0577  MVI B,6
443 CD 4A 03          0578  CALL SRCH
446 DA 54 04          0579  JC RPOK  NOT HERE
449 21 BE 03          0580  LXI HL,ASTR  HERE
44C 06 09             0581  MVI B,BSTR-ASTR
44E CD 09 03          0582  CALL BMESS
451 C3 5C 04          0583  JMP CHK4
454 21 C7 03          0584 RPOK LXI HL,BSTR
457 06 08             0585  MVI B,CSTR-BSTR
459 CD 09 03          0586  CALL BMESS
45C 21 B6 03          0587 CHK4 LXI HL,CBUF
45F 06 06             0588  MVI B,6
461 CD 13 03          0589  CALL BLP  AUTO WILL BE ON FROM XMIT
464 21 BE 03          0590  LXI HL,ASTR
467 06 04             0591  MVI B,4  **PARTING CHAR-CR,0,LF,CR**
469 CD 13 03          0592  CALL BLP  AUTO AGAIN
46C C3 15 04          0593  JMP START
46F                   0594 *
46F CD 7E 03          0595 LOG CALL FBUF
472 21 B6 03          0596  LXI HL,CBUF
475 EB                0597  XCHG
476 2A BC 03          0598  LHLD CLIST
479 06 06             0599  MVI B,6
47B CD 4A 03          0600  CALL SRCH  FIND HOLE
47E CA 9E 04          0601  JZ LOG1
481 E5                0602  PUSH HL
482 5D                0603  MOV E,L
483 54                0604  MOV D,H  DE=BEGIN
484 06 4C             0605  MVI B,LISEH  BC=END
486 0E 00             0606  MVI C,LISEL
488 CD 77 03          0607  CALL AD6HL
48B CD 03 01          0608  CALL MOVEC
48E 21 BB 03          0609  LXI HL,CBUF+5
491 44                0610  MOV B,H
492 4D                0611  MOV C,L
493 21 B6 03          0612  LXI HL,CBUF
496 EB                0613  XCHG
497 E1                0614  POP HL  SAVED AFTER SEARCH
498 CD 03 01          0615  CALL MOVEC
49B C3 54 04          0616  JMP RPOK
49E 21 F8 03          0617 LOG1 LXI HL,FSTR
4A1 06 12             0618  MVI B,GSTR-FSTR
4A3 CD 09 03          0619  CALL BMESS
4A6 C3 5C 04          0620  JMP CHK4
4A9                   0621 *
4A9 CD 7E 03          0622 BAND CALL FBUF
4AC 21 15 04          0623  LXI HL,START  NO WAY TO MATCH
4AF EB                0624  XCHG
4B0 21 5A 05          0625  LXI HL,DTAB  LOOKING FOR BOUNDARIES
4B3 06 06             0626 BAND2 MVI B,6
4B5 CD 4A 03          0627  CALL SRCH
4B8 3A B6 03          0628  LDA CBUF  MUST COME BACK W/ CARRY
4BB BE                0629  CMP M  CHAR OF BOUNDARY
4BC CA CB 04          0630  JZ BAND1  NEW BAND
4BF 7E                0631  MOV A,M  ALL THRU
4C0 FE 00             0632  CPI 0
4C2 CA DC 04          0633  JZ BAND3
4C5 CD 77 03          0634  CALL AD6HL
4C8 C3 B3 04          0635  JMP BAND2
4CB CD 77 03          0636 BAND1 CALL AD6HL
4CE 22 BC 03          0637  SHLD CLIST
4D1 21 E1 03          0638  LXI HL,DSTR
4D4 06 0A             0639  MVI B,ESTR-DSTR
4D6 CD 09 03          0640  CALL BMESS
4D9 C3 5C 04          0641  JMP CHK4
04DC 21 EB 03         0642 BAND3 LXI HL,ESTR
04DF 06 0D            0643  MVI B,FSTR-ESTR
04E1 CD 09 03         0644  CALL BMESS
04E4 C3 5C 04         0645  JMP CHK4
04E7                  0646 *
04E7 CD DD 02         0647 DUMMY CALL BI
04EA C3 E7 04         0648  JMP DUMMY
04ED                  0649 *
04ED CD 7E 03         0650 REMOV CALL FBUF
04F0 21 B6 03         0651  LXI HL,CBUF
04F3 EB               0652  XCHG
04F4 2A BC 03         0653  LHLD CLIST
04F7 06 06            0654  MVI B,6
04F9 CD 4A 03         0655  CALL SRCH
04FC DA 0F 05         0656  JC REMO1  NOT THERE
04FF E5               0657  PUSH HL
0500 CD 77 03         0658  CALL AD6HL
0503 EB               0659  XCHG
0504 06 4C            0660  MVI B,LISEH  BC=END
0506 0E 00            0661  MVI C,LISEL
0508 E1               0662  POP HL
0509 CD 03 01         0663  CALL MOVEC
050C C3 54 04         0664  JMP RPOK
050F 21 CF 03         0665 REMO1 LXI HL,CSTR
0512 06 12            0666  MVI B,DSTR-CSTR
0514 CD 09 03         0667  CALL BMESS
0517 C3 5C 04         0668  JMP CHK4
051A                  0669 *
051A                  0670  DS 64  PATCH AREA
055A                  0671 *
055A                  0672 *
055A                  0673 *
055A                  0674 * DATA TABLE STARTS HERE
055A                  0675 *
055A                  0676 *
055A 41               0677 DTAB DB 'A'
055B 00               0678  NOP
055C 00 00            0679  DW 0
055E 00 00            0680  DW 0
0560 42               0681  DB 'B'
0561 00               0682  NOP
0562 00 00            0683  DW 0
0564 00 00            0684  DW 0
0566 43               0685  DB 'C'
0567 00               0686  NOP
0568 00 00            0687  DW 0
056A 00 00            0688  DW 0
056C 44               0689  DB 'D'
056D 00               0690  NOP
056E 00 00            0691  DW 0
0570 00 00            0692  DW 0
0572 45               0693  DB 'E'
0573 00               0694  NOP
0574 00 00            0695  DW 0
0576 00 00            0696  DW 0
0578 46               0697  DB 'F'
0579 00               0698  NOP
057A 00 00            0699  DW 0
057C 00 00            0700  DW 0
057E 47               0701  DB 'G'
057F 00               0702  NOP
0580 00 00            0703  DW 0
0582 00 00            0704  DW 0
0584 48               0705  DB 'H'
0585 00               0706  NOP
0586 00 00            0707  DW 0
0588 00 00            0708  DW 0
058A 49               0709  DB 'I'
058B 00               0710  NOP
058C 00 00            0711  DW 0
058E 00 00            0712  DW 0
0590 4A               0713  DB 'J'
0591 00               0714  NOP
0592 00 00            0715  DW 0
0594 00 00            0716  DW 0
0596 4B               0717  DB 'K'
0597 00               0718  NOP
0598 00 00            0719  DW 0
059A 00 00            0720  DW 0
059C 4C               0721  DB 'L'
059D 00               0722  NOP
059E 00 00            0723  DW 0
05A0 00 00            0724  DW 0
05A2 4D               0725  DB 'M'
05A3 00               0726  NOP
05A4 00 00            0727  DW 0
05A6 00 00            0728  DW 0
05A8                  0729 * END RECORD
05A8 00 00            0730  DW 0
05AA 00 00            0731  DW 0
05AC 00 00            0732  DW 0
NEWP
```

enting registers. They use he B register several times y pushing and popping it.

Lines 360-380: The BI rouine is a single character in utine for Baudot from the dio circuits. At the front is three-byte patch space for utting in a jump to another mporary data source, inended for checkout. Then llows a strong check for the presence of the autostart. If at any time this routine senses that the tones have left the air, it causes dupe checker to abandon whatever command it was executing. It keeps the current band and table pointers, but it goes back to the main parser (command decode) and resets the stack pointer. With this feature, if the user gets confused about what's happening, before he enters a (CR) to activate a command, he can inactivate it by just dropping off the air. BI calls TOASC so that it returns ASCII to the calling routine in register A.

Lines 382-398: BMESS is a routine for sending ASCII characters from a buffer out on the air. HL must point to the buffer to be sent, and register B must contain the number of characters to be sent. Just before the first character is sent through BMESS, TON is called, turning on the transmitter. Since there most likely will be multiple uses of BMESS for each total message, BMESS does not turn off the transmitter; the calling routine must do so.

```
LIST
0100
0110
0120
0130           HERE IS SOME SIMULATED OUTPUT OF THE PROGRAM AS IT
0140           WOULD APPEAR ON THE CONSOLE OF THE TARGET PROCESSOR.
0150           THE LEFT JUSTIFIED LINES COME FROM THE FIELD, THE
0160           INDENTED LINES ARE PROCESSOR ANSWERS.
0170           THE COMMENTS, OF COURSE, ARE ADDED HERE
0180           FOR EXPLANATION.
0190
0200           BA
0210            BAND=A      ESTABLISH BAND
0220           CWB5ABC      CHECK TABLE FOR THIS CALL
0230            OK WB5ABC   THIS CALL OK
0240           LWB5ABC      LOG IT
0250            OK WB5ABC   LOGGED
0260           CWB5ABC      TRY IT AGAIN
0270            DUP WB5ABC  ALREADY THERE
0280           RWB5ABC      REMOVE IT
0290            OK WB5ABC   REMOVED
0300           CWB5ABC      NOW CHECK IT AGAIN
0310            OK WB5ABC   NOW OK TO WORK AGAIN
0320           LWB5ABC      LOG IT AGAIN
0330            OK WB5ABC   LOGGED
0340           R            REMOVE IT (SHORTHAND FORM)
0350            OK WB5ABC   REMOVED AGAIN
0360           C            CHECK IT AGAIN, WB5ABC STILL IN CALL BUFFER
0370            OK WB5ABC   OK TO WORK AGAIN
0380           BD
0390            BAND=D
0400           LW1AEL
0410            OK W1AEL
0420           LW8LT
0430            OK W8LT
0440           **********NOW HERE ARE EXAMPLES OF COMMON ERRORS
0450
0460           W8LT               L=LOG PICKED OUT OF CALL
0470            OK T
0480           R                  REMOVE THAT GARBAGE (T)
0490            OK T
0500           WB5KVZ             B=BAND CHANGE PICKED OUT OF PREFIX
0510            NO BAND=5KVZ
0520           WA3ROF             R=REMOVE CALL OF
0530            NOT IN LIST. OF
0540           WA2ALA             L=LOG THE CALL A
0550            OK A
0560           R                  REMMOVE CONTENTS OF CALL BUFFER (A)
0570            OK A
0580           **********HERE IS AN EXAMPLE OF THE COMMAND D
0590
0600           D WE NEED SOME FRESH CW OPERATORS.
```

Simulated printout.

Lines 400-420: COMP is used to check for matching text in the call buffer and a table entry. As written, COMP will check variable length strings, but in dupe checker, the strings are always six characters long. If respective characters don't match, data word NOTEQ is incremented. Boundary strings in the call table are found by detecting zeros in the call table string.

Since the call buffer is filled out to six characters with blanks, only the boundary strings will have zeros.

Lines 422-449: SRCH uses COMP to do a search for a match to the text string in the call buffer. Between unsuccessful comparisons, it initializes ZEROS and NOTEQ (the counters for COMP), sets up the HL register to the next string in the call table, and sets DE back to the beginning of the call buffer. A search can end only at the boundary in the call table of the next band (carry set) or with a match to the call buffer (equal bit set).

Lines 459-490: FBUF handles the filling of the call buffer. It calls BI to get characters, handles the rubout (here defined to be a period, "."), and even terminates the task in progress if the user elects to rub out the command letter. If the call being entered has less than six characters on the terminating (CR), FBUF fills out the buffer with blanks so that the boundary strings remain the only ones with zeros. If the first character entered is a (CR), the buffer is left untouched, allowing the user to execute a second command with the same buffer contents, such as logging it after checking for it.

Lines 494-549: These are the text strings sent routinely as responses. They are referred to by the label at the beginning of the string and the length is fixed by the assembler by subtracting the addresses of the enclosing labels. This makes the strings easy to change during re-assembly.

Lines 555-571: Here is the main command decoding string. All commands are single letter for speed of use. Any additional commands need only a CPI-JZ pair to jump out and execute the new command. In this setup, each execution module is responsible for calling FBUF if it needs text in the call buffer.

Lines 573-593: CHECK is used to find out if a particular call has been entered previously on this band. It primarily calls SRCH to do this, but it also provides the proper messages and a standard return to START which echoes the call buffer. This standard return is also used by the rest of the commands.

Lines 595-620: LOG will put a call into the call table at the end of the current band segment if it is not there already. If it is already there, it issues a message to that effect and does not double-entry. It could be used in lieu of CHECK to save time as it also calls SRCH.

Lines 622-645: BAND is in charge of band changes. It has to find the proper starting point for each section of the table corresponding to each band. Bands are identified here by single letters. A band boundary is a six-word string carrying the ASCII for its letter identifier in the first word and zeros in the other five. To find them in the call table as they move up, before calling SRCH, the DE register is set to point where no match can occur. Here it points to executable code that cannot be interpreted as ASCII. Each time SRCH returns with carry set, the first word of the string is checked for the first character in the call buffer. When the correct starting place is found, HL is incremented to the first location beyond the boundary and then stored at CLIST as the place to begin searching for calls entered.

Lines 647-648: Since all traffic through the processor is echoed to the console device, this call prints text there until the autostart drops out. This command was included so that operators in the field can leave messages to the computer operator without leaving the keyboard, i.e., send more beer, round up more recruits, etc.

Lines 650-668: REMOV will attempt to remove a text string corresponding to the call buffer from the call table. Note the use of the term "text string." This command is not only for those loggers who log the contact that wasn't completed, but also for the Model 19 users who forget the shift key and for those who forget the single-letter command before the call (and have one picked out of the call itself). These last two were found to be the two most common operator errors at K5OJI. Note again that R(CR) will take that garbage in the call buffer that the user just logged and remove it without having to recreate that garbage.

Line 670: This area is saved for fixes, updates, and the like. The task assumes the stack is at 0100H and the table extends out to very near the end of memory. Therefore, a safe patch area was included here inside the object code.

Lines 677-732: This table shows the initialized state of the call table, containing at this stage only the band boundary markers.

So there you have it. Maybe this will help put some of the fun back into Field Day that the FCC seems determined to take out with all the new prefixes. ■

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A/D Converters Explained!

—another enigma unraveled

It's my bet that the overwhelming majority of you computer enthusiasts out there don't really know what an analog-to-digital converter is, much less how it is used. Well, this is your chance! After all, contrary to what most of you believe, the majority of the world is analog. So, if you can't beat 'em . . .

What is an A/D?

Radio Shack's *Dictionary of Electronics* defines the analog-to-digital converter as "A circuit that changes a continuously varying voltage or current into a digital output.The input may be ac or dc, and the output may be serial or parallel . . ." This is quite a broad definition and doesn't really tell us too much, so maybe I should expound upon it a little bit.

The input voltage to an A/D could be from almost anything imaginable. One possible example could be that of a voltage across a thermistor. A thermistor is a solid-state device which changes its electrical resistance with temperature. Therefore, the A/D "sees" the temperature (an analog level) of the thermistor and changes it to a digital word which our computer would be able to understand. Another example would be that of looking at the voltage across a strain gauge. A strain gauge is a resistive device which has an electrical output proportional to the amount it is deformed under strain. Again, this is an analog level and must be changed into something which our computer can understand. The input voltage levels to most A/Ds must be limited to some finite value, and that value is generally something in the range of ±20 V, ±10 V, ±5 V, or ±2.5 V.

The output of an A/D converter is usually a 4-, 6-, 8-, 10-, or 12-bit digital word that is proportional to the analog voltage level at its input. This digital word can be in binary, binary coded decimal (BCD), or two's complement form. (I will assume that these terms are familiar to you and will not explain them.) It is this digital word, then, which is available to our computers for manipulation. But let's slow down a bit and take a look at a sample A/D to clarify things.

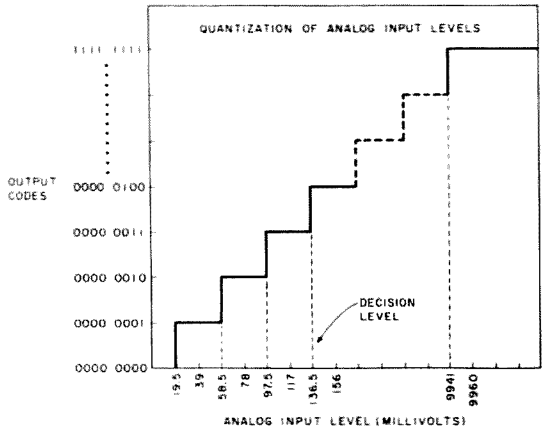

Fig. 1. This graph indicates how an analog signal is quantized through a decision-making process inside of the A/D. When the analog voltage to the A/D reaches 19.5 millivolts, the decision is reached to call this level binary 00000001. Similar decision levels can be seen at 58.5 mV, 97.5 mV, and so on throughout the 0- to 10-volt input range.

Suppose we have just purchased an A/D with an allowed input voltage range of 0 to 10 volts and an output which takes the form of an 8-bit binary word. Well, we all know (don't we?) that a binary word with n bits has 2^n different binary levels. Therefore, with an 8-bit output for our A/D, we have 2^8 or 256 different states which we can use to represent the 0 to 10 volts present on the input. With our grade school education, we can deduce that the least significant bit (LSB) of our 8-bit word would then have a value of 10 volts/256 = .039 volts, or 39 millivolts. Therefore, as the input voltage to our A/D varies, voltage changes as small as 39 millivolts may be detected (see Fig. 1).

The binary output for corresponding input voltage levels can be seen in Table 1. Notice that the all ones in the binary coding

column do not correspond to the full-scale voltage of 10 V, but to 10 volts − 39 mV = 9.96 volts. I might add here that the higher the number of bits on the output of an A/D, the higher is its resolution. Therefore, with a 12-bit A/D, the 0- to 10-volt input could be represented in 2^{12} (4096) different increments. The LSB would then have a value of 10 volts/4096, or 2.44 millivolts. We could, therefore, recognize a voltage change on the input as small as 2.44 millivolts.

How Does the A/D Work?

To truly know all there is to know about an A/D, we really should study things like quantizing theory, sampling theory, digital coding theory, filter theory, and a lot of other forbidding subjects in which I'm sure none of you is really interested. Pages and pages of information could be written on these subjects, but the purpose of this article is not to make engineers out of you, but to introduce you to something which, if used correctly, could open up a whole new field for you.

A lot of different methods have evolved over the years to obtain A/D conversion, but all of them produce the same end result. The result is, of course, a digital word which is proportional to an analog voltage level present at the input to the device. Some methods are slower than others, some are more expensive, and some even have a higher conversion error than others. The one you choose to utilize in your system is up to you. We will look at only two of the many ways in which A/D conversion is obtained, the two methods which I feel are the easiest to understand.

The *Counter* type of A/D is one of the simplest and cheapest to implement (see Fig. 2). Here's how it works. When conversion begins, a clock is gated to a binary counter. With each clock pulse, the output of the counter changes its binary state. This binary output of the counter is the input to a digital-to-analog converter (D/A). As the binary count increases, the voltage, V_x, at the output of the D/A increases. When V_x compares equally to the analog input voltage, the clock is gated off and the conversion process ceases. The output of the binary counter is then proportional to the analog input voltage.

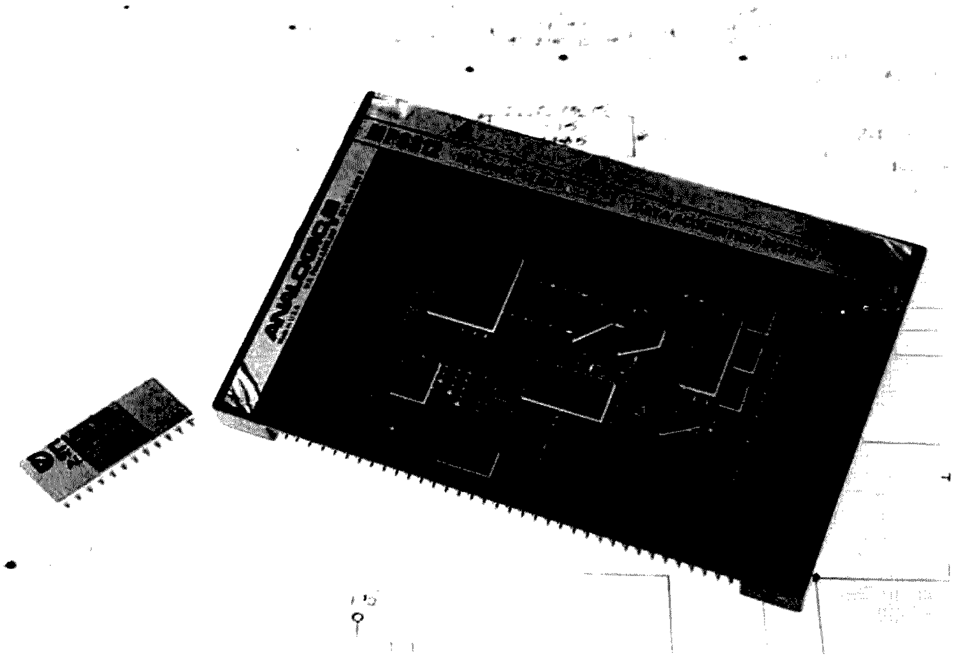

Photo A. Photo by Vernon Brady and Mike Sinclair.

This converter is simple to implement, cheap, and accurate, but it can be really slow. Its conversion time is proportional to the input voltage, so the greater the input voltage, the longer it takes to produce the binary word at the output. This can tend to be a problem in applications where time is a constraint. In some applications, using an up-down counter will speed things up a bit because then the counter can count either up or down from its previous value rather than having to be reset at the beginning of conversion and counting up.

The other method of A/D conversion to be examined here is called *Successive Approximation* (see Fig. 3). This is the method which is generally used in practice because of its high speed. Here's how it works. At the start of the conversion cycle, the MSB of the D/A is set to 1. This corresponds to an output voltage from the D/A of ½ of full scale. This D/A output voltage is compared to the analog input voltage. If it is smaller than the input voltage, then the next LSB of the D/A is set to 1. Now the D/A's output is

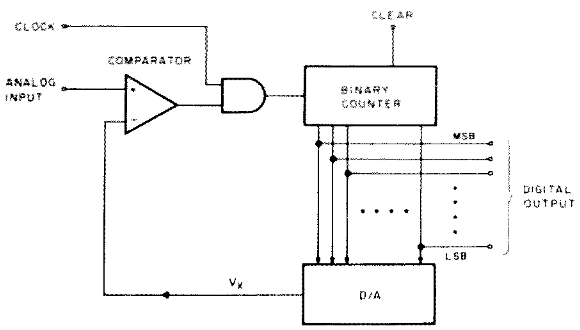

Fig. 2. The counter-type A/D in simplified form can be seen here. See the text for explanation. MSB = most significant bit. LSB = least significant bit.

Input Voltage Level	Binary Coding
0.000	00000000
0.039	00000001
0.078	00000010
0.156	00000100
0.313	00001000
0.625	00010000
1.250	00100000
2.500	01000000
5.000	10000000
7.500	11000000
9.960	11111111

Table 1. The binary coding for a few different values of input voltage to the A/D can be seen above. Remember, there are 245 additional values of voltage that can be represented with the 8 bits of binary data available to us.

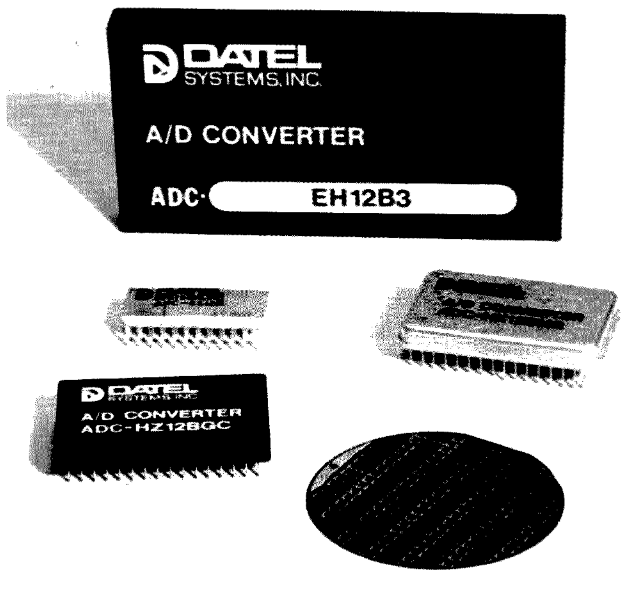

Photo B. Datel Systems offers a complete line of A/D converter products. Here are just a few. (Courtesy of Datel Systems, Inc.)

again compared with the input voltage. If the input voltage is still larger than the D/A's output voltage, the process continues. If, however, the D/A's output exceeds the input voltage, then the bit which was just set to 1 on the D/A is now set to zero (0), the next LSB is set to 1, and the process continues all the way down to the very least significant bit. The output register then contains the complete digital number representing the input. A sample of the successive-approximation analog-to-digital conversion process can be seen in Fig. 4, which might help to explain things a bit.

The successive-approximation type of A/D operates with a fixed conversion time per bit and, therefore, no matter what the input voltage is, the conversion time is the same. The accuracy of this technique is dependent upon the accuracy of the D/A conversion technique used.

Well, now we know what an A/D does and basically how it does it, but how can it be used?

What is an A/D Good For?

A/Ds can be used with a transducer to provide a digital output which corresponds to a physical parameter such as pressure, temperature, strain, or position. In the beginning of this article, I mentioned briefly how temperature and strain could be measured with a thermistor and strain gauge, respectively. The possibilities here are endless. For example, a thermistor and A/D could be used for a digital thermometer, a temperature control system for cooking, a temperature control system for heating the home, or a fire alarm system. A strain gauge and A/D could be used to detect illegal entry through locked doors or windows and for many other strain-related uses.

Pressure and position transducers can be put to good use in much the same way: detecting and correcting gas pressures or detecting the position of a joy stick for computer games. All of these analog inputs can be detected and corrected through "feedback" networks with the use of A/D converters.

Fig. 5 is a block diagram of a basic control system utilizing an A/D. In this system, the input signal is applied to the A/D which converts the signal to digital form. The microprocessor takes this digital information and conducts some kind of decision-making process. Once a decision is reached, the processor feeds this information back into the system to compensate for any discrepancies.

I am speaking in generalities here because I do not want to limit myself to one or two applications. The field is extremely wide open, and a little imagination will take you far. For example, couldn't we use the A/D and microprocessor combination as a simple, direct-readout, smart, digital voltmeter?

What's Available?

Table 2 is a brief listing of some commonly-available A/Ds. While it is possible to find A/Ds for less than $15, it also is possible to find them for as much as $900. I don't mean to scare you

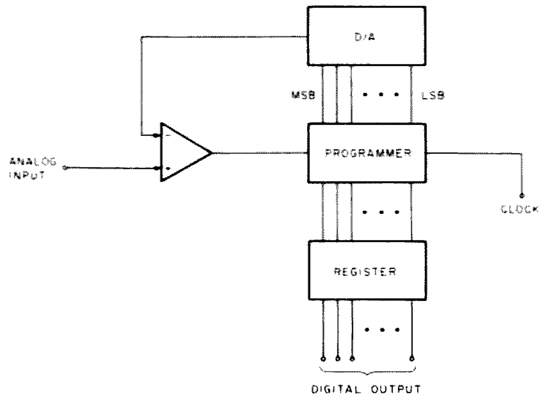

Fig. 3. A simplified schematic of the successive-approximation technique for A/D conversion. In this technique, the programmer in the diagram simply makes an educated guess as to the value of the analog input voltage and then compares this guess with the actual value. In this manner, each guess is closer and closer to the actual input value.

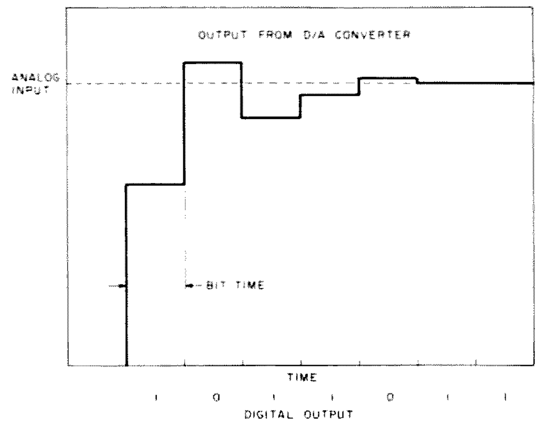

Fig. 4. This depicts the guessing process which the programmer goes through while closing in on the actual input-voltage level. If the programmer's guess is too high, the bit which was just set to 1 is reset to 0, and the next LSB is set to 1. This process continues until the least significant bit is assigned its final value.

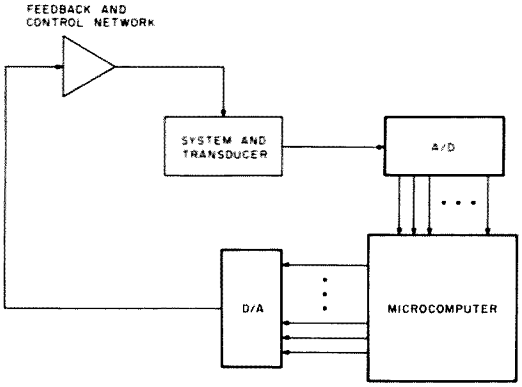

Fig. 5. One of the many uses for A/Ds is in the area of feedback and control systems. An analog voltage level representing position, temperature, strain, pressure, speed, or practically anything you wish is converted to digital form with the A/D. The microprocessor then reads this information and makes some decision in response to a question such as: Is the temperature correct? Is the pressure too high? How fast is the electric train going? Is the printer near the end of the page? When a decision is reached, the processor outputs a digital word to correct or change the present situation. The D/A converts this word to analog form and the feedback network makes the necessary changes.

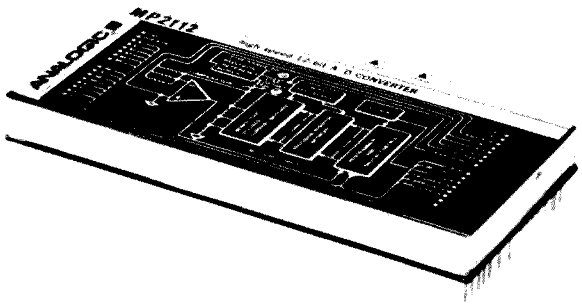

Photo C. Analogic Corporation is another large manufacturer of A/Ds. Pictured above is one of their more expensive units. (Courtesy of Analogic Corporation)

away, but as with anything else, you can pay as much for an A/D as you want. The higher the performance, the more the cost to you.

Choosing the Right A/D

The A/D selection process can be quite mind-boggling if you don't know what you are looking for! There are all kinds of specifications listed which, for the hobbyist, aren't all that important. So now we will wade through the specifications which normally are listed and dip out those which I feel are most important for the average hobbyist.

One of the first things we need to decide on when choosing an A/D is its *resolution*. The resolution of an A/D is a measure of the degree to which it can distinguish changes in voltage on its input and is determined by the number of bits on the A/D's output. For example, a 12-bit A/D has more resolution than an 8-bit A/D, and therefore can detect smaller voltage changes on its input. If an analog voltage variation is to be digitized and stored in memory for later reproduction through a digital-to-analog conversion process and the output signal has to be a faithful reproduction, then we would need as much resolution as possible. If less accuracy is dictated, however, the number of bits could be reduced.

The *coding* of the output of an A/D also is very important. Coding merely defines whether the output of the A/D is in binary, BCD, or two's complement form. If

Manufacturer	Item	Resolution # Bits	Coding	Power	Input Voltage or Current Range	Conversion Time	Price (1978)
Datel	ADC-MC8BC	8	Binary	+5	0 to +5, +10 V	500 μs	$ 8.00
Datel	ADC-EK8B	8	Binary	±5	0 to 10, ±5 V	1.8 ms	$ 11.50
Datel	ADC-EK10B	10	Binary	±5	0 to 10, ±5 V	5.0 ms	$ 26.00
Datel	ADC-EK12B	12	Binary	±5	0 to 10, ±5 V	20 ms	$ 34.00
Datel	ADC-ECONO	6	Binary	±15, +5	+5, +10, ±2.5, ±5 V	50 μs	$ 29.95
Datel	ADC-89A8B	8	Binary	±15, +5	0 to 10, ±5 V	200 μs	$ 69.00
Teledyne	8700CJ	8	Binary	Vdd 3 to 7	±10 mA	1.25 ms	$ 11.95
Teledyne	8703CJ	8	Binary	Vss −3 to −7	±10 mA	1.25 ms	$ 13.75
Teledyne	8704CJ	10	Binary	Vss −3 to −7	±10 mA	5.0 ms	$ 17.25
Teledyne	8701CN	10	Binary	Vss −3 to −7	±10 mA	5.0 ms	$ 23.50
Teledyne	8702CN	12	Binary	Vss −3 to −7	±10 mA	20 ms	$ 29.75
Teledyne	8705CN	12	Binary	Vss −3 to −7	±10 mA	20 ms	$ 35.00
Analogic	MN2301	3½ digits	BCD	±15	±2 V	100 ms	$ 24.00
Analogic	MP2410	10	Binary	+5, ±15	±10, ±5, 0 to +10, 0 to +5 V	30 μs	$ 95.00
Analogic	MP2112	12	Binary	+5, ±15	±10, ±5, 0 to +10, 0 to +5 V	7 μs	$219.00
Hybrid Systems	ADC586-8	8	Binary	±5	0 to 10 V	1.8 ms	$ 19.00
Hybrid Systems	ADC586-10	10	Binary	±5	0 to 10 V	6.0 ms	$ 33.50
Hybrid Systems	ADC586-12	12	Binary	±5	0 to 10 V	24 ms	$ 45.00

Table 2. A listing of some of the commonly-available A/Ds on the market today. If you would like more information about any particular product, consult the manufacturer. A listing is provided for your convenience at the end of this article.

you don't know how the data is represented, it probably can't be very meaningful.

The *power requirement* of most A/Ds is on the order of ±15 V, ±5 V, or some combination thereof. It would be to your advantage, of course, to choose an A/D that fits your present supply capabilities. However, in some cases, a new power supply might be necessary.

Analog input voltage ranges vary quite a bit in A/Ds. As in most devices, these voltages are the "never-exceed" voltages and care must be taken to adhere to the limits. These voltages therefore represent the range of input levels which the A/D can convert to digital form. In some of the more expensive A/Ds, the input-voltage range can be programmed into the device through a simple pin connection. This is usually a choice between two ranges such as either 0 to 10 volts *or* ±5 volts and not some arbitrary voltage set by the designer. The less expensive units are not so flexible and must be purchased with a specified input range.

In some analog interfacing applications, time is an important factor. In these cases then, the *conversion time* of the A/D could be a potential problem. The conversion time is defined as the time between the commands "start conversion" and "end of conversion." As was stated previously, some A/Ds are faster than others. If time is no problem, then a cheaper and slower A/D would seem to be indicated.

There are quite a few more specifications listed by most manufacturers, but it is my feeling that for our purposes those listed in the above paragraphs should be sufficient to at least make preliminary selections as to the correct A/D for the job.

Conclusion

The analog-to-digital converter is quite a powerful tool and, as such, can greatly increase the power of our home-computer systems. Just think of the control problems that can be solved by you consultant types with the use of this device.

This article is by no means complete in itself. It was meant as a general introduction to the world of analog-to-digital interfacing to your computer, and I hope that it has brought you one step closer to conquering the analog world. ■

References

1. Millman and Halkias, *Integrated Electronics: Analog and Digital Circuits and Systems*, McGraw-Hill Book Co., New York, 1972.

2. *Electronic Design's Gold Book*, vol. 3, Datel Systems, Inc., 1976-1977.

List of Manufacturers

1. Datel Systems, Inc., 1020G Turnpike St., Canton MA 02021; (617)-828-8000.
2. Hybrid Systems Corp., Dept. G, Crosby Drive, Bedford Research Park, Bedford MA 01730; (617)-275-1570.
3. Analog Devices, Inc., Dept. G, Box 280, Norwood MA 02062; (617)-329-4700.
4. Analogic Corp., 1G Audubon Rd., Wakefield MA 01880; (617)-246-0300.
5. Burr Brown Research Corp., Dept. G, 6730 S. Tucson Blvd., Tucson AZ 85734; (602)-294-1431.
6. Teledyne Semiconductor, 1300 Terra Bella Avenue, Mountain View CA 94043; (415)-967-9241.

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A Computer-Controlled Talking Repeater

—part II: microcomputer details

The first part of this article provided a description of the principal features of the control system, the design approach, and overviews of the hardware and software. This part describes details of the microcomputer hardware and the software nucleus.

The microcomputer block diagram is shown in Fig. 1. The Pragmatic Designs CPU-1A single board microcomputer provides the 8085A CPU, six programmable I/O ports, two programmable counter/timers, two blocks of 256 bytes of RAM, and sockets and decoding for two EPROMs. The breadboard area of the CPU-1A was wired to contain one additional ROM socket, an eight-bit latch as an additional output port, an eight-input multiplexer as additional inputs, a watchdog timer, an A/D converter, a binary divider, and edge connectors for the Telesensory speech synthesizer boards and a small CMOS RAM board.

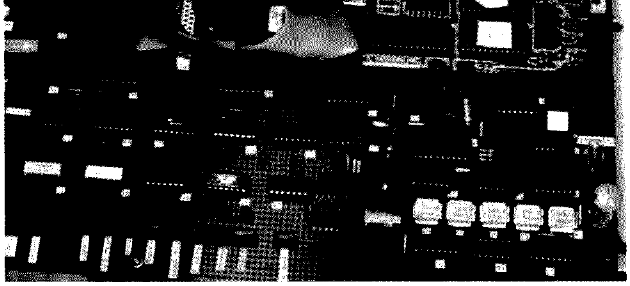


Photo A. CPU-1A microcomputer mounted on main control board. I/O signals interconnect through A P Products Great Jumper™ cables.

Program Memory

The software was designed to be ROM resident, unlike many traditional real time control programs which execute from RAM. RAM resident software must be loaded from a disk or communications line, increasing the complexity and cost of the system. ROM resident software is ready to execute immediately upon powerup. It allows the use of a small, low cost, single board computer and results in a highly reliable system.

It was hoped originally that the computer program would fit in the 4K of ROM provided directly on the CPU-1A. As the programming progressed, it became clear that restricting program size to 4K would have required leaving out features. A third ROM socket was added in the breadboard area to allow up to 6K of program ROM using 2716s. Address decoding for the ROM was obtained from a spare output of the existing decoder IC on the CPU-1A. The final program used 5½K of the available 6K of ROM.

I/O Assignments

At first glance, it would seem that an enormous amount of I/O would be required to interface the computer to the repeater, making it impractical to use a single board computer. Careful sharing and multiplexing of available ports reduced the amount of I/O hardware required with just a small amount of extra software. The entire I/O is accommodated by the two programmable I/O chips on the single board computer plus an octal latch and an eight-input multiplexer. Several spare bits remain for future use. Since the entire computer bus is available on a separate connector on the CPU-1A, virtually unlimited expansion capability remains with the addition of more hardware.

The functions of the I/O ports are shown in Fig. 3. The DACPORT output port

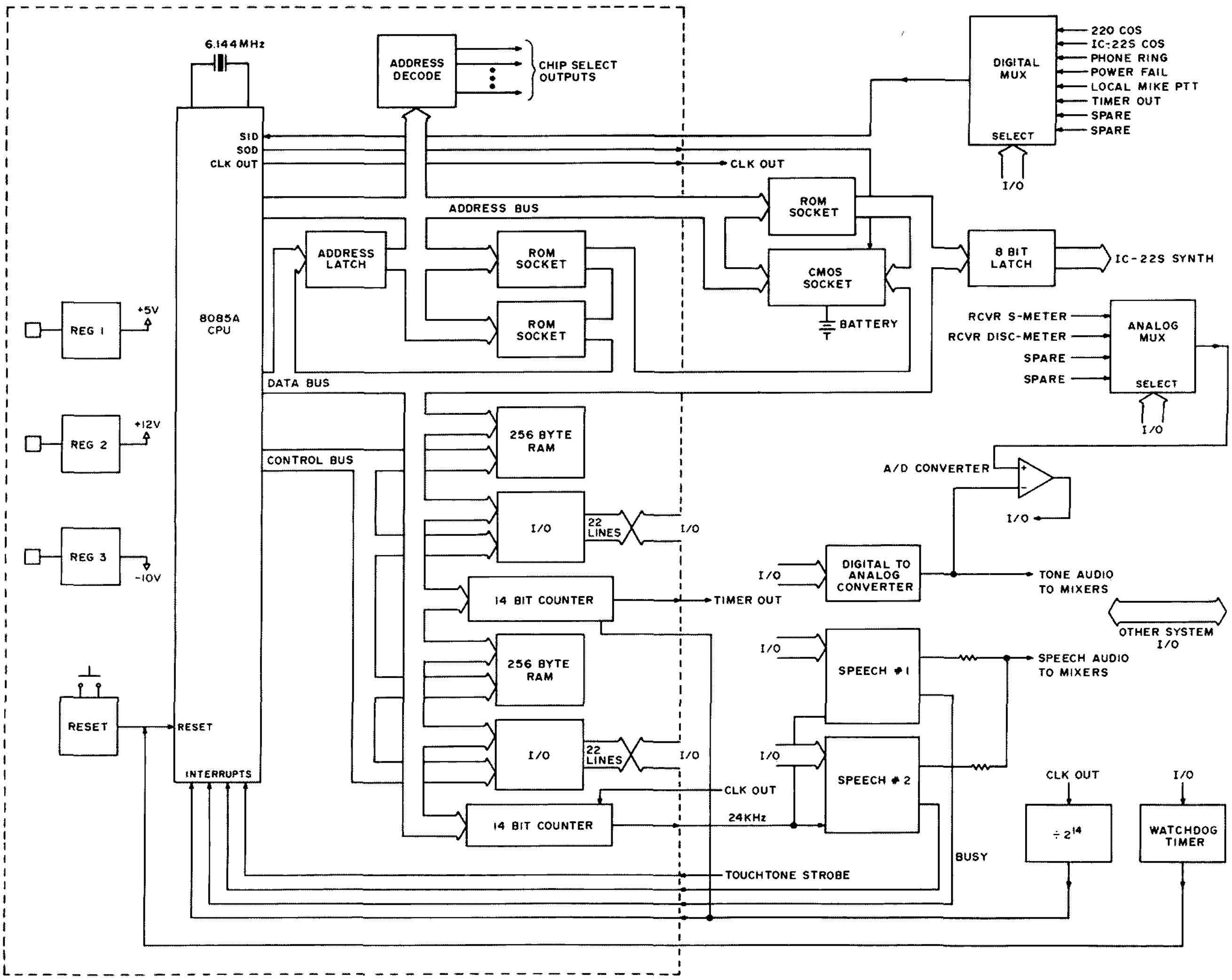


Fig. 1. Microcomputer hardware block diagram. CPU-1A provides portion enclosed in dotted lines. Remainder of hardware shown is wired in CPU-1A's breadboard area.

serves several functions, including driving the eight-bit DAC for tone generation and A/D conversion, providing the six-bit word select for the two speech synthesizers, and selecting the input to the expansion multiplexer which drives the CPU's serial input line.

XPORT output port provides eight single-bit oriented control lines. Active low was chosen for several of the control lines since during processor reset the I/O chip port lines float high. Active low ensures that the transmitters and phone line are not activated when pressing reset.

CHPORT output port selects the A/D analog channel to be measured and the proper input to the touchtone™ receiver. The watchdog timer pulse is generated by this port.

RPORT input port receives the touchtone receiver data bits, the A/D converter comparator output for the software-controlled A/D conversion, and other status inputs.

AUD1 and AUD2 output ports select the audio inputs to the transmitter and phone audio mixers. One or more audio sources may be connected to either or both mixers. AUD2 port also controls the IC-22S two-meter remote base transmit frequency offset.

IC22PORT is a hardwired memory mapped output port which drives the IC-22S remote base frequency synthesizer.

The 8085A CPU contains a single-bit input and a single-bit output line. The output line (SOD) enables the CMOS autodialer RAM. The input line (SID) is multiplexed between several status signals, with the select to the SID multiplexer derived from DACPORT.

Two of the 8085A's vectored interrupt inputs are used as additional single bit inputs to accommodate the speech synthesizer busy signals. The Interrupt 5.5 and 6.5 inputs on the 8085A are normally used as maskable level-sensitive interrupt inputs. If they aren't needed as interrupt inputs, though, they can be used like an input port since their level can be read by executing the RIM instruction and testing the "interrupt pending" bits. Just be sure that the interrupt masks remain set when using the SIM instruction so that a high level does not cause an interrupt to occur.

Interrupts

Two interrupts are used in the system. The 3.072-MHz clock-out signal from the 8085A is divided by a 14-bit CMOS binary ripple counter down to a 5.33-ms period square wave. This signal drives the rising-edge-sensitive Interrupt 7.5 input to cause the Background module interrupt routine to be executed

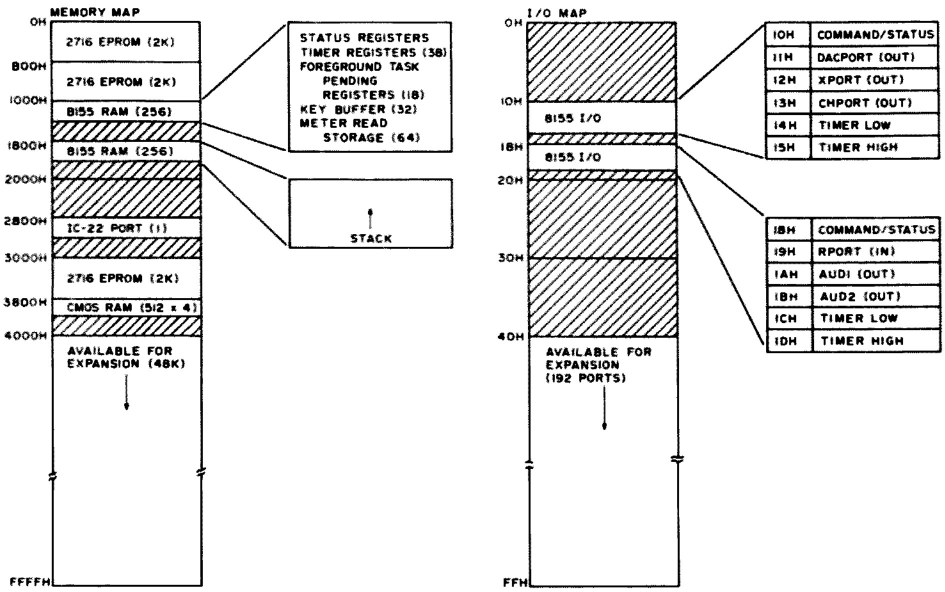


Fig. 2. Memory and I/O maps. Three quarters of the 8085A's memory and I/O capacity remain for expansion if needed.

every 5.33 ms. This interrupt is maskable by software.

The second interrupt in the system is generated by the touchtone receiver's data-ready strobe output driving the TRAP input. The TRAP interrupt is rising-edge sensitive and nonmaskable, and requires certain cautions in its use which will be described later. The TRAP interrupt causes the TRAP Interrupt module to be executed, placing the received touchtone data into a RAM buffer.

Timers

Two 14-bit programmable counter/timers are provided by the CPU-1A. Each counts its timer input pulses and can be programmed to produce a square wave or pulse output when the counter's terminal count is reached.

In the repeater control system, one counter/timer divides the 8085's 3.072-MHz clock signal to 24 kHz to supply the Telesensory Systems' speech synthesizer boards with a crystal-derived clock frequency. The second counter/timer divides the 5.33-ms interrupt signal to a one-minute period, which is further divided in software to time the tape voice ID.

CMOS RAM

Autodialer phone numbers are stored in RAM so that users can load and change the phone numbers over the air at any time. The RAM is battery backed up so that the numbers aren't lost when the repeater is taken down for maintenance.

CMOS RAM is best for battery backup since it draws only a few microamps when powered down. A separate small board was built which plugs into the CPU-1A microcomputer, containing the CMOS RAM, batteries and power switching (Fig. 4). The board can be removed so that the rest of the computer can be worked on without the pos-

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
DACPORT (OUT)	DAC7	DAC6	DAC5 SPEECH 5	DAC4 SPEECH 4	DAC3 SPEECH 3	DAC2 SPEECH 2 SIDMUX 2	DAC1 SPEECH 1 SIDMUX 1	DAC0 SPEECH 0 SIDMUX 0
XPORT (OUT)	AMPLIFIER ON	TOUCHTONE MUTE DISABLE	TAPE STROBE	PHONE OFFHOOK	SPEECH 2 STROBE	SPEECH 1 STROBE	IC-22S XMTR ON	220 XMTR ON
CHPORT (OUT)			SPARE	TOUCHTONE CHANNEL 1	TOUCHTONE CHANNEL 0	WATCHDOG	A/D CHANNEL 1	A/D CHANNEL 0
RPORT (IN)	A/D COMPARATOR	TOUCHTONE STROBE	TAPE BUSY	DIAL TONE READY	TOUCHTONE BIT 3	TOUCHTONE BIT 2	TOUCHTONE BIT 1	TOUCHTONE BIT 0
AUD 1 (OUT)	SPARE 1 TO XMTR	LOCAL MIKE TO XMTR	TAPE TO XMTR	TONE TO XMTR	SPEECH TO XMTR	PHONE TO XMTR	IC-22S RECEIVER TO XMTR	220 RECEIVER TO XMTR
AUD 2 (OUT)			IC-22S DUPA	IC-22S DUPB	SPARE 1 TO PHONE	TONE TO PHONE	SPEECH TO PHONE	220 RECEIVER TO PHONE
IC22PORT (OUT)	IC-22S D7	IC-22S D6	IC-22S D5	IC-22S D4	IC-22S D3	IC-22S D2	IC-22S D1	IC-22S D0

SID	17.5	16.5	15.5	TRAP
74LS151 MUX OUTPUT	5.66ms PERIOD SQUARE WAVE	SPEECH 2 BUSY	SPEECH 1 BUSY	TOUCHTONE DATA READY STROBE

0	220 COS
1	IC-22S COS
2	PHONE RING
3	POWER FAIL
4	LOCAL MIKE PTT
5	TIMER 2 OUT
6	SPARE
7	SPARE

SOD
5101 RAM CE2

Fig. 3. I/O port definition. CHPORT and AUD2 ports are six bits wide. 8085A serial input (SID) is multiplexed between several status signals, selected by DACPORT bits 0-2.

sibility of destroying the data in RAM.

The RAM is organized as 512 words by 4 bits for convenient storage of BCD numbers. Two 5101L-1 RAMs are used. These parts can draw up to 27 mA each when operating, but only 10 μA when in standby, where standby for the chip is defined as CE2 < .2 volts. Data also is retained with supply voltage as low as 2.0 volts when in standby. Unlike other CMOS RAMs, no special precautions are required to ensure that the 5101's inputs are defined as highs or lows during powerdown, as with many other CMOS RAMs. Note that in an application such as this, the L-1 suffix part should be used for 450-ns access time and low-voltage data retention.

The 8085A CPU SOD serial output line drives the RAM CE2 input. The SOD line normally is held low by the software except when the RAM is to be accessed for autodialer activities, so the RAM is normally in the low-current standby mode. It's also ready in case primary power is lost, so no special power-fail software routines are required to save the data. Finally, if the CPU should ever go berserk and write over existing data in RAM, the CMOS RAM would not be written into when address-selected by CE1/ because its other chip enable (CE2) would be inactive. To play it really safe, a switch in the CE2 line can be opened when intentionally powering down the computer.

Power switching from primary to battery backup for the RAM can be done in one of several ways, but diode switching is probably the simplest. The primary supply normally powers the RAM. A 5-volt regulator is biased up to about 5.7-volts output by placing a diode in its common lead and supplies the RAM through a diode so that the RAM sees a 5-volt supply. The diode to the battery is reversed biased and no current flows from the battery. If the primary supply goes away, the 3-volt batteries forward bias their diode and reverse bias the other to supply approximately 2.3 volts to the CMOS RAM.

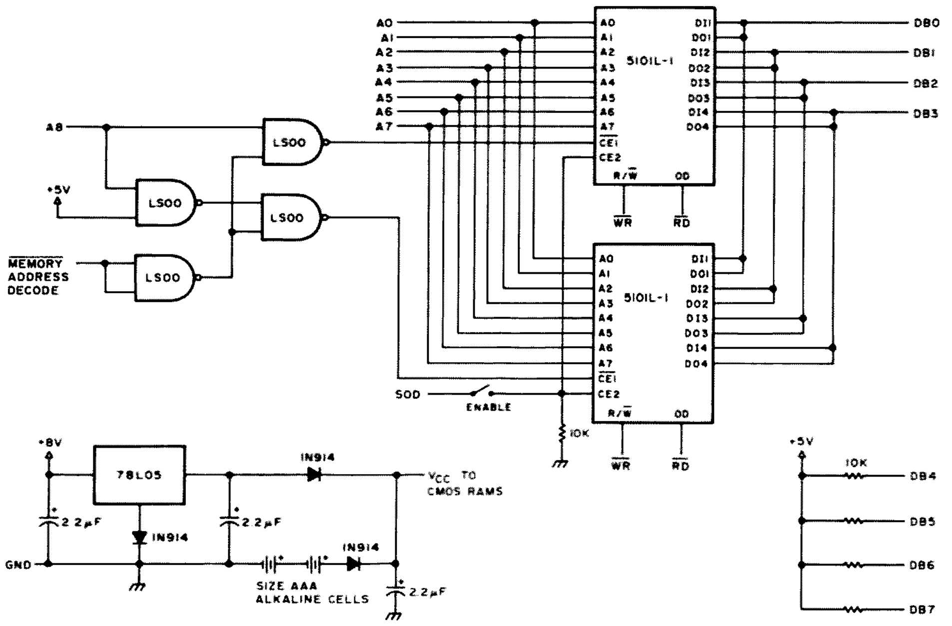


Fig. 4. CMOS autodialer RAM board schematic.

Since the batteries normally supply no current, and only around 10 μA when in service, their life essentially is equal to their shelf life. Good silver oxide watch batteries or the AAA alkaline batteries used here are appropriate. Alternatively, nicad batteries could be used and trickle charged, so that they would never need to be replaced.

Watchdog Timer

Most microcomputer systems have reset buttons, allowing them to be cleared in case they hang up as the result of a noise glitch, hardware intermittent, or software bus. Since the repeater is located miles away on a hilltop, provisions should be included for either a remote reset or an automatic reset. An approach considered, but not used, was to decode touchtone A, B, C, or D for a reset function, but only one user has a 16-key touchtone pad. Instead, built into the microcomputer is an automatic reset circuit, or watchdog timer, that requires no user interaction if the computer gets hung up. A 555 timer and a transistor are wired as a "missing pulse detector" (Fig. 5). The pulse is provided by an output port of the microcomputer.

The software routine which provides the pulse is deep in the Foreground module program, so that if the software is not functioning properly the watchdog timer times out and generates a reset pulse to the CPU. The routine was placed in the foreground program rather than the background program because the foreground execution could be out of control but the background interrupt program, forced by the hardware interrupt request, could still execute normally. The computer pulses the watchdog timer every ten seconds, and the timer is set to time out at about thirty seconds.

The watchdog timer isn't foolproof—it activates only if the foreground is not

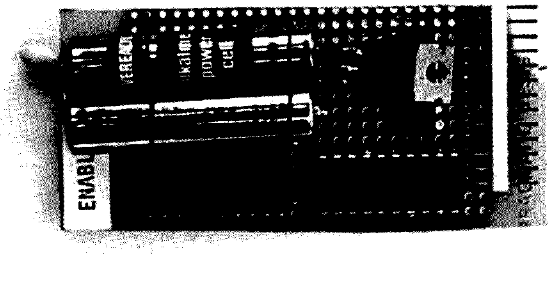


Photo B. CMOS autodialer RAM plug-in board, with battery backup.

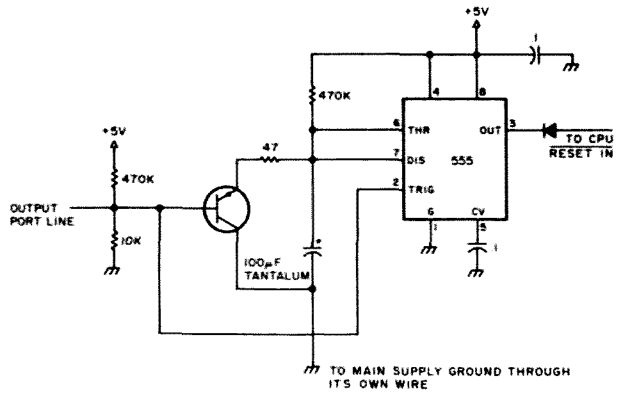


Fig. 5. Watchdog timer (missing pulse detector) schematic. A reset signal is generated if the software "misses a pulse."

executing properly. This usually means that control over the air or primary control has been lost. Since the sequence detection is performed in the foreground, control should be retained if the watchdog timer doesn't activate in response to a failure.

A second error recovery technique used is a "Jump to 0" instruction placed at address 38H ("An 8080 Repeater Control System," *73 Magazine*, April, 1979). In case the program should ever find itself executing instructions where no memory is present, the floating bus appears as instruction RST 7 (all ones), which calls location 38H, causing the program to jump to location zero for initialization.

Software

A computer-controlled repeater is a good example of a real time control system. The computer monitors and controls a number of external, asynchronous events which occur in real time. The program must react to and control the events based on their relative priorities. It must synchronize the events and communicate with I/O and other parts of the program.

The computer is a sequential device—it can perform only one operation at a time. However, since it executes its operations extremely fast relative to a human's perception (hundreds of thousands of operations per second), it is possible to program the machine in a way that causes it to appear to be doing a number of things simultaneously.

Several approaches are possible to multi-tasking real time programming. The approach used here is a relatively simple foreground/background mode of operation. Background activities occur on a regular, periodic basis and include monitoring of receiver squelches and phone ring, and control of transmitters and phone off/on hook. Timing in the system also is managed by the background.

Foreground activities, or tasks, are those infrequent events which, when performed, occupy a significant amount of processor time—such as speech synthesizer announcements and tone generation. Background activities are allowed to continue while foreground tasks are being performed. For example, the computer will detect a receiver squelch open and turn on the repeater transmitter immediately, even while talking over the primary control phone line.

Another important element of the software is a highest priority activity (TRAP interrupt) initiated by the data-ready strobe of the touchtone receiver, which loads the touchtone data into a RAM buffer as the data is received. Because of its highest priority, touchtone data can be received and stored at any time, regardless of the operation in progress, without interfering with that operation.

The various elements of the program communicate with each other by leaving information in memory registers, or "mailboxes." Repeater status, timing information, and task requests are deposited and read from the memory mailboxes by the program.

Simplified flowcharts of the principal modules are shown in Fig. 6, and a description of each follows.

Initialization Module

The Initialization module is executed after powerup or other processor reset. After I/O is initialized, the autodialer RAM contents are checked for valid data and the RAM is cleared if the contents are not valid, as in initial autodialer RAM powerup. Main RAM registers are cleared, then initialized, and control is transferred to the Foreground module.

Background Module

The Background module is an interrupt-driven routine initiated every 5.6 ms by the edge-sensitive Interrupt 7.5 input to the 8085A CPU. The activities which occur during the background occupy a significant period of time relative to the interrupt tick period. A slower interrupt tick would be preferred to allow all activities to be performed without the possibility of missing an interrupt tick. However, since an available signal (3.072 MHz) and a cheap 14-stage binary divider (4020) yield a 5.66-ms period, a simple hardware/software tradeoff can be made—the background routine is divided up five ways. During every fifth background interrupt tick (we'll call it the primary background interrupt tick), the background sample, decision, and timer routines are executed. The background meter-read routine executes during the other four out of five interrupt ticks, measuring one of the four analog channels at each tick and storing the measured value in RAM.

Background Sample

During the primary background interrupt tick (every 26.6 ms), several status inputs are sampled, including 220 receiver squelch, remote base squelch, ac power fail, phone ring, and local mike. Status bits are set and timers are loaded (mail delivered) based on the results of the samples.

Background Decisions

Several questions decided by the computer at every primary background interrupt tick include: should the 220 transmitter be on, should the remote base transmitter be on, and should the phone be off hook? To simplify the decisions, status information for each question is stored in registers (Fig. 7)—the 220 Transmitter On Register (TTOR), Remote Base Transmitter On Register (RBOR), and Phone Offhook Register (POHR).

The bits of the registers are set and cleared by foreground and background routines and are tested at the decision times (the mail is checked). For example, the TTOR 220 hang timer bit is set by the background sample program when a receiver squelch open is detected, at which time the 220 hang timer is also loaded. The bit is cleared by the 220 hang timer timeout routine. The TTOR repeater enabled bit is set by the Initialization module, and then may be set or cleared

by primary control commands. The 220 transmitter is turned on if repeater is not timed out, is enabled, and local mike is active or autopatch is on or function is in progress or the 220 hang timer is not timed out. Otherwise, the 220 transmitter is turned off by the background decision routine.

Background Timer Structure

In the repeater controller, as in most real time control systems, a need exists for implementing a number of timers. Some events must occur at periodic intervals and other events must occur at fixed time periods after the occurrence of other events. A general-purpose software scheme was used which allows virtually any number of independent timers to be implemented. Just think of each timer implemented this way as one less 555 timer in the system! With timers so easy to add, the tendency is to refine the operation of the system by using timers where they normally wouldn't be used because of cost or complexity.

Each timer is assigned a two-byte RAM location where the timer's current value is stored. The RAM locations are used as 16-bit presettable dead-end down counters. If non-zero, the value is decremented by one by the Background module during the primary interrupt tick (every 26.6 ms). The resolution of the timers is therefore 26.6 ms, with a maximum period of 29.1 minutes.

When a timer value dead-ends or is decremented from one to zero, the routine associated with the timer is executed. Typically, the timeout routine loads other timers and/or sets status bits used by other parts of the Background and Foreground modules (leaves mail in mailboxes).

Any timer that has a non-zero value or is counting can be forced to zero by any part of the program to inhibit execution of its timeout routine. Also, at any point the timer's value can be read by any part of the program to determine when the initiating event occurred or when timeout will occur.

The timer software executes with the remainder of the primary background software every 26.6 ms. Since the next background

Table 1. Timer program listing.

```
                ;SOFTWARE TIMER LOAD VALUE DEFINITIONS (EQUATES).
                ; VALUE = (TIME/26.66 MS)
                ;
34BC =          TID      EQU 13500          ;ID TIMER=6 MIN
1A5E =          TAID     EQU 6750           ;ANXIOUS ID TIMER=3 MIN
08CA =          TFCWID   EQU 2250           ;FORCED CW ID TIMER=1 MIN
0177 =          TTTHT    EQU 375            ;220 HANG TIMER=10 SEC
0026 =          STTTHT   EQU 38             ;220 SHORT HANG TIMER=.75 SEC
0013 =          TRBHT    EQU 19             ;REMOTE BASE HANG TIMER=.5 SEC
1A5E =          TPPTW    EQU 6750           ;PHONE PATCH TO WARN TIMER=3 MIN
0465 =          TPPT     EQU 1125           ;PHONE PATCH TIMER=30 SEC
1A5E =          TMT      EQU 6750           ;MONOLOGUE TIMER=3 MIN
0071 =          TSEQDET  EQU 113            ;SEQ DET INTERDIGIT TIMER=3 SEC
08CA =          TREVP    EQU 2250           ;REVERSE PATCH TIMER=1 MIN
0177 =          TSREVP   EQU 375            ;SHORT REVERSE PATCH TIMER=10 SEC
0017 =          TBEEP    EQU 23             ;BEEP TIMER=.62 SEC
0177 =          TSFCWID  EQU 375            ;SHORT FORCED CW ID TIMER=10 SEC
0071 =          TPHAD    EQU 113            ;PHONE ANSWER DELAY=3 SEC
0230 =          TTCYT    EQU 560            ;TAPE CYCLE TIME=15 SEC
0011 =          TFIP     EQU 17             ;FUNCTION IN PROGRESS HT=.45 SEC
0011 =          TTTCOVER EQU 17             ;TT COVER TIMER=.45 SEC
0177 =          TWATCH   EQU 375            ;WATCHDOG TIMER=10 SEC

                ;TIMER REGISTER RAM ALLOCATION (DEFINE STORAGE)
                ;
1017 =          TIMLOC   EQU $
1017            LID:     DS 2    ;ID TIMER
1019            LAID:    DS 2    ;ANXIOUS ID TIMER
101B            LFCWID:  DS 2    ;FORCED CW ID TIMER
101D            LTTHT:   DS 2    ;220 HANG TIMER
101F            LRBHT:   DS 2    ;REMOTE BASE HANG TIMER
1021            LPPTW:   DS 2    ;PHONE PATCH TO WARN TIMER
1023            LPPT:    DS 2    ;PHONE PATCH TIMER
1025            LMT:     DS 2    ;MONOLOGUE TIMER
1027            LSEQDET:DS 2     ;SEQ DETECTOR INTERDIGIT TIMER
1029            LREVP:   DS 2    ;REVERSE PATCH TIMER
102B            LBEEP:   DS 2    ;BEEP TIMER
102D            LTTBEEP:DS 2     ;220 SEQUENCE ACKNOWLEDGE TIMER
102F            LGPT:    DS 2    ;GENERAL PURPOSE FOREGROUND TIMER
1031            LPHAD:   DS 2    ;PHONE ANSWER DELAY TIMER
1033            LTCYT:   DS 2    ;TAPE CYCLE TIMER
1035            LFIP:    DS 2    ;FUNCTION IN PROGRESS HANG TIMER
1037            LTTCOVER: DS 2   ;TOUCH TONE COVER HANG TIMER
1039            LFDEL:   DS 2    ;RINGBACK RING DELAY TIMER
103B            LWATCH:  DS 2    ;WATCHDOG TIMER
103D =          FINTIMLOC EQU $

                ;TIMERS ARE DEADEND DOWN COUNTED, AND COUNTERS WHICH
                ;DECREMENT FROM 1 TO 0 (DEADEND) CAUSE APPROPRIATE ROUTINE
                ;TO BE EXECUTED.
                ;
01C4 =          RES75CONT EQU $
01C4 211610              LXI H,TIMLOC-1   ;POINT TO FIRST TIMER LOCATION - 1
                ;
01C7 =          R75T     EQU $
01C7 CD4103              CALL DECR         ;DOWNCOUNT AND JMP TO ROUTINE IF DEADEND
01CA 7D                  MOV A,L           ;DONE ALL TIMERS?
01CB FE3C                CPI LOW FINTIMLOC-1
01CD C2C701              JNZ R75T          ;NO, LOOP
                ;
                ;FINISHED RESTART 7.5 ACTIVITIES.  RETURN FROM INTERRUPT ROUTINE.
                ;
01D0 C3D900              JMP FIN75         ;YES, RETURN

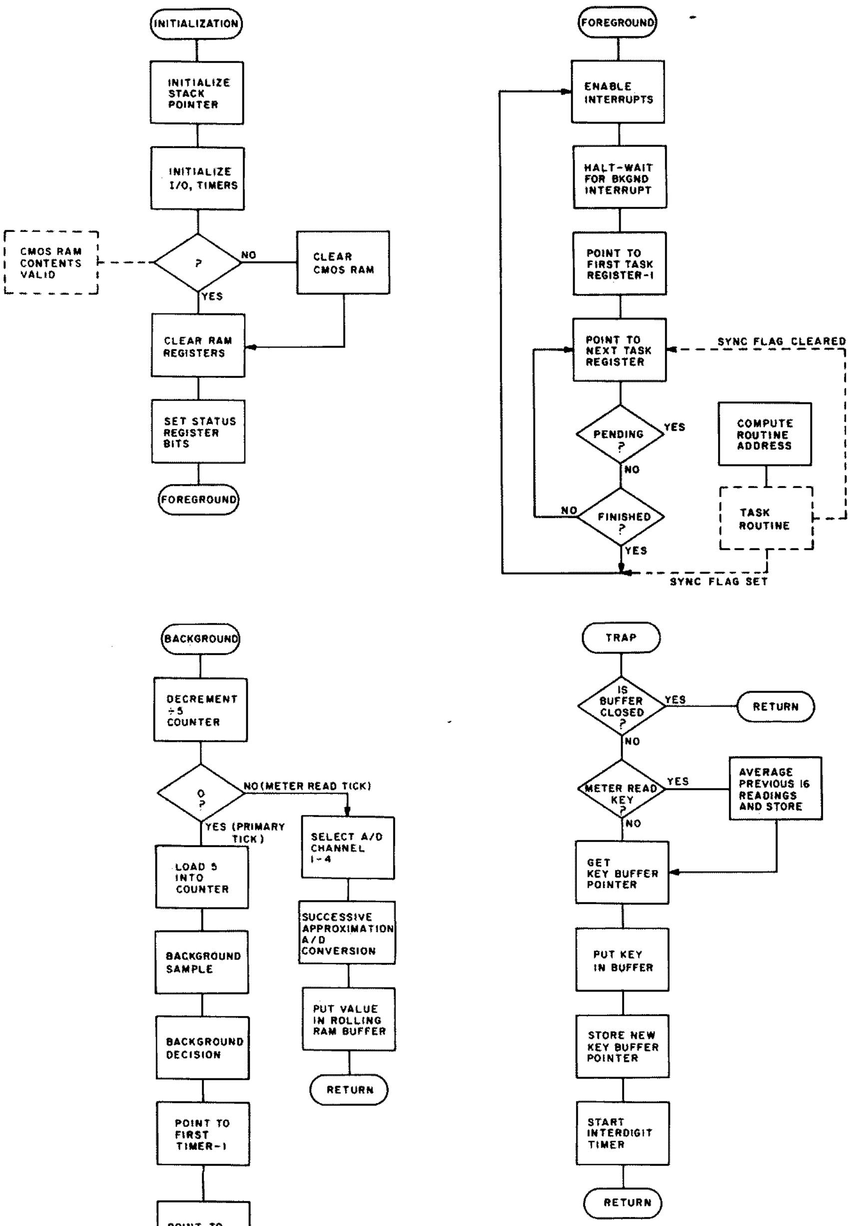
                ;COUNTER DECREMENT ROUTINE. (HL)->COUNTER LS LOCATION -1. THE 16
                ;BIT COUNTER IS TESTED FOR ZERO, AND IF NOT IS DECREMENTED.  IF
                ;DECREMENTED FROM ONE TO ZERO, DROPS THRU TO APPROPRIATE
                ;CONTROL ROUTINE.  RETURNS WITH (HL)->COUNTER MS LOCATION.
                ;INR L AND DCR L SHOULD BE INX H AND DCX H IF TIMER
                ;RAM IS AT START OF OR CROSSES PAGE BOUNDARY.
                ;
0341 =          DECR     EQU $
                ;
0341 2C                  INR L    ;(HL)->COUNTER LS LOCATION
0342 5E                  MOV E,M  ;GET LS COUNTER VALUE
0343 2C                  INR L    ;(HL)->COUNTER MS LOCATION
0344 7E                  MOV A,M
0345 B3                  ORA E    ;IS COUNTER ZERO?
0346 C8                  RZ       ;RETURN IF ALREADY ZERO
0347 56                  MOV D,M  ;DE=COUNTER VALUE
0348 1B                  DCX D    ;DECREMENT IT
0349 72                  MOV M,D  ;PUT IT BACK IN MEMORY
034A 2D                  DCR L
034B 73                  MOV M,E
034C 2C                  INR L    ;(HL)->COUNTER MS LOCATION
034D 7B                  MOV A,E
034E B2                  ORA D    ;IS COUNTER ZERO NOW?
034F C0                  RNZ      ;RETURN IF NO
                ;
                ;(HL)->COUNTER MS LOCATION.  THIS ROUTINE FINDS THE ADDRESS OF
                ;THE TIMEOUT ROUTINE FROM THE COUNTER TIMEOUT ROUTINE TABLE,
                ;AND TRANSFERS EXECUTION TO THAT ROUTINE.  SUBROUTINE RETURN
                ;FROM DECR OCCURS FROM THE TIMEOUT ROUTINE.  HL IS SAVED
                ;TO POINT TO NEXT TIMER REGISTER.
                ;
0350 =          DOTIME   EQU $
                ;
0350 E5                  PUSH H            ;SAVE HL
0351 113FF3              LXI D,TIMROUTAB-TIMLOC-1
0354 C34531              JMP JMPTAB2       ;COMPUTE ROUTINE ADDRESS AND JUMP

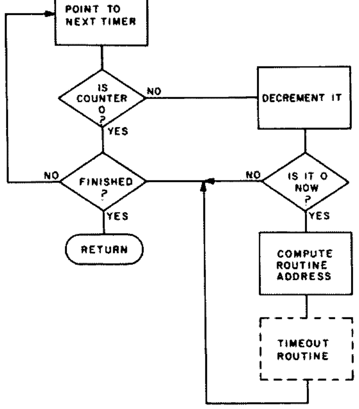
                ;TIMEOUT ROUTINE ADDRESS TABLE.  ENTRIES MUST BE IN SAME ORDER AS
                ;IN TIMER RAM REGISTER TABLE.
                ;
0357 =          TIMROUTAB EQU $
                ;
0357 7D03                DW RID            ;ID TIMEOUT
0359 9003                DW RAID           ;ANXIOUS ID TIMEOUT
035B AD03                DW RFCWID         ;FORCED CW ID TIMEOUT
035D B303                DW RTTHT          ;220 HANG TIME TIMEOUT
035F BD03                DW RRBHT          ;REMOTE BASE HANG TIME TIMEOUT
0361 C703                DW RPPTW          ;PHONE PATCH TO WARN TIMEOUT
0363 DF03                DW RPPT           ;PHONE PATCH TIMEOUT
0365 EF03                DW RMT            ;MONOLOGUE TIMEOUT
0367 F503                DW RSEQDET        ;SEQ DETECTOR INTERDIGIT TIMEOUT
0369 FF03                DW RREVP          ;REVERSE PATCH TIMEOUT
036B 0504                DW RBEEP          ;BEEP TIMEOUT
036D 2704                DW RTTBEEP        ;220 ONLY BEEP TIMEOUT
036F 4404                DW RGPT           ;GENERAL PURPOSE TIMER TIMEOUT
0371 4604                DW RPHAD          ;PHONE ANSWER DELAY TIMEOUT
0373 4404                DW RTCYC          ;TAPE CYCLE TIMEOUT
0375 9C03                DW RF1P           ;FUNCTION IN PROGRESS HANG TIME TIMEOUT
0377 4C04                DU RTTCOVER       ;TT COVER TIMEOUT
0379 4404                DW RFDEL          ;RINGBACK INTERRING DELAY
037B A603                DW RWATCH         ;WATCHDOG TIMER TIMEOUT

                ; *** SAMPLE TIMEOUT ROUTINES ***
                ;
                ;ID TIMER TIMEOUT ROUTINE.  THE ID FOREGROUND TASK
                ;PENDING REGISTER BIT IS SET AND THE ANXIOUS ID
                ;TIMER IS LOADED.
                ;
037D =          RID      EQU $
                ;
037D 3A4F10              LDA IDREQ         ;ID REQUIRED?
0380 0F                  RRC
0381 D28E03              JNC FINRID        ;DO NOTHING IF NO
                         SETF PID          ;YES, SET ID PENDING BIT
0384+214110              LXI H,PID
0387+71                  MOV M,C
0388 215E1A              LXI H,TAID        ;ANXIOUS ID TIMER VALUE
038B 221910              SHLD LAID         ;LOAD TIMER REGISTER
                ;
038E =          FINRID EQU $
038E E1                  POP H
038F C9                  RET
                ;
                ;
                ;ANXIOUS ID TIMER TIMEOUT ROUTINE.  THE ANXIOUS ID
                ;FOREGROUND TASK PENDING REGISTER BIT IS SET
                ;AND THE FORCED CW ID TIMER IS LOADED.
                ;
0390 =          RAID     EQU $
                ;
                         SETF AID          ;SET ANXIOUS ID PENDING BIT
0390+214210              LXI H,AID
0393+71                  MOV M,C
0394 21CA08              LXI H,TFCWID      ;FORCED CW ID TIMER VALUE
0397 221B10              SHLD LFCWID       ;LOAD TIMER REGISTER
039A E1                  POP H
039B C9                  RET

                ;FORCED CW ID TIMER TIMEOUT ROUTINE.  THE FORCED CW
                ;ID FOREGROUND TASK PENDING REGISTER BIT IS SET.
                ;
03AD =          RFCWID   EQU $
                ;
                         SETF FCWID        ;SET FORCED CW ID PENDING BIT
03AD+213E10              LXI H,FCWID
03B0+71                  MOV M,C
03B1 E1                  POP H
03B2 C9                  RET
```

Fig. 6. Software nucleus flowchart. Nucleus consists of Initialization, Background, Foreground, and TRAP Interrupt Modules.





interrupt tick is only 5.6 ms away, and it would be nice to allow some foreground processing time between ticks, the timer software was optimized for minimum execution time. When no timeout routines are executed, the entire list of the repeater's 19 timers is scanned in less than 700 μs.

A listing of the background timer routine is given in Table 1. At the beginning of the main program, the timer load values are given names so that they may be referred to symbolically in the program. Memory locations are allocated for the timer registers in RAM, along with the allocation for other buffers and temporary storage registers. The main timer program is executed at the end of the primary background routine, and control is allowed to drop through to a timeout routine when its timer dead-ends. A table of addresses is used to find the appropriate routine address for each timer.

Three sample timeout routines are shown. Six minutes after the last ID occurred, the ID timer times out, causing the RID routine to execute. The "pending ID" foreground task-pending register is set. The anxious ID timer is also loaded, so that if the pending ID is not performed in the next three minutes (after a hang timer timeout), the anxious ID timeout routine sets the "anxious ID" task register and loads the forced CW ID timer. Finally, if the forced CW ID timer times out because an anxious ID hasn't worked its way in before a beep (because someone has continued to talk), the "forced CW ID" task bit is set and the foreground routine sends a CW ID. The SETF and CLRF macros simply set or clear foreground task-pending registers by loading register B or C into the proper memory location. B and C were previously loaded with values zero and one.

Background Meter Read

During four out of every five background interrupt ticks, one of the four analog input channels is measured using a successive approximation A/D conversion routine controlled by the software. The measured value is stored in RAM along with the last fifteen measured values for that

channel. The newest value is written over the oldest, so that the latest sixteen values are available at any time to the TRAP Interrupt module to be averaged and read out by the Foreground module.

220 TRANSMITTER ON REGISTER (TTOR)

TIMED OUT (TTTIM)	REPEATER ENABLED (RPTEN)	———	LOCAL MIKE (LM)	———	AUTOPATCH ON (APON)	FUNCTION IN PROGRESS (FIP)	220 HANG TIMER (TTHT)

220 TRANSMITTER ON = $\overline{\text{TTTIM}}$ · RPTEN · (LM + APON + FIP + TTHT)

REMOTE BASE TRANSMITTER ON REGISTER (RBOR)

TIMED OUT (RBTIM)	REPEATER ENABLED (RPTEN)	REMOTE BASE ENABLED (RBEN)	———	REMOTE BASE RECEIVER ENABLED (RBREN)	———	REMOTE BASE TRANSMITTER ENABLED (RBXEN)	REMOTE BASE HANG TIMER (RBHT)

REMOTE BASE TRANSMITTER ON = $\overline{\text{RBTIM}}$ · RPTEN · RBEN · RBREN · RBXEN · RBHT

PHONE OFFHOOK REGISTER (POHR)

———	———	———	———	———	PATCH PENDING (PPEND)	PRIMARY ON (PRIM)	AUTOPATCH ON (APON)

PHONE OFFHOOK = PPEND + PRIM + APON

Fig. 7. Background decision registers. Each register is a RAM memory location.

Foreground Module

The Foreground module is normally executed following each background interrupt tick (Fig. 8). Each foreground task-pending register is tested starting at the first entry of the list. If no tasks are found to be pending, the processor returns to the start of the module, entering a HALT state waiting for the next interrupt tick. When a task is found pending, the program branches to the task routine, then returns either to check the next task register down the list, or to the beginning of the module to resynchronize to the background interrupt tick. If a task is pending but not all conditions required for its complete execution are present, the execution may be postponed temporarily until the required conditions are met. For example, if an ID task is pending but the hang timer has not yet timed out, the ID will not be performed. The ID task routine will quickly return allowing continuing scanning down the table. Eventually, the task routine may find that the hang timer has timed out. The ID is then performed and the task-pending register is cleared.

The ID task routine returns control with the synchronize flag cleared to continue checking the next registers down the list while waiting for the hang timer timeout. When the task is finally performed, during which time background interrupts are allowed to occur, the task routine returns with the synchronize flag set so that the return is to the beginning of the Foreground module, and further table scanning will be resynchronized to the background interrupt tick.

Foreground task-pending registers are frequently set by the Background module. Synchronizing the Foreground module to the Background module by use of the HALT instruction ensures that the foreground tasks are performed according to the desired priority. Without the HALT, the background interrupt would normally occur in the middle of the foreground's continuous scanning of the table. When control was returned to the foreground, new pending tasks could possibly be performed out of the desired sequence or priority.

When the foreground is not tied up executing a task, the computer actually spends about 80% of its time in the HALT state—sleeping! This has at least two small system benefits. When asleep, the computer is not sensitive to noise which may appear on its bus, and thus the system's noise immunity is improved. Also, the 2716 EPROMs remain deselected during the HALT state, lowering their power dissipation and total power supply current by about 50 mA.

The apparent simplicity of the Foreground module is deceiving, since most of the repeater's features are implemented as foreground tasks. The largest foreground task is the sequence detector with its function decodes. Its task-pending register bit is set by the timeout of the 220 beep timer. The sequence detector task examines the RAM key buffer after every 220 transmission for a valid command sequence. Efficient command decoding is important to a multi-feature, expandable, easily modifiable repeater. Because of the sequence detector's importance, it will be described in detail in part III of this article.

The listing of the Foreground module nucleus and three sample task routines are given in Table 2. RAM is allocated at the beginning of the program for the task registers. The main program loop is followed by a table of task routine addresses, followed by the task routines themselves. The pending ID routine (FPID) causes a speech ID (or CW ID when remote base is on) to occur when the 220 hang timer times out. The anxious ID routine causes the same if the beep timer times out (occurs just before the beep). The forced CW ID routine sends the Morse code ID over any conversation in progress if the repeater wasn't given the opportunity to ID at a convenient time.

TRAP Interrupt Module

The leading edge of the touchtone receiver's data-ready strobe initiates execution of the TRAP Interrupt module. The module reads the touchtone key in the binary format presented by the touchtone receiver and stores the data at the next position in the key buffer in RAM.

The TRAP input to the 8085A CPU is a rising-edge sensitive, non-maskable interrupt input. Because the interrupt cannot be disabled by software, its use requires certain cautions.

Often in interrupt driven systems, an entire group of instructions must be allowed to execute without being interrupted. Interrupts could allow certain parameters to be modified during a critical operation. For example, a single bit in a status register in memory may be modified by reading the memory location, ANDing or ORing the contents with a value, and then writing the modified value back to RAM. If between the time the RAM contents are read and rewritten an interrupt occurs which changes the contents of the status register in RAM, the value rewritten by the interrupted routine is obsolete—the in-

Table 2. Foreground nucleus program listing.

```
               ;FOREGROUND TASK PENDING REGISTER RAM
               ; ALLOCATION (DEFINE STORAGE).
               ;
103D =         FTPR     EQU $
103D           PTTSEQ: DS 1     ;PENDING TT SEQUENCE
103E           FCWID:  DS 1     ;FORCED CW ID
103F           PVID:   DS 1     ;PENDING VOICE ID
1040           AVID:   DS 1     ;ANXIOUS VOICE ID
1041           PID:    DS 1     ;PENDING ID
1042           AID:    DS 1     ;ANXIOUS ID
1043           SAYCALL:DS 1     ;DIRECTED RINGBACK SAY CALL
1044           MWARN:  DS 1     ;MONOLOGUE WARNING
1045           PPTWARN:DS 1     ;PHONE PATCH TIMEOUT WARNING
1046           PBEEP:  DS 1     ;BEEP
1047           P73HANG:DS 1     ;SAY 73 AND HANG UP PHONE
1048           RINGBACK:DS 1    ;RING BACK RING
1049           PRIM:   DS 1     ;PRIMARY ANSWER
104A           TIMEOUTANNC: DS 1  ;TIME OUT RESET ANNOUNCE
104B           CLRANNC:DS 1     ;INITIALIZE ANNOUNCEMENT
104C           WATCH:  DS 1     ;WATCHDOG TIMER INITIALIZE
104D           PCOVER: DS 1     ;COVER TONE
104E           TTCOVER:DS 1     ;TT COVER TONE
104F =         FINFTPR EQU $

               ;*****************************************************
               ;        FOREGROUND ROUTINE
               ;*****************************************************
               ;
               ;        THE FOREGROUND ROUTINE EXAMINES THE FOREGROUND
               ;        TASK PENDING REGISTERS, AND IF A TASK IS PENDING THE
               ;        APPROPRIATE ROUTINE IS CALLED.  THE HALT INSTRUCTION
               ;        SYNCHRONIZES THE FOREGROUND ROUTINE TO THE RST7.5
               ;        INTERRUPT, ENSURING THE FOREGROUND TASKS ARE PERFORMED
               ;        ACCORDING TO PRIORITY.
               ;
0523 =         FOREGROUND EQU $
               ;
0523 FB                 EI                 ;ENABLE RST7.5 INTERRUPT
0524 31EF18             LXI SP,102*256+0EFH     ;DON'T PRESS YOUR LUCK
0527 213C10             LXI H,FTPR-1       ;POINT TO FIRST REGISTER LOCATION
052A 76                 HLT                ;WAIT FOR NEXT INTERRUPT TO CONTINUE
               ;
052B =         FORE1    EQU $
052B CD3A05             CALL DFCR          ;SEE IF TASK PENDING
052E DA2305             JC FOREGROUND      ;START OVER IF CY=1
0531 7D                 MOV A,L            ;OTHERWISE CONTINUE, DONE?
0532 FE4E               CPI LOW FINFTPR-1
0534 C22B05             JNZ FORE1
0537 C32305             JMP FOREGROUND     ;DONE, START OVER
               ;
053A =         DFCR     EQU $
               ;
053A 23                 INX H              ;NEXT
053B 7E                 MOV A,M
053C 0F                 RRC                ;TASK PENDING?
053D D0                 RNC                ;RETURN IF NOT
               ;
053E =         DOFORE   EQU $
               ;
053E E5                 PUSH H             ;YES, (HL)-> FTPR LOCATION
053F 7D                 MOV A,L
0540 D63D               SUI LOW FTPR       ;SAVE ADD VALUE
0542 110CF5             LXI D,FROUTAB-FTPR
0545 19                 DAD D              ;CALCULATE ROUTINE ADDRESS
0546 C34231             JMP JMPTAB1        ;  AND JUMP TO ROUTINE

               ;FOREGROUND TASK ROUTINE ADDRESS TABLE.  ENTRIES MUST BE IN SAME
               ;ORDER AS IN FOREGROUND TASK PENDING RAM REGISTER TABLE. PRIORITY
               ;IS DEPENDANT ON POSITION IN TABLE.
               ;
0549 =         FROUTAB EQU $
               ;
0549 1008               DW FPTTSEQ         ;SEQUENCE DETECTOR BUFFER READY
054B C105               DW FFCWID          ;FORCED CW ID
054D D605               DW FPVID           ;PENDING VOICE ID ROUTINE
054F 6D06               DW FAVID           ;ANXIOUS VOICE ID ROUTINE
0551 9205               DW FPID            ;PENDING ID
0553 BB05               DW FAID            ;ANXIOUS ID
0555 6D05               DW FSAYCALL        ;DIRECTED RINGBACK SAY CALL
0557 1007               DW FMWARN          ;MONOLOGUE WARNING
0559 BE06               DW FPPTWARN        ;PHONE PATCH TIMEOUT WARNING
055B 7306               DW FPBEEP          ;PENDING BEEP
055D FA06               DW F73HANG         ;PRIMARY HANGUP
055F B207               DW FRINGBACK       ;RINGBACK RING
0561 5F07               DW FPRIM           ;PRIMARY PHONE ANSWER
0563 3A07               DW FTIMERANNC      ;TIMED OUT RESET ANNOUNCMENT
0565 9F07               DW FCLRANNC        ;INITIALIZE ANNOUNCEMENT
0567 D906               DW FWATCH          ;WATCHDOG TIMER RESET
0569 9207               DW FPCOVER         ;PENDING COVER TONE
056B 9207               DW FTTCOVER        ;PENDING TT COVER TONE

               ; *** SAMPLE FOREGROUND TASK ROUTINES ***
               ;
               ;PENDING ID.  IF 220 HANG TIMER TIMED OUT AND AUTOPATCH
               ;OFF, THEN ID.
               ;
0592 =         FPID     EQU $
               ;
0592 2A1D10             LHLD LTTHT         ;220 HANG TIMER
               ;
0595 =         FPID1    EQU $
0595 7D                 MOV A,L            ;IS TIMER ZERO?
0596 B4                 ORA H
0597 C2B905             JNZ FINFPID        ;IF NOT DONT ID, CY=0
059A 3A0010             LDA TTOR           ;YES, PATCH ON?
059D E604               ANI SAPON
059F C2B905             JNZ FINFPID        ;IF YES DONT ID, CY=0
05A2 3A0110             LDA RBOR           ;RB RCVR ON?
05A5 E628               ANI SRBEN OR SRBRON
05A7 FE28               CPI SRBEN OR SRBRON
05A9 CAC105             JZ FFCWID          ;IF YES, DO CW ID
               ;
05AC =         FPID2    EQU $
05AC 210000             LXI H,VIDENT       ;POINT TO MESSAGE
05AF CD3C33             CALL TALKR         ;  AND TALK
05B2 DAB905             JC FINFPID         ;ABORT IF SQUELCH OPENED, TOP OF FTPR
               ;
05B5 =         FPID3    EQU $
05B5 CD7231             CALL CLEARID       ;CLEAR ID REQUIRED, TIMERS, ETC
05B8 37                 STC                ;SO RETURN TO TOP OF FTPR
               ;
05B9 =         FINFPID EQU $
05B9 E1                 POP H              ;RESTORE HL
05BA C9                 RET
               ;
               ;
               ;ANXIOUS ID.  IF BEEP TIMER TIMED OUT AND AUTOPATCH OFF,
               ;THEN ID.
               ;
05BB =         FAID     EQU $
               ;
05BB 2A2B10             LHLD LBEEP         ;BEEP TIMER
05BE C39505             JMP FPID1
               ;
               ;
               ;FORCED CW ID.
               ;
05C1 =         FFCWID   EQU $
               ;
05C1 CD8333             CALL CONNTONER  ;CONNECT TONE GENERATOR TO RADIO
05C4 010080             LXI B,8000H        ;DELAY
05C7 CD9A34             CALL DEL2
05CA 210000             LXI H,MIDENT       ;POINT TO MORSE CODE MESSAGE
05CD CD1432             CALL MORSE         ;SEND ID
05D0 CDD733             CALL XCONN         ;DISCONNECT
05D3 C3B505             JMP FPID3          ;FINISH

               ;JUMP TO ADDRESS IN TABLE.  A=ENTRY IN WORD TABLE.  (HL)-> TOP OF
               ;TABLE.
               ;
3141 =         JMPTAB   EQU $
3141 07                 RLC                ;AX2
               ;
3142 =         JMPTAB1 EQU $
3142 5F                 MOV E,A
3143 1600               MVI D,0            ;DE=OFFSET VALUE
               ;
3145 =         JMPTAB2 EQU $
3145 19                 DAD D              ;(HL)-> ADDRESS IN TABLE
3146 5E                 MOV E,M
3147 23                 INX H
3148 56                 MOV D,M
3149 EB                 XCHG               ;HL=JUMP ADDRESS
314A E9                 PCHL               ;JUMP
```

terrupted routine failed to correctly perform its job.

Although the probability of an occurrence at exactly the wrong time of an interrupt which modifies the memory location is extremely low, when a computer executes hundreds of thousands of operations per second, twenty-four hours per day, year after year, the "highly improbable" *will happen*. This type of problem may appear only once every few months, but it is a source of software unreliability and is extremely difficult to test for. The goal must be 100% reliability; aiming for anything less will probably leave room for software failures. A critical section of code such as that described must be protected by disabling interrupts around it so that the operation may be completed before an interrupt is allowed to occur. The solution is simple—it's just necessary to be careful in the design of interrupt driven software. When using the TRAP interrupt, which cannot be disabled by software, care must be taken to ensure that no conflicts such as those described can exist.

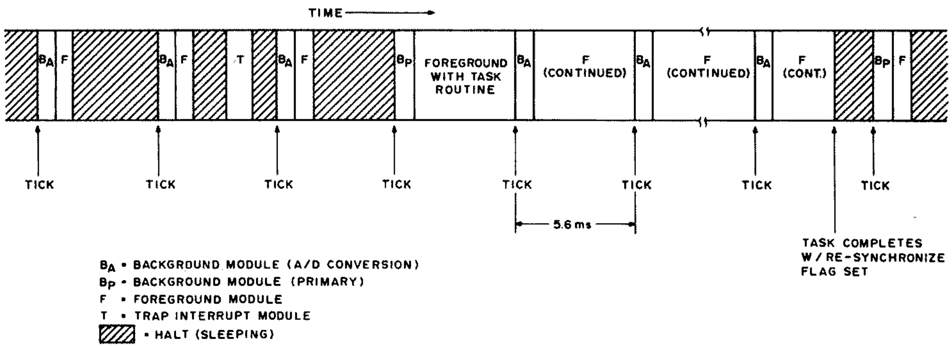


Fig. 8. Typical software module execution interaction.

A second potential problem using the TRAP interrupt input is that if a TRAP interrupt can be generated before the computer is completely initialized after reset, the system may not

be able to process the interrupt correctly, since the stack pointer may not yet be set, data memory may not yet be initialized, etc. Because of these two potential problems, the TRAP interrupt must be used with care. The hardware and software were designed here so that these restrictions were not a problem.

Following the TRAP interrupt, the previous interrupt enable status can be found by executing a RIM instruction. For example, at the end of the TRAP routine before the return, the RIM instruction can be used to enable interrupts if they were previously enabled, or to leave them disabled if they were disabled at the time the TRAP interrupt occurred. The RIM instruction and the conditional enable interrupt should be placed before the POP PSW instruction, however, since the RIM modifies the contents of the accumulator.

In retrospect, the touchtone data read routine could have been accommodated in the background. The touchtone data-ready strobe could be checked either at every background interrupt tick or at every fifth (primary) tick. The extra complexity of a second interrupt would have been avoided and it would have been a lower risk approach.

Next Time

The conclusion of this article will discuss hardware and software interfacing of peripheral circuits including the speech synthesizer, remote base, audio mixers, and audio delay line.

A single-density, eight-inch CP/M-compatible diskette containing a source listing of the repeater software is available from the author. ■

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The Radio Spectrum at a Glance

—from VLF to UHF, SWLing is fun

Spies, smugglers, military missions, rescue operations, foreign broadcasts, undercover surveillances, medical relief messages, and space and satellite communications are but a tiny fraction of the communications networks humming throughout the most concentrated portion of the radio spectrum: 2-420 MHz.

To keep these millions of radio operations worldwide from landing on top of each other, nations of the Earth, developed and developing, have established departments to regulate the users of the radio spectrum.

On an international level, the United Nations provides a cooperative effort known as the International Telecommunications Union. Entirely voluntary, it was the ITU which conducted the World Radio Administrative Radio Conference last fall at its Geneva, Switzerland, headquarters. The ramifications of agreements made at WARC '79 will not be fully appreciated until further meetings are held for ratification. But there will be some changes in the next few years.

In the United States, two government agencies provide for regulation of the users of the radio spectrum. We are familiar with the agency closest to amateur radio, the Federal Communications Commission. It is the primary purpose of the FCC to draft rules and regulations pertaining to the non-federal government users of the spectrum. Police and fire, trucking, business and industry, amateur and CB, common carrier services, ship to shore, and many other conventional services are regulated by rules proposed and maintained by the FCC.

At the federal level, it is the Interdepartment Radio Advisory Committee, now a function of the Department of Commerce, which regulates government radio assignments. Interestingly enough, although the FCC regulates non-government communicators, they are a government entity and their communications thus are regulated by IRAC!

Callsign blocks for both government and non-government operations are issued by the FCC. Table 1 shows the basic band plan as allocated in the United States.

With this brief introduction to the agencies which cooperatively do their best to prevent chaos on the radio bands, let's have a closer look at the spectrum itself and see who is doing what with whom, where!

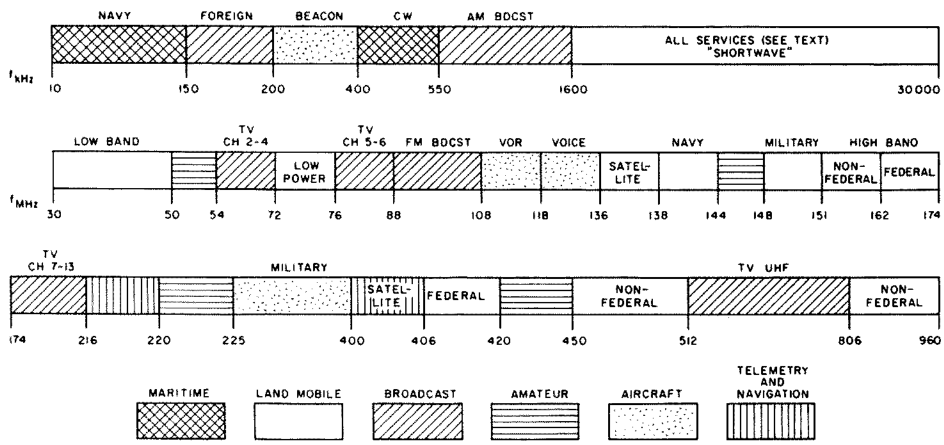

Table 1. Frequency band allocations.

Below the Broadcast Band

Because of reliable ground wave coverage, the

spectrum below the standard broadcast band, 10-535 kHz, is utilized primarily by long-distance point-to-point and ship-to-shore communications. The lowest portion (10-15 kHz) is occupied extensively by navigational signals such as Omega.

Some high-speed Morse and a great deal of narrow-shift radioteletype is encountered by listeners while monitoring this basement band of radio. There is no voice below 150 kHz, although 150-285 kHz is used for broadcasting in parts of Europe. The venerable 200-400-kHz range has been used for aeronautical navigational beacons since before World War II and still is filled with tone-modulated Morse identifiers for airports all over the world. From 400-535 kHz, CW transmissions from government and non-government ocean-going vessels communicate with their land stations.

Above the broadcast band, from 1.6 to 30 MHz, we encounter the best-known region of the radio spectrum. Classically called "shortwave" because the wavelengths of emissions are shorter than those first encountered in the early low-frequency days of radio, this frequency range is absolutely polluted with virtually every imaginable electromagnetic emanation! AM and sideband, CW and RTTY, telemetry and multiplex, tone paging and FM, broadcasters and broadcast jammers, facsimile and data—the high-frequency range is a veritable polyglot of activity.

In the United States, frequency allocations are made on an alternating basis; that is, the same service will be assigned at intervals throughout the spectrum. For example, international broadcasters are assigned discrete frequencies in the ranges 5950-6200, 9500-9775, 11700-11975, 15100-15450, 17700-17900, 21450-21750, and 25600-26100 kHz.

This same alternating allocation procedure is used for aeronautical, maritime, fixed and mobile, and mobile services. We see this procedure in our own hobby, with amateur bands spaced at intervals as the 160-, 80/75-, 40-, 20-, 15-, and 10-meter bands, with others added at WARC '79.

For convenience of discussion, all radio operations are divided into two basic categories: broadcasting and "utilities." The broadcasters don't listen; they radiate signals for reception by anyone who is interested in listening. All two-way communications are classified as utilities.

Are there some "hot spots" of listening intrigue? Yes, there certainly are. The most interesting portion of the shortwave spectrum is between 3 and 18 MHz, outside of the foreign broadcast bands and ham bands. They center around the most-used military bands and include spies, embassy communications, tactical maneuvers, smuggling operations, undercover agencies, and other drama.

To avoid monitoring, clandestine operations frequently change operating frequencies, but because of propagation, antennas, or equipment limitations, they generally will occupy certain key portions of the spectrum. These include 50-100 kHz or so up or down from the following center frequencies (kHz): 4725, 5700, 6700, 7400, 9000, 11250, 13300, 15050, and 18000.

VHF/UHF

As communications congestion becomes increasingly worse, frequencies used by communicators become increasingly higher (Grove's Law of Proportionate Pollution!). So it has been with shortwave and higher frequencies for years.

The sunspot cycle has contributed a great deal to motivating users to new frequencies, and worldwide skip now can be heard up through 50 MHz.

The 30-50-MHz spectrum peaks in the afternoon, with worldwide land mobile users of every language (including profane) populating "low band," as this block of spectrum is commonly referred to.

In the United States, the most common users of low band are military bases, paging systems, and state public safety agencies. FM mode dominates, although occasional AM is encountered.

Above 54 MHz, TV broadcast (channels 2 through 6) dominates through 88 MHz, with a short break between 72-76 MHz. A variety of low-power industrial and public safety communications may be found there, especially in larger cities. The familiar FM broadcast band is 88-108 MHz (with low-cost "bugs" popularly used between 86-90 MHz—listen in on your neighbors!).

Aeronautical services share the exclusive use of the 108-136-MHz band. Aeronavigational beacons (VOR) dominate 108-118 MHz; this is why most aircraft scanners include only 118-136 MHz, the active air-to-ground band. Emission in this range is always AM voice. Commercial carriers chat with their home offices in the 129-132-MHz portion of this range, and when pilots get bored (?!), they get together on 123.45 MHz.

There still is some satellite activity in the 136-138-MHz region, with ATS-3 commonly reported on 135.575 MHz with voice relays from scientific users all over the hemisphere.

Military agencies use land mobile on their bases on each side of the two-

Frequency Lists

A listener without a frequency directory is like a hunter without a gun. Fortunately, there are a number of useful guides on the market. The new *Federal Frequency Directory* features more than 100,000 frequencies, agencies, and locations of US Government radio communicators using the spectrum 2-420 MHz, inclusive. Unlike many smaller volumes, this exhaustive directory is taken directly from the unclassified IRAC computer file. It is available for $14.95 postpaid from Grove Enterprises, Rt. 1, Box 156K, Brasstown NC 28902.

The popular *Confidential Frequency List* is now in its 4th edition. It is geared toward the shortwave listener, confining its listings to 4-25 MHz. It may be purchased from Gilfer Associates, PO Box 239, Park Ridge NJ 07656.

The *Radio Communications Guide* features hundreds of commonly reported frequencies in the shortwave and VHF/UHF range. A copy is available for $6.95 plus $1.00 postage from Handler Enterprises, PO Box 48, Deerfield IL 60015.

For the scanner listener, two directories are outstanding. The *Police Call Directory* has become a classic for public safety monitoring. It is regionalized and available from Radio Shack outlets.

A new scanner frequency directory has been released from Electra, manufacturer of the famous Bearcat scanner line. Featuring a variety of VHF/UHF services, it may be obtained for $12.95 from Better Bearcat, Electra Co., Cumberland IN 46229.

meter band: 138-144 and 148-150.8 MHz.

VHF high band is divided into two distinct halves: 150.8-162 non-government and 162-174 federal government. There are very few exceptions within this range. Mobile telephone may be found from 152.51-152.81 MHz (30-kHz channel separation); police and fire are most commonly assigned in the 154-156-MHz portion; ship-to-shore is in the 156-158-MHz range (with some telephone traffic from boats to shore clustered near 162 MHz).

High band is the most populated mobile band in the spectrum, with government services from every agency represented in the upper portion. Military, agriculture, FBI, Secret Service, VA hospitals, Indian Affairs . . . everybody is up there. While some sensitive intelligence is openly conducted, most of those voice communications are encoded or even encrypted beyond recognition.

TV channels 7-13 occupy 174-216 MHz, and a few navigational and control signals may be found from 216-220 MHz, but no voice has ever been reported.

Above the 220-225-MHz ham band, military aeronautical communications dominate nearly 200 MHz of spectrum! AM tactical and air-to-ground voice is heard from 225-400 MHz, usually channelized at 100-kHz intervals. The space shuttle *Columbia* (*Enterprise* will no longer fly) will use 259.7 and 296.8 MHz as UHF backup while in flight. Air Force, Navy, Coast Guard, and Navy aircraft use this band constantly.

While AM is the operating mode almost exclusively, the new FLEETSATCOM military satellites may be heard using FM in the 240-270-MHz portion, shared with air-to-ground AM.

If you like beeps and whistles, you'll love 400-406 MHz. It is used for satellite telecommand and environmental/meterological telemetry, such as radiosonde balloons. You're welcome to listen, but polar-bear tracking satellites rarely QSL!

We won't discuss the 406-420 MHz band because there is a lot of sensitive federal government stuff in there. Don't listen, or you may hear all manner of fascinating things. Naturally, I never listen due to a keen sense of patriotic duty.

The 420-450-MHz band is shared by hams and navigational beacons. Some Navy ships are equipped with long-distance radar in that region that would wipe out everything in range if it were used near land; fortunately, it isn't.

The 450-470-MHz band has been extended through 512 MHz (called "T-band" because it was taken from the lower UHF TV channels allocations). It is also becoming congested in major metropolitan areas, forcing the FCC to consider adding even more UHF space.

512-806 MHz still is claimed by UHF-TV broadcasting, with 806-960 MHz the new land mobile frontier. A few assignments have been made in the large metropolitan areas with varying degrees of success. As costs come down, users will move up.

Conclusion

The radio spectrum is a precious natural resource. A full understanding of its uses will make us all better equipped to understand the struggles which users outside the ham bands face for effective and often vital communications. ■

Be Prepared!

—30 meters for the FT-101B

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Lansing MI 48910

If you were as excited as I was to find out about the new amateur allocations at WARC, you probably wanted to be the first ham on the block to operate the new frequencies. Unfortunately, the 24.890-24.990-MHz and the 18.068-18.168-MHz bands won't be available for five to ten years. However, the 10.100-10.150-MHz 30-meter band probably will be usable in two years or thereabouts.

When I saw 10 MHz, it rang a bell; that is the same as the WWV band on my Yaesu FT-101B! By studying the bandswitch and schematic, you will note that there is a WWV position from front to back on the bandswitch. WWV has its own heterodyne oscillator and crystal, but the receiver front end and driver grid tuned circuits are borrowed from 20 meters to save space and money. The driver plate and final amplifier tuned circuits are left out to prevent transmission on an unauthorized band. By adding separate tuned circuits (i.e., trimmer and capacitor) to the receiver front end and driver grid circuits, adding a new tuned circuit to the driver plate circuit, and rewiring the final amplifier, the FT-101B can be modified to operate on the 30-meter band.

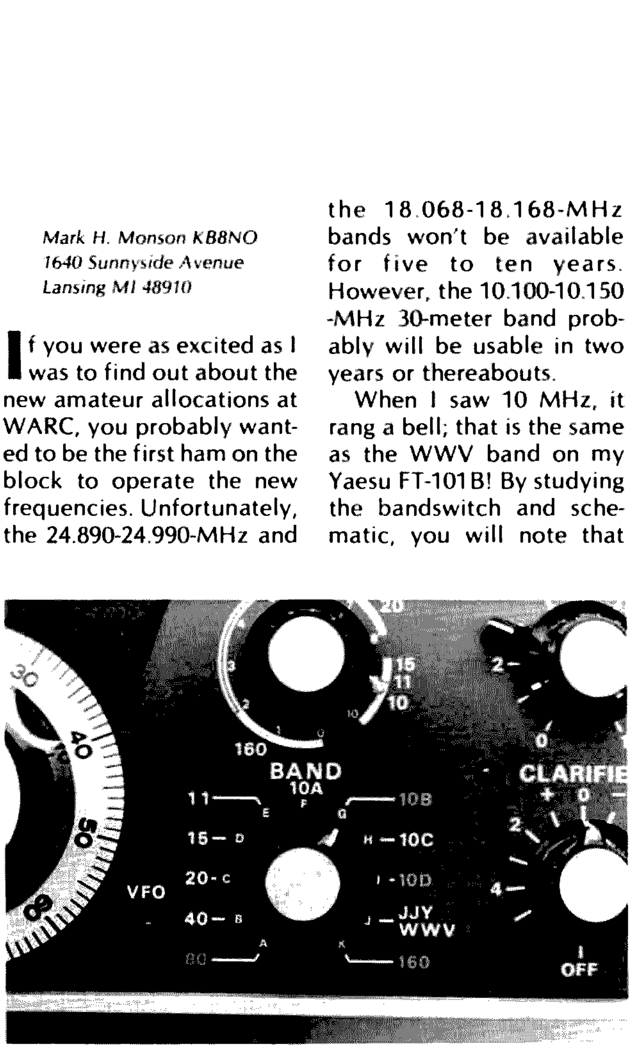

Photo A. The WWV position on the bandswitch is used to cover 10.0 to 10.5 MHz, which includes the 30-meter band. The 11-meter position on the bandswitch can easily be modified to cover 24.0 to 24.5 MHz, which includes the 13-meter band, at a later date. Likewise, the 160-meter position could be sacrificed to cover 18.0 to 18.5 MHz, which includes the 17-meter band.

Fig. 1 is a very important aid in making the modification and locating the bandswitch wafers. All parts were purchased at an average local electronics store at premium prices for about $15.00. The bottom and case must be completely removed first. You should work with the rig on its top with the bottom up for the best view.

TC13′, TC3′, and TC8′ all can be mounted wherever you can find space for them. I mounted them on their respective circuit boards (PB1188, PB1187A, and PB1092) by finding an open spot on the boards and judiciously drilling the appropriate holes. Drill the holes with the rig on its side so borings don't fall into the works. Use the modifier's trick of drilling holes on the edge or through the circuit board foil. When you mount the trimmers, you can then build a solder bridge to the lug of the trimmer for electrical contact and mechanical stability. Be careful not to ding up the existing trimmers.

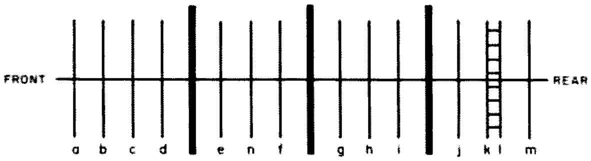

Fig. 1. Bottom view of the S1 wafer physical arrangement.

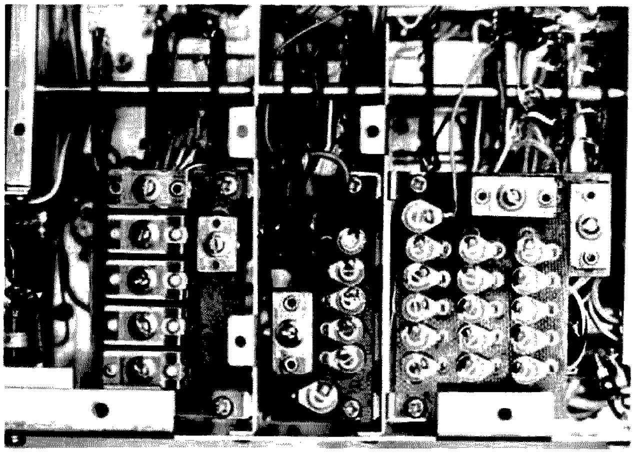

Photo B. Wafers a through i and n, and PB1188, PB1187A, and PB1092 are shown in this photo. Note my positioning of TC13', TC3', and TC8' on their respective boards.

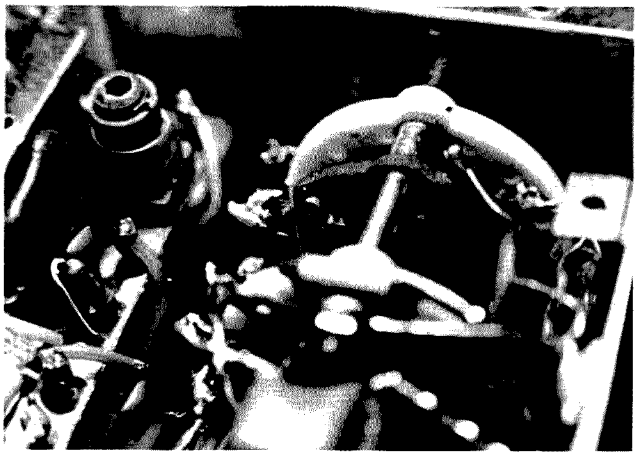

Photo C. Wafers j, k, l, and m are shown in this photo. Note the added tab in the center of the photo on S1l, held in place by the rivet and Super Glue.

Likewise, C43', C6', and C10' all can be mounted under their respective circuit boards.

The receiver front end tuned circuit is separated from 20 meters by removing the jumper between the WWV and 20-meter tabs on S1c. TC13' and C43' are then placed in the circuit by a wire to the WWV tab.

The driver grid tuned circuit is separated from 20 meters by removing the jumper between the 20-meter and WWV tabs from the 20-meter tab *only* on S1e. This is because the WWV tab is very difficult to reach—so lengthen the jumper by soldering on an extra piece of wire and attach this to TC3' and C6'.

The driver plate tuned circuit is not tied to 20 meters and WWV has a blank tab on S1g. Simply solder a wire from the blank tab to TC8' and C10'. This tab is deep, but if you are careful, it can be accessed readily with a soldering gun.

All that is left to do is to modify the final amplifier tuned circuit. This required the most ingenuity. S1l adds extra load capacitance on 160, 80, 40, and 20 meters by ganging the two parts of the load capacitor, VC2, together. 30 meters also should be ganged together, and all that is necessary is to add a jumper from the WWV to the 160-meter tab.

The only problem is that there is no WWV tab! Where the tab should be on the S1l, there is a lonely hole on the wafer board. What you do is make a tab! Go to your junk box and find an old wafer switch. Look for a tab that matches the 160-meter tab. Then break the wafer along the axis of the tab through the rivet hole, freeing the rivet and the tab without damaging them. Then take a good wire cutter and carefully nip the lip off the end of the rivet that was under the wafer until it fits freely through the hole on S1l. Place the tab and the rivet appropriately in the hole and check to make sure that there is good contact when the bandswitch is rotated. Then glue the rivet and tab onto the wafer with Super Glue. Then jump the WWV and 160-meter tabs.

Finally, add a 30-meter tap on the tuned circuit coil and connect it to the WWV tap on S1m. L9, C133, and C136 are temporarily unsoldered from their tabs on S1m and lifted out of the way to facilitate soldering. The 30-meter tap should fall about halfway between the 40- and 20-meter taps (i.e., just below the nut holding the last wafer on the bandswitch).

If you study the coil, you will note that the turns just beside the other taps are bent down into the crack in the ceramic form. You can also do this by placing a small screwdriver over the adjacent turn and tapping the screwdriver with a small block of wood. Then solder the tap to the coil. Make sure you don't leave a solder bridge to the adjacent turns. Then reattach L9, C133, and C136 to their tabs.

Your Yaesu will now be a seven-band rig. All that is necessary is to peak TC13', TC3', and TC8' according to the manual. The preselector should be set around 4. Don't be fooled by the noise in the receiver at about 9 on the preselector. If you try to tune and transmit here, the driver will go into uncontrolled oscillation. Again, make your adjustments at 4 where the receiver will peak to the calibrator signal. Use a dummy load to prevent illegal operation. Performance seems as good as the other bands. I drilled holes in the shield plate over TC13' and TC3' to facilitate tuning. If operation is restricted to Extras, then you have two years to upgrade!

For future reference, the 11-meter band will be easily modifiable to the 24-MHz band. Probably all that will be necessary will be the addition of a different crystal and adjustment of the heterodyne oscillator. To enable the 11-meter transmit section, all that needs to be done is to (1) remove the jumper from the 11-meter tab on S1g that goes to S1h and (2) remove the jumper from the 11-meter tab on S1i that goes to ground.

If you want to get onto the 18-MHz band, remember that the 160-meter band used to be an auxiliary position on the bandswitch. If you can sacrifice the 160-meter band and you understand and have completed the previous modifications, then with appropriate changes and substitutions you can get on 18 MHz also. You now have an eight-band rig! ■

Parts List

TC13' TC3'	79-pF trimmer, 250 volts dc (Sprague "Q line" #QTI-31 or similar)
TC8'	40-pF trimmer, 500 volts dc (Calectro AI-246 or similar)
C43'	50-pF silver mica, 250 volts dc
C6'	68-pF silver mica, 250 volts dc
C10'	68-pF silver mica, 500 volts dc

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Automated Operating Comes of Age

—Microlog's ATR-6800

Back in October of 1978, *73 Magazine* published an article of mine entitled "Triple Threat." It was about a then new CW/RTTY/ASCII system manufactured by the Microlog Corporation. Recently, Microlog introduced a new and very innovative system called the ATR-6800, and that is what we now are going to take a very close look at.

The Microlog ATR-6800 is not the run-of-the-mill CW/RTTY/ASCII system—in fact, there is no other unit available from one manufacturer offering all of the features to be found in the ATR-6800. From the expected CW/RTTY/ASCII modes, the ATR expands the horizons to include full functioning as a "smart" terminal and a stand-alone microcomputer with 4K of onboard RAM. Its price, when all things are considered, is better than competitive.

When I bought my first Microlog system, I was impressed with the attitude of the company, the quality of their equipment, the enhanced operational capabilities of their system over others, and the full one-year warranty. Now that I have the new ATR system, I find that the features and performance of the earlier system(s) were just the tip of the proverbial iceberg! Not only have they maintained their impressive attitude and high quality, but in the ATR-6800 they have produced a product that is just short of being miraculous. As their ad says, "For additional performance specs, just use your imagination. . ." With the addition of a printer and a floppy drive or two, your computing powers are virtually unlimited.

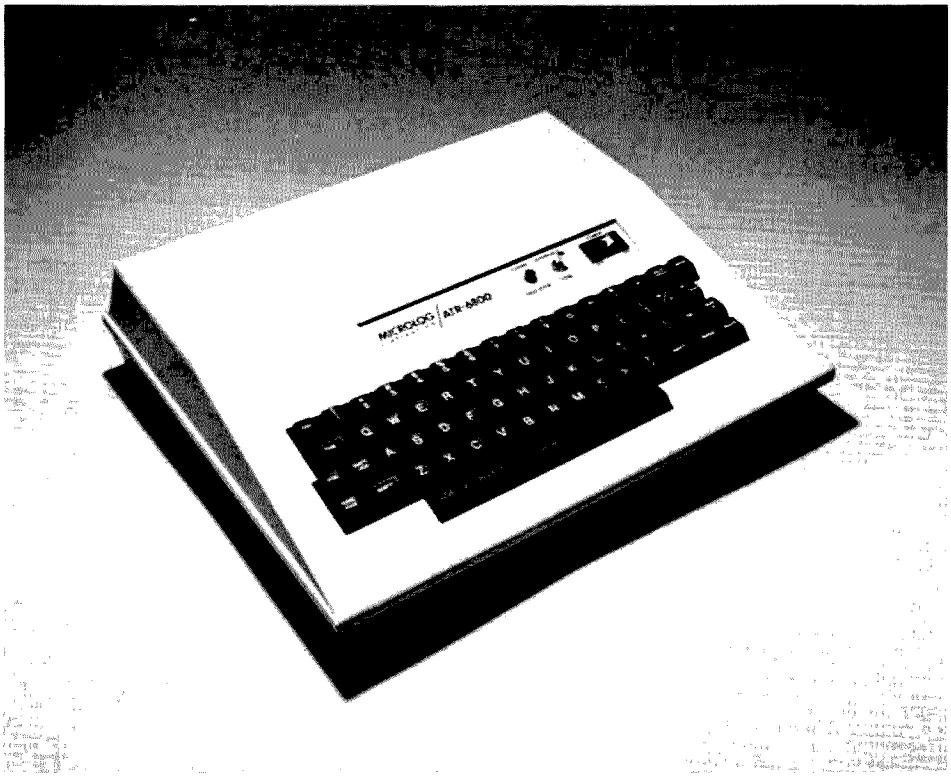


Photo A. The Microlog ATR-6800. On the recessed strip above the keys are (r to l) power switch with integral indicator, reference tone switch, and LED indicator.

The Stage Is Set

Look at this little scenario to gain some insight into the capability of the ATR-6800: You are having breakfast with the family while also trying to work an expected band opening into the South Pacific on 20-meter RTTY. There you are, sitting at the breakfast table casually sipping your coffee while scanning the morning paper and ducking the biscuit fight the kids are having. Suddenly, you hear *beep, beep*—not too loud, of course (after all, you don't want Rover scared out of his wits)—and you stroll into the shack to see that a 3D2 is calling you!

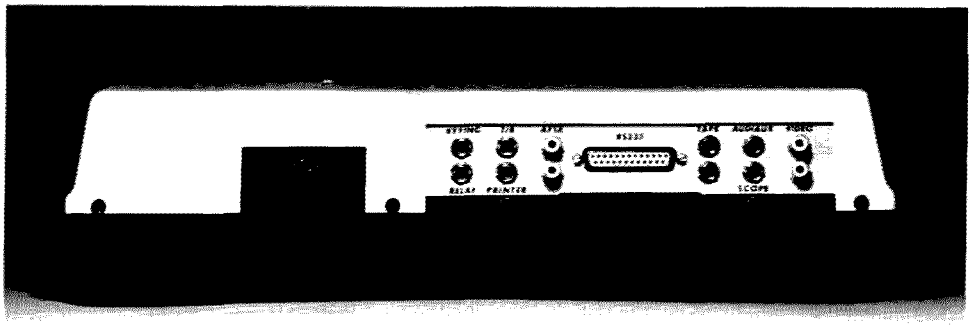
Nonchalantly, you head back to the kitchen, pour

yourself another cup of coffee, and wend your way back to the solitude of your shack. Now settled in properly, you can *continue* your QSO with the 3D2 in complete comfort. Yup! I sure did say *continue*. You see, while you were having that quiet breakfast with the family, your ATR-6800 was hard at work. Having been programmed by you, it was diligently calling CQ every ten minutes, then listening for a return call, and repeating this ritual tirelessly. Finally, when the 3D2 called, the ATR went into high gear. It responded to the 3D2 while also beginning your log entry.

Oh, yes, it took a moment out to trigger an I/O line which set off the little beeper to advise you that your presence was desired in the shack to *continue* the QSO. Now in the shack and comfortable, you see on the monitor that the 3D2 is Henry and that he is on holiday. Now, as soon as the ATR-6800 finishes giving your name, QTH, and the run-down on your shack, you can take over the QSO *live*!

If the foregoing sounds like something from an old Buck Rogers comic strip, let me assure you that it is not science fiction! That was just a sample of what the system is capable of providing.

Another feature (and perhaps a big selling point with the little lady) is that the ATR is also a smart terminal. You can subscribe to a service offered all small-computer users called The Source. As an ATR owner and a subscriber, you open up an incredible new vista to yourself and your family. Through The Source, you can have instant access to such features as classified ads, consumer information, dining-out information, energy saving news and tips, games, home entertainment, a *New York Times* news summary, personal finance guidance, UPI (United Press International) news wire service, educational subjects, and (the ultimate bribe) discount shopping via computer! All this is available via a local number and a nominal charge of $2.75 per hour of on-line time, provided, of course, that you have paid the one-time $100.00 subscriber fee. (For further information on The Source, contact Doug Eddy at The Comm Center, Laurel Plaza, Laurel MD 20810.)



"The ATR Connection"—A look at the business end of the ATR from whence it is possible to interface with the world!

Quality Control—From Beginning to End

With the Microlog factory and engineering facilities so close to my home, I decided to do more checking on the ATR-6800 than I had done while writing about the earlier system. During the course of several trips to the factory, I was to find many reasons for Microlog's acceptance by the ham community. Unlike too many other companies in the amateur radio marketplace, Microlog does *not* hold to a "you bought it, it's your problem now" attitude. While they may not respond overnight to your letters, they do respond and usually by telephone. Their feeling is that while it may be slightly cheaper to respond with a letter, it is not always best. As they explained it to me, a letter may answer a customer's question, but it also may leave him with new or additional questions to be answered. By using the telephone, they feel that they can better assist a customer with his needs and assure final resolution of any problem or question without undue delay.

Production of the ATR-6800 is a closely supervised affair, with intense quality-control inspection throughout. Incoming parts shipments are checked and double checked. Circuit boards are inspected before, during, and after assembly. Keyboard contacts are tri-redundant and fully gold-plated to ensure long-term reliability.

By far the most fascinating part of the production of the ATR is the final test and alignment procedure. After undergoing initial testing and basic alignment, each ATR-6800 is subjected to a full twenty-four-hour "burn-in"; then it is sent for final test and alignment. This, by the way, is a much more positive method than that used by many manufacturers who usually perform a final test and alignment and *then* follow with a burn-in and a last minute function check.

Check procedures include the final alignment of the demodulator to the *geometric* mean for both the high and the low tone groups. Every key of the keyboard is individually tested for both mechanical and electrical operation. A complete functional test is made of all I/O ports. A failure at any point in the checklist results in return of the unit to production with the test cycle begun again from scratch, including another burn-in period.

Now, after all of the preliminary final tests and adjustments have been completed, the ATR under test is connected to a "master" ATR-6800 and to a very special tape via the Tape I/O port, and at this point, *the ATR-6800 begins testing itself*! A very thorough and complete test is conducted of every operation of the ATR, and should any problem crop up, the ATR tells you not only what the problem is, but also where it is located! I had this procedure demonstrated for me by one of Micrologʼs top design engineers, Bob Bugash WA3VPE. Bob let the full test program run on a unit to ensure that in fact it was operating properly, then he removed a RAM chip from one socket and replaced it with a defective chip. After restarting the diagnostic program, it was just a matter of seconds until the ATR-6800 discovered something amiss and stopped the test automatically; it then displayed on the monitor what was wrong and the location of the problem. If only I could figure out a way to get it to do that with my rig!

No Strong Signals From Home

Many fellow RTTY enthusiasts that I have talked

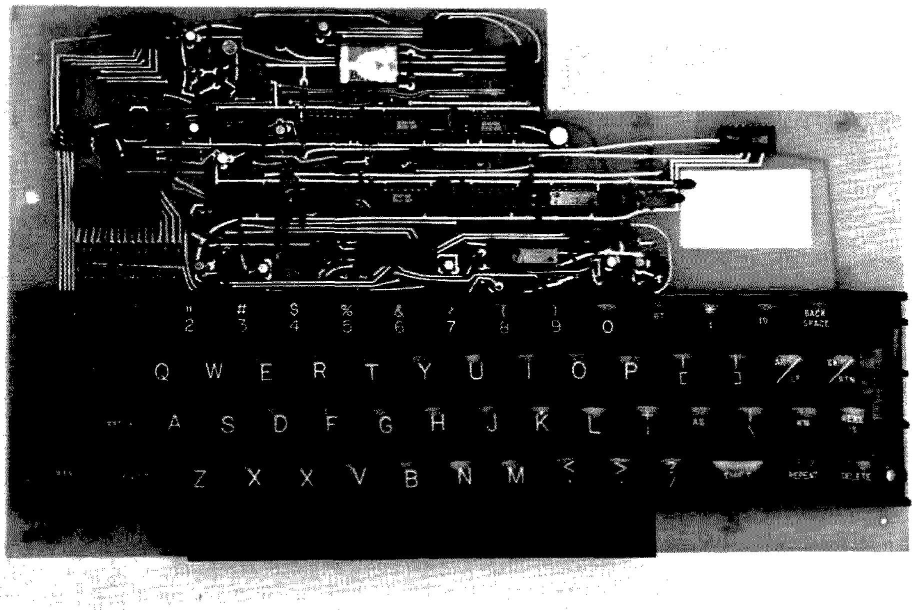


Photo C. A close-up look at the ATR-6800 keyboard and its associated circuitry. All keycaps are double-injection molded and cover four gold-plated, leaf contacts which ensure positive contact on every keystroke. Debouncing of the contacts is ensured via an integral part of the ATR's sophisticated firmware program.

with about the ATR-6800 have asked the same two questions: "But what does it do to your receiver?", and "Yeah, but can it stand being in an rf environment?"

If you have read "Microcomputers and Radio Interference" by Paul E. Cooper N6EY, *QST*, March, 1980, then you have some idea of what a horror story a makeshift, "not-designed-for-that-use" lash-up can create. For those of you who have not read this article, I heartily suggest that you do so, especially if you are contemplating going the route of the corner computer store and mail-order interfacing. I am not by any means knocking the many fine microcomputers on the market, but beware of the fact that these units were *not* designed with amateur radio in mind; they were not designed to operate in an rf environment.

Too many of us have seen what plastic cabinets and profit motives have given us in consumer electronics—RFI, and more RFI—all for the saving of a few bypass capacitors and for a pretty injection-molded cabinet. Microcomputers, some produced by those same folks who keep us busy fighting RFI problems, are produced the same way. If you like the idea of having calibration markers every 10 kHz and really enjoy redesigning and repackaging factory-built equipment, microcomputers are the way to go. If, however, your time is of some value to you and the unknown expenses of redoing someone else's work is unattractive, then it is time to look for a piece of equipment designed for the uses at hand.

Now to those two questions: First, there is no measurable RFI emanating from the ATR-6800 cabinet (not measurable or even detectable with a Drake TR-7). Second, the ATR-6800 has no susceptibility to strong rf fields—at least those which would be encountered in any legally operated shack! The major factor responsible for this is that the ATR is housed in a heavy-duty, heli-arc-welded, aluminum enclosure which provides a fully-shielded cabinet when coupled with the shielded keyboard and the Corcom "brute-force" ac line filter/connector in the ATR-6800. In addition, all sensitive lines are either bypassed or filtered against RFI. So those strong signals from home that are emitted by the average home computer and wreak havoc with your receiver, and the stray rf from your transmitter which causes unplanned program "dumps" on microcomputers, are nonexistent with the ATR-6800.

Meanwhile, Back in the Shack...

I have had the pleasure of giving the ATR-6800 a real shakedown with several of the latest state-of-the-art offerings in ham rigs. Of course, my first on-the-air test had to be with my own TR-7. The first contact was with an old friend, Bill K8TBW. He was amazed that I finally had learned how to type *and* spell. What Bill didn't know was that the ATR and I had him fooled; I was typing with all the speed of both index fingers into the two-kilocharacter buffer, where I was able to see and correct what I was typing *before* it was transmitted. With the incredible buffer and the split-screen feature of the ATR, your response to the other station can begin the moment he asks the first question. More about this later.

The interface with the TR-7 is a little bit more of a pain than it is with the Icom IC-701. This is because Drake did not provide rear-panel access for RTTY interconnections. This results in having to change connectors on the microphone jack every time you want to go from SSB to RTTY or vice versa. You could, of course, build a little mini-box switching arrangement to solve this problem.

With the IC-701, interfacing was a breeze! With two connections (one to the molex® connector and one to the keyjack), the interface is complete.

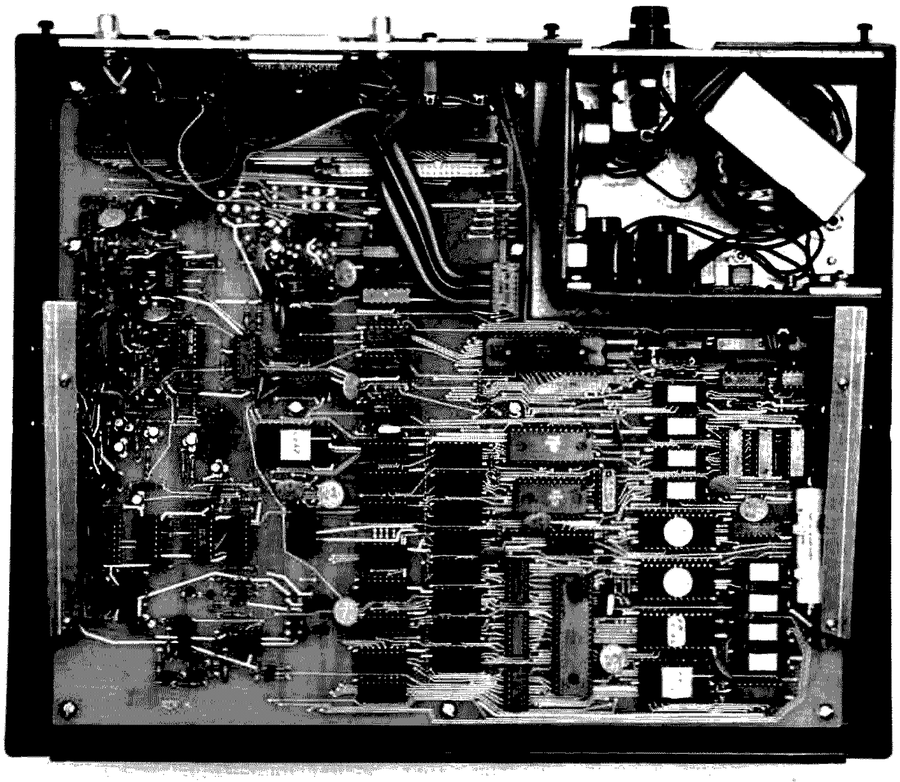
The last rig that I tried was the new Swan Astro 150. The Astro, like the TR-7, is not fully RTTY-oriented; however, at least with a rear-panel audio-input jack, speaker jack, and PTT control, interfacing was reasonably easy.

Ignoring the differences in operating style of the various rigs, there is virtually no detectable difference in performance of the ATR among the several rigs tried, and this includes the use of receiver bandwidths from 500 Hz to 2.7 kHz.

Operating convenience with the ATR-6800 is an understatement! In RTTY operation as well as CW, computer software handles signal conditioning and enhancement, resulting in extremely clean copy. The AFSK generator, which is digitally controlled via the keyboard, has an output that varies only ±3 dBm

from center frequency over the range from 500 Hz to 3 kHz (measured on an H-P 3551 transmission test set). The running buffer will accommodate almost 2,000 characters and this, combined with the variable split-screen feature which allows selection of up to 20 lines of buffer text as well as simultaneous display of received text, eliminates the need for note-taking during a QSO.

Character, word, or line modes of transmission are easily keyboard-selected, with the back-space key allowing error correction prior to transmission. The back-space key also has another unique function when combined with the shift key: It permits continuous loop transmission of whatever has been loaded into the running buffer. This can be a handy feature for making tests and adjustments to equipment. Operating speeds are more than plentiful in each mode, and they also are keyboard-selectable.



The main chassis of the ATR-6800. Partially hidden from view under the ribbon cable, slightly left of top center, is one of the two connector blocks which provide expansion interfacing (the other connector is hidden from view). Near the lower right can be seen what appears to be a large capacitor. This is the battery back-up which is responsible for nonvolatile storage of user-programming.

These are only a few of the many features of the ATR; I will try to cover all of them in a review of the specifications accompanying this article.

On the receive end, the ATR-6800 is no slouch, either. The video monitor (a Sanyo VM-4209, 9-inch unit is supplied with every ATR) displays a T or R indicating either transmit or receive mode, or the word "computer" when in that mode. Along this top line of the display, the operating speed also is indicated (in the case of CW, both the transmitted and the received speeds are displayed), and a real-time, six-digit clock with zone display also is included. There also is room to program the ATR to display your call or any other short message on this top line. Via keyboard command, you may select either white-on-black or black-on-white display, and, for group viewing or for those of you who, like me, don't wear glasses when you should, another keyboard command will allow selection of either standard characters which are 3/16" or "zoom" characters which are 3/8".

Going from your rig to and from the ATR should not pose any major obstacle. As I mentioned earlier, most, if not all, rig deficiencies can be made up for by the simple addition of a switching box. As for the ATR itself, cables are provided for connection to both the monitor and ac mains. In addition, cables also are provided with ATR-compatible connectors already attached to one end. Several extra connectors are provided which mate with the special, high quality, military-style jacks of the ATR. All that you must provide are the mating connectors for your particular rig.

To get on the air right after receiving the ATR-6800 requires the following connections be made to the rig: key line (for CW), PTT line (for T/R switching), microphone line (for AFSK output), and the rig's speaker (to drive the ATR).

During all of the on-the-air tests and in everyday operation, the ATR has performed flawlessly. At one point, I was able to borrow a friend's Alpha 374 amplifier (I never run over 250-Watts input on any mode) to test the immunity of the ATR to high levels of nearby rf. I placed the ATR on top of the amplifier while running the amp at full-bore . . . and, as I had fully expected, the ATR proved to be immune to the effects of stray rf even that close to the source! Even if there were absolutely no leakage from the amplifier itself, my shack is only about 15 feet from one antenna and directly under another.

A rather unusual and also enjoyable feature of the ATR is the freedom of movement that it gives you. For instance, sitting back in the recliner in my shack, I was able to comfortably hold the ATR in my lap and carry on a QSO with the rig about 6 feet away, and with the previously-mentioned zoom display of the moni-

SPECIFICATIONS

Inputs
Audio—800 Hz nominal (CW)
Digital—TTL levels
Electronic keyer
Hand key or bug
AFSK—from rig audio output or other source
RS-232—voltage levels
Outputs
CW—solid-state keying, positive or negative polarity
Mercury-relay keying
AFSK—any tone pair, 500 Hz to 3 kHz
FSK—solid-state transistor switching
RS-232—voltage levels
RTTY loop—isolated mercury relay
RS-232—printer-compatible
TTL—printer-compatible
Codes
Morse—including all punctuation, foreign letters, and special CW signals
Baudot—with auto carriage return/line feed and letters/figures coding user-selectable
ASCII
Random—5-character, alphanumeric groups
Data Rates
Morse—5 to 199 words per minute, in one-word-per-minute increments
Baudot—60, 66, 75, 100, and 132 words per minute
ASCII—110, 300, 600, 1200, 2400, 4800, and 9600 baud
Video Display
40 characters per line (normal), 3/16" high
24 lines per page (normal)
20 characters per line (zoom), 3/8" high
12 lines per page (zoom)
Black on white display
White on black display
Operating Modes
Character
Word (outputs only when spacebar is depressed)
Line (outputs and the end of preset line length)
1,800-character running buffer
Split screen—simultaneous display of input to running buffer and received data
Computer
4K RAM (Random Access Memory)
Built-in monitor for debugging
Built-in monitor for execution of user-developed (M-6802) programs
May be used for user-defined action in response to digital selective calls
Terminal mode—full or half duplex at standard ASCII rates from 300 to 9600 baud with the RS-232 interface
Modem
Mark/space frequencies up to 3 kHz, keyboard-selectable
Crystal-controlled frequency generation
Computer-enhanced demodulation
Dual-tone shift to 850 Hz
Normal or inverted operation
Input bandpass filter provided for 170-Hz shift
Low tone group, nominal frequency—900 Hz
High tone group, nominal frequency—2.2 kHz
Computer-enhanced Morse (correlation detector)
100-Hz active filter for CW, centered at 800 Hz
Tuning Indicator
LED indicator for RTTY and CW tuning and mark/space indication
Scope output—rear-panel connector (RTTY tuning)
Audio reference—800-Hz tone
Audio Tape Interface
Off-the-air recording
Brag tape functions
Computer program storage and preservation
Other Features
Up to 10 independent messages of up to 80 characters may be user-programmed into non-volatile memory
Special ID feature allows user programming of callsign for transmission in the operating mode or autoshift to CW ID when in the RTTY mode
Reception of a WRU (Who aRe yoU) character string will trigger up to a 16-character message which can be user-programmed into non-volatile memory
Up to four separate selective call (SELCAL) character sequences of up to 16 characters each may be user-programmed into non-volatile memory. User may define the specific function of each SELCAL, such as activating relay contacts, etc.
Keyboard-selectable automatic unshift-on-space
Keyboard-selectable automatic carriage return/line feed
Internal 24-hour clock, synchronized to ac line frequency, displayed in the upper right-hand corner of the monitor, including time zone
Keyboard command allows insertion of the time into the transmission
24 independent I/O lines (TTL) are available for user-defined functions
ROM-based test messages—RYRYRY in Baudot; U*U*U* in ASCII; and VVVVVV in CW
ROM-based "Quick brown fox . . ." test message
Full keyboard control of transmit/receive switching
Keyboard-controlled status command displays all system operating parameters on the monitor
Keyboard selection of printer mode and speed, both ASCII and Baudot, for hard-copy output of *all* received data
Solid State Components
82 integrated circuits
24 Transistors
50 Diodes
6 Other solid-state devices

tor there was no need to move it away from the rig. All this is possible because all transmit/receive switching is controlled by the ATR. For seriously disabled of bedridden hams, this capability may well enable them to expand their horizons and add a little more variety to their operating.

As I stated in my earlier article, neither this system nor any other is intended to replace the human brain for copying CW. The ATR can cope with human inconsistencies only to a limited degree. It will copy exactly what is being received; if someone is sending "—. —. — — .—" and intends this to be a CQ, don't be surprised if the ATR doesn't exactly see it that way. It will read out "NN MA," which *is* what was sent even though that was not what was intended. As for the guys who are so ashamed of their calls that they send them 30 times faster than they send anything else, the ATR can't copy them either.

All that the ATR does, it does very well. If you want to perfect your fist, the ATR will be quite accommodating; merely plug your hand key into your rig and, using the sidetone, you can key the ATR. Please remember to do this either into a dummy load or with the rig out of the transmit position! (By the way, the ATR is also a great aid for setting up a bug properly, as it will search for the correct dot/dash ratio, thus enabling you to properly set the weighting and spacing of the bug.)

I would be one of the last to advocate the demise of CW, but there are a few "left-footed fists" out there that would certainly benefit from the use of the ATR-6800 on CW. The very light touch of the ATR's keyboard may also make it less painful for those afflicted with arthritis to continue using the time-honored mode of CW. And, while on the subject of CW, the ATR-6800 also can be used to improve copying ability, as it has a random code key which can generate code groups (random alphanumerics) from 5 to 199 wpm. For the ham who wants to improve himself or provide a service to others, this feature is hard to beat.

No Hidden Expenses

With the ATR-6800 there are no hidden expenses for added extras that other systems must have before they can *really* be put on the air. The folks at Microlog are not infallible, however. They did goof very early on with the very first decoder, the AVR-1. Due to the design, this unit was not readily adaptable to new features that followed. This was corrected after a very few units had been manufactured.

The AVR-1 was replaced by the AVR-2, which opened the door to the concept of the ATR-6800. The ATR-6800 is a cornerstone, and while it requires no additional "hidden" extras, this is not to say that it has

no future. Quite the opposite is true. According to the folks at Microlog, the ATR is intended to be the heart of a limitless system. By the time you read this, a special program for generating SSTV graphics may be available.

On the ATR-6800, the RTTY terminal unit is built right and is fully controllable from the keyboard, even to the selection of shift frequency groups. In other systems, the absence of this feature can add anywhere from about $300 to well over $1,000 to the final cost. For CW reception, a rig with a CW filter would produce slightly improved reception, but it is not absolutely necessary, for the ATR is able to copy even weak signals quite well.

With the ATR-6800, all you need to do to get on the air is unpack it, provide two ac outlets (one for the monitor and one for the ATR), spend a few minutes with your soldering iron installing the connectors for your rig, and apply the power. (However, I would strongly recommend that you spend a little time with the instruction manual before actually jumping in with both feet and going on the air!)

During my visits to Microlog, I spent quite a bit of time with Joe Lynn N3JL, president of the company. Joe and I discussed the overall concept of the ATR and some of the philosophy behind the design. With rigs constantly being downsized yet packed with more and more features (such as the IC-701), it was only natural for Microlog to take this concept into the terminal field. Another very important consideration, according to Joe was to design and produce a unit that would be *expandable* rather than replaceable. Since, as he says, "We have no intention of stopping our research," they also wanted a unit that would not present the average ham with an expensive piece of equipment that would be outdated in a few years.

The ATR-6800 seems to fill these requirements and much more as well. It is a piece of gear that is both complete as well as expandable, and is compact to the point of "briefcase" portability, which should be of interest to the traveling ham, vacationer, and DXpeditioner. Oh, yes, the ATR can be ordered for use in foreign countries with ac mains different from those here in the United States.

On The Technical Side

A word of warning this section is by no means complete in terms of details, nor is it the story of all of the capabilities of the ATR, since those are almost without limit.

The only functions of the ATR that are not controlled by keyboard commands are: turning power on and off to the ATR and to the video monitor, and turning the audio reference tone on and off. Virtually everything else is controlled either automatically or by keyboard-input commands. Basically, there are three sets of controls. There are primary controls which require only one keystroke to accomplish. There are those major functions which require access via the use of the control key and another key. Finally, there are secondary commands which also require the use of two keystrokes.

The computer functions of the ATR are directly compatible with standard audio tape recorders through the tape I/O port on the rear panel of the ATR. In this computer mode, the ATR-6800 is a stand-alone Motorola 6800 microprocessor-based microcomputer with 4K of user-accessible, on-board RAM. Expansion of the computing capabilities of the ATR is made both feasible and accessible between the combination of the RS-232 rear-panel port and a special opening on the rear connector panel intended to accommodate two ribbon cables to be attached to internal connectors which will permit full expansion interfacing of the ATR.

Look at the specifications. You can see that this little (14.75" X 12.25" X 4") package packs a lot of wallop! It probably is the most versatile 10-pound package ever offered to amateur radio operators. Both units come well packed and are shipped via United Parcel Service in the United States. Foreign shipments are sent via the best available method.

The one-year warranty should also be pleasing to those of us who have grown weary of manufacturers claiming to have the best products while willing to guarantee them for only 60 to 90 days. The entire system, consisting of the ATR-6800 and its companion Sanyo VM-4209 video monitor, with all necessary cabling, is $1,995.

Those of you who would like further information or assistance should write Charlie Talbot K3ICH at Microlog Corporation, 4 Professional Drive, Gaithersburg MD 20760, or call him at (301)-948-5307. Charlie is in charge of amateur sales and customer service. Also, remember to tell him that you read about the ATR in *73*!

One final comment. In answer to the many inquiries after my last article, I am in no way connected with Microlog, other than being a very satisfied customer who is willing to praise a product, a company, and its people when they deserve it. ■

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New Weather Eye in the Sky

—a primer on NOAA's TIROS

Fig. 1. An NOAA 6 visible light picture recorded during orbit #567 on 6 August 1979. Hudson and James Bays show to the north (top) of the picture, while almost all the Great Lakes are visible in the center of the display.

Over the past few years, the amateur weather satellite community has been concentrating on the GOES geostationary weather satellites.[1] In part, this has been due to the technical challenge of setting up receiving gear on the 1691-MHz GOES S-band frequency, coupled with the declining performance of the last of the US ITOS/NOAA satellites in polar orbit (NOAA 5).

Technical challenge aside, the GOES spacecraft do have a number of factors in their favor including fixed antenna bearings (no tracking), predictable signal levels, and scheduled image transmissions. Of course, the S-band converter and antenna do increase the cost of the ground station as compared to the relatively simple VHF receiving requirements for polar-orbiting spacecraft.

A number of other developments, including omnidirectional receiving antennas that can eliminate the need for tracking in many polar-orbiting installations[2] and the increasing use of

Minutes After Crossing	Subpoint Latitude	Subpoint Longitude
0	0	0
1	3.5	.8
2	7	1.6
3	10.5	2.4
4	14	3.2
5	17.4	4
6	20.9	4.9
7	24.4	5.7
8	27.9	6.6
9	31.4	7.6
10	34.3	8.6
11	38.3	9.7
12	41.8	10.9
13	45.2	12.1
14	48.6	13.5
15	52.1	15.1
16	55.5	16.9
17	58.9	18.9
18	62.2	21.4
19	65.5	24.4
20	68.8	28.2
21	71.9	33.2
22	74.9	40.1
23	77.6	50
24	79.8	64.5
25	81.1	84.7
26	81.1	108
27	79.8	128.2
28	77.6	142.7
29	74.9	152.6
30	71.9	159.5
31	68.8	164.5
32	65.5	168.3
33	62.2	171.4
34	58.9	173.8
35	55.5	175.9
36	52.1	177.9
37	48.6	179.2
38	45.2	180.6
39	41.8	181.9
40	38.3	183.1
41	34.8	184.1
42	31.8	185.1
43	27.9	186.1
44	24.4	187
45	20.9	187.9
46	17.4	188.7
47	14	189.6
48	10.5	190.4
49	7	191.2
50	3.5	192
51	0	192.8

Table 1(a). Satellite subpoint data for the Northern-Hemisphere half of the reference orbit based on a nominal period of 102 minutes. Note: These data replace Table 1, reference 3, and Table 2 in reference 4 (Ch. 6).

Minutes After Crossing	Subpoint Latitude	Subpoint Longitude
52	−3.5	193.5
53	−7	194.3
54	−10.5	195.1
55	−14	195.9
56	−17.5	196.8
57	−20.9	197.6
58	−24.4	198.5
59	−27.9	199.4
60	−31.4	200.4
61	−34.8	201.4
62	−38.3	202.4
63	−41.8	203.6
64	−45.2	204.9
65	−48.6	206.3
66	−52.1	207.8
67	−55.5	209.6
68	−58.9	211.7
69	−62.2	214.1
70	−65.5	217.2
71	−68.8	221
72	−71.9	226
73	−74.9	232.9
74	−77.6	242.8
75	−79.8	257.3
76	−91.1	277.5
77	−81.1	300.8
78	−79.8	321
79	−77.6	335.5
80	−74.9	345.4
81	−71.9	352.3
82	−68.8	357.3
83	−65.5	1.1
84	−62.2	4.1
85	−58.9	6.6
86	−55.5	8.6
87	−52.1	10.4
88	−48.6	12
89	−45.2	13.4
90	−41.8	14.6
91	−38.3	15.8
92	−34.8	16.9
93	−31.4	17.9
94	−27.9	18.9
95	−24.4	19.8
96	−20.9	20.6
97	−17.4	21.5
98	−14	22.3
99	−10.5	23.1
100	−7	23.9
101	−3.5	24.7
102	0	25.5

Table 1(b). Satellite subpoint data for the Southern-Hemisphere half of the reference orbit, again based on a period of 102 minutes. Note: These data replace Table 1 in reference 3 and Table 2 in reference 4 (Ch. 6).

microcomputers to ease the burden of orbital and antenna tracking calculations,[8] have made polar-orbiting spacecraft a more attractive proposition than was the case only a few years ago, so it was with some interest that the weather satellite community awaited the launch of the first of a new series of TIROS weather satellites. The prototype spacecraft went up in October of 1978 (TIROS N), followed in June of 1979 by the second operational spacecraft in the series (NOAA) 6). Most of the promises of improved polar-orbit service have been borne out in our early experience with these new spacecraft, and it will be the purpose of this article to acquaint you with some of the details of the new TIROS/NOAA system so that you can get in on the fun!

Orbital Characteristics

The older ESSA and ITOS/NOAA polar orbiters operated in near polar orbits at altitudes of approximately 1400 km. The orbits were such as to yield daylight passes in the morning hours and night-side passes in the early evening. In order to get improved resolution in the new TIROS series, they are placed in lower orbits—approximately 825 km, with periods of about 102 minutes instead of the nominal 115 minutes characteristic of ESSA and the early NOAA (NOAA 2-NOAA 5) spacecraft. The 115-minute orbital data could be used with techniques specifically tailored for weather satellite work [3,4] or the various OSCAR tracking articles and devices could be used. The latter approach was made possible by the fact that the OSCAR satellites were launched piggyback with NOAA spacecraft and thus had essentially identical orbits.

The 102-minute orbits of TIROS call for new tracking data although you can still use the tracking techniques cited above. The new data you will need are a reference orbital track (provided in Table 1) and the data for plotting antenna elevation circles around your location (provided in Table 2). If you replace the original 115-minute orbital data with the material from the new tables, you can proceed with tracking as before. TIROS equatorial crossing data are included in the W1AW bulletins, so you should be able to keep up with the new birds just as you did the older ones. The primary effects of the new orbits on station opera-

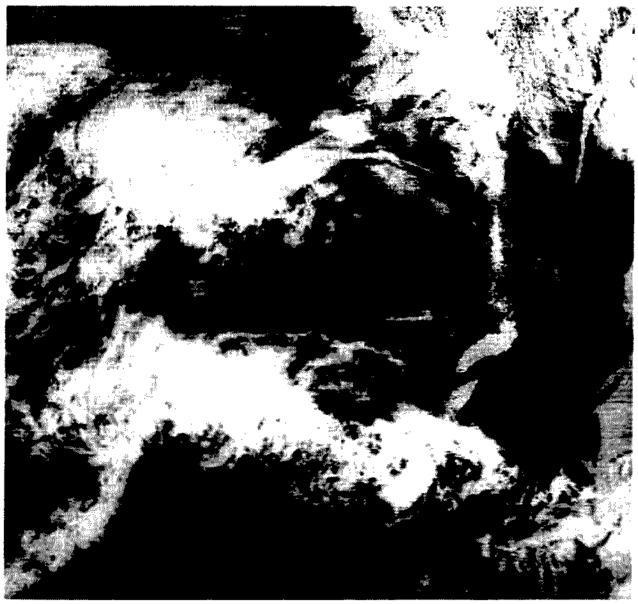

Fig. 2. An NOAA 6 pass (orbit #610) on 9 August 1979. Water in the eastern U.S. and Canada is highlighted due to sun glint, making the eastern seacoast highly visible along the right edge of the picture. Interior lakes and large rivers also are visible, including the Finger Lakes in upper New York.

Fig. 3. Another NOAA 6 pass showing a major storm system centered in the northeastern States. The coastline from Chesapeake Bay south through the Carolinas also is visible.

tions are threefold:

1. Passes are shorter. Instead of the 20+ minutes for a NOAA 2-5 overhead pass, you will get about 14 minutes of coverage from the new satellites.

2. The spacecraft come across much faster as a result of the shorter pass length and thus you have to pay more attention to tracking than you did with the older satellites. For this reason, data in Table 1 are provided at one-minute intervals instead of the two minutes employed in the earlier tables.

3. Reduced geographic coverage. The older NOAA spacecraft would produce a strip of picture coverage extending from central Greenland to Yucatan with an overhead pass over the east coast. The new TIROS satellites will produce useful pictures from central Hudson Bay to the central Gulf of Mexico.

Although one may look at the reduced coverage as a disadvantage, most operators feel that you get ample compensation by the contribution of the lower altitude to increased picture resolution.

Another major improvement, inaugurated when both TIROS N and NOAA 6 became operational, was the fact that the TIROS polar-orbit system is designed to have two fully operational spacecraft in orbit at any time. One of the spacecraft (currently NOAA 6) provides early morning visible light and IR (infrared) coverage, followed by IR coverage in the early evening hours. The second spacecraft (currently TIROS N) provides early afternoon visible and IR imagery, followed by IR coverage in the early morning hours.

Orbital decay is a factor in TIROS orbits that could effectively be ignored with the older ESSA and NOAA spacecraft at 1400 km. The TIROS spacecraft, at an orbital altitude of about 825 km, experiences significant atmospheric drag, which has the effect of slowing the spacecraft. This causes it to drop slightly with each orbit, and thus the period decreases by a measurable amount with each orbit. Most microcomputer programs that carry out orbital calculations over a period of several weeks or more incorporate a decay factor that is subtracted from the period for each orbit of the Earth. Computing a decay factor is quite complicated, but WA7MOV, working from ground track corrections determined from spacecraft imagery, has arrived at a factor of 1.7873×10^{-5} minutes/orbit. While not precise, this factor will result in long-term predictions of greater accuracy than if no correction is applied. If you are working from crossing data only a few days old, you can pretty much ignore decay correction.

Rf Characteristics

Rf characteristics of the TIROS/NOAA system are covered in Table 3. The operating frequencies for the older polar-orbiting spacecraft were 137.5 and 137.62 MHz. The 137.5 frequency was the primary operating frequency for the NOAA 2-5 spacecraft, with 137.62 being used as a backup in case of conflicting passes. In the present system, both frequencies can be expected to see equal use, so a two-channel system is recommended. At present, the "morning" spacecraft (NOAA 6) uses 137.5 while the "afternoon" spacecraft (TIROS N) uses 137.62. Some juggling of these two frequencies is to be expected every time a new spacecraft is launched and checked out prior to the deactivation of the previous operational satellite.

Antenna Elevation (Degrees)	Great-circle Radius (Degrees)
90	0
80	1.2
70	2.4
60	3.8
50	5.4
40	7.5
30	10.2
20	14.0
10	19.7
0	28.1

Table 2. Great Circle arc radius (in degrees) corresponding to antenna elevation angles. Because of the crowding in the center of the overlay, you may want to put in the circles for elevation angles of 0-60 degrees, leaving out 70 and 80 degrees. The point marking the station location corresponds to 90 degrees. Note: These data replace Table 2 in reference 3 and Table 3 in reference 4.

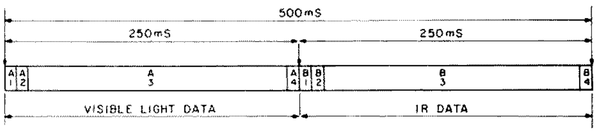

Fig. 4. TIROS/NOAA video line format.
Channel A (normally visible light data.)
A1—Sync pulse (9.37 ms); 7 cycles of 1040-Hz square-wave modulation.
A2—Pre-Earth space scan and minute markers (11.30 ms); normally black.
A3—Channel A Earth scan (218.50 ms).
A4—Telemetry data (10.82 ms).
Channel B (normally infrared data.)
B1—Sync pulse (9.37 ms); 7 cycles of 832-Hz square-wave modulation.
B2—Pre-Earth space scan and minute markers (11.30 ms); normally white.
B3—Channel B Earth scan.
B4—Telemetry data (10.82 ms).

Ground Signal Levels

The power output of the TIROS/NOAA spacecraft is roughly equivalent to that (about 5 W) of the older polar orbiters, but significant increases in ground signal level—an increase of 3-6 dB—can be expected due to reduced path loss brought about by the lower altitude. This prediction appears to be consistent with actual ground signal levels.

Antenna Factors

The older polar-orbiting spacecraft employed antennas radiating a linearly polarized signal. Since the attitude of the spacecraft relative to the ground antenna shifts during a pass, it was necessary to use a circularly polarized antenna. The two most common antenna types used for reception were the helix and the crossed yagi beam.[4] My omnidirectional "Satellite Zapper" was also designed for circular polarization.

The TIROS/NOAA spacecraft now use a quadrifilar helix as the transmitting antenna, producing a radiated signal with right-hand circular polarization. It should thus be possible to use a linearly polarized ground station antenna (simple dipole, conventional yagi, etc.) with a worst-case drop of 3 dB compared to the use of an antenna of the same gain with matched circular polarization. Unfortunately, my observations indicate that this is not the case. Linear antennas seem to produce deep fades characteristic of the polarization mismatches noted with the use of linear antennas with the older NOAA spacecraft. Optimum results appear to be obtained with the use of circular polarization at the ground station antenna. You should therefore continue to use your existing polar-orbit antenna array, or plan to build a circularly polarized system if you are just getting started.

Receiver Bandwidth Requirements

With the older NOAA spacecraft, most stations employed a receiver with a 30-kHz bandwidth set by a crystal filter in the 10.7-MHz i-f portion of the receiver.[4, 5] Such a filter would neatly accommodate the ±9 kHz of Doppler shift. The new spacecraft employ ±17-kHz deviation so that modulation alone would require at least 34 kHz of i-f bandwidth. If an allowance is made for Doppler and other sources of frequency error, you end up with a recommended bandwidth of 50 kHz.[6] This is a most inconvenient value!

Standard crystal filters are readily available for 30 kHz, but the more complex filters required for 50 kHz must be custom-built and are quite expensive. Two alternatives exist. The first, which I have successfully employed, is to stay with the 30-kHz i-f filter. There are a number of factors which make this approach possible.

First, the simple and inexpensive crystal filters which are plug-in replacements for the standard 15-kHz units used in many wired-and-tested and kit receivers have a relatively mild roll-off at the edge of the nominal passband, providing useful response out somewhat beyond ±15 kHz.

Second, satellite video excursions rarely approach the deviation limits with visible light data, although they do so in the case of IR data. If you have a good strong signal, you can usually punch through the 30-kHz filter with only minor effects on the dynamic range of white level data. The biggest problems will be at low signal levels (close to the horizon) with maximum Doppler shift. In such cases, you probably will squelch out on white level peaks with the IR data although visible light data should still be obtainable.

Several cautions are required, however. The first is to use a relatively inexpensive—and hence sloppy—30-kHz filter. A good multipole filter will have sharp shoulders on the passband and you will have problems. Second, if your receiver is a double-conversion unit in which the 10.7-MHz i-f is converted to 455 kHz, watch the tuning of the 455 stages. If you align the receiver for maximum gain, you will probably have a tighter system due to 455-kHz Q. The 455 stages should always be stagger-tuned to minimize their contribution to system bandwidth, even if this results in lower i-f gain.

If you want a receiver with sufficient bandwidth to avoid any of these problems, there probably is no simple off-the-shelf solution; you may have to build your own. The best approach would be to ignore the conventional 10.7-to-455 i-f approach and use a 4.5-MHz i-f. This is relatively easy due to the large selection of i-f components designed for TV sound systems. If you use enough tuned stages at 4.5 MHz, you ought to be able to attain a 50-kHz bandwidth with careful tuning. With a given front-end design, you will lose something in terms of signal-to-noise ratio, but usually there is enough signal available to handle the tradeoff.

Such a receiver would have one drawback, however. Most satellite opera-

Frequency:	137.5 and 137.62 MHz ($\pm 2 \times 10^{-5}$)
Transmitter Power:	5.5 Watts (5 Watts end-of-life)
Antenna:	Type—quadrifilar helix Gain—From +3.7 dBi (nadir) to −0.3 dBi (horizon) Polarization—right circular Transmitter-Antenna Losses—2.1 dB
Modulation:	Type—analog FM Modulation Index—17 ±0.85 kHz (peak) Subcarrier Frequency—2400 Hz Subcarrier Modulation—92% AM Baseband Video Bandwidth—1600 Hz

Table 3. TIROS/NOAA rf characteristics.

	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
Spectral Range (μm)	0.55-0.90	0.725-1.0	3.55-3.93	10.5-11.5	11.5-12.5
Detector	Silicon	Silicon	Indium Antimonide	Mercury Cadmium Telluride	Mercury Cadmium Telluride
Resolution	1.1 km	1.1 km	1.1 km	1.1 km	1.1 km

Fig. 5. TIROS AVHRR image sensor channels. The TIROS/NOAA imaging system is designed as a five-channel instrument with two channels in the visible light range (1 and 2) and three channels in the infrared ranges (3,4, and 5). The early spacecraft in the series will have only channels 1-4, with the channel 5 slot filled with a repeat of the channel 1 data. On the high resolution S-band frequency, all channel data are transmitted at full 1.1 km resolution (the instantaneous field of view directly below the spacecraft). The APT data link on VHF can handle any two of these channels at reduced resolution (4 km). Normally, APT Channel A will carry either channel 1 or 2 data while Channel B will carry data from IR channels 3 or 4.

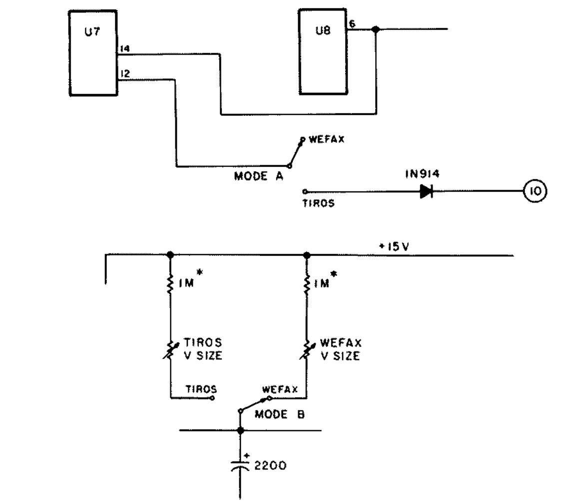

Fig. 6. Modifications to the WB8DQT GOES monitor to provide switch selection of either TIROS or GOES image display.

tors like to use the VHF satellite receiver as an i-f in conjunction with a suitable S-band downconverter for reception of GOES signals at 1691 MHz. In the case of a 50-kHz i-f bandwidth, the S/N loss with the GOES signal may be prohibitive with small antenna systems (3- to 4-foot parabolic antennas). Unless you want to run two different VHF receivers—not a bad idea if you can spare the bucks—I would recommend the "sloppy 30" approach as being the best compromise between TIROS/NOAA and GOES receiver requirements.

As an editorial comment, I think that the decision to go with the wider deviation for TIROS/NOAA was a bad call. Extensive experience with the old ESSA polar orbiters (±9-kHz deviation) and the superb pictures from the Soviet METEOR satellites (±10-kHz deviation) would indicate that we probably would have had no observable drop in resolution with a ±10-kHz system, and receiver compatibility would have been preserved!

Video Modulation

The TIROS/NOAA spacecraft retain the same basic video modulation system that has served well in all previous polar orbiters and in the GOES WEFAX format. Basically, the video information is transmitted via amplitude modulation of a 2400-Hz audio subcarrier. Minimum subcarrier modulation (4%) represents black, maximum subcarrier level (90+%) represents white, and intermediate gray-scale values are transmitted as intermediate subcarrier levels. As in previous spacecraft, white in the IR channel represents cold objects while black represents warm objects. No changes in display equipment are required to accommodate this modulation format.

Video Format

Like the older NOAA polar orbiters, the TIROS/NOAA data format included both visible light and infrared (IR) data. In the older designs, two separate scanning radiometers were used to generate data. One was a very high-resolution instrument that generated both visible and IR data for real-time S-band transmission (wide bandwidth modulation), while the second generated the low-resolution IR and visible light data for transmission at VHF. The new spacecraft have gone to a single high-resolution instrument for all data—the Advanced Very High Resolution Radiometer, or AVHRR. The high-resolution data are transmitted directly on S-band and the data are selectively sampled via on-board microcomputer hardware for transmission at lower resolution on the VHF frequencies. The sampling process follows an algorithm designed to eliminate almost entirely the panoramic distortion that was characteristic of NOAA 2-5 scanning radiometer data, producing images that look very much like the much-prized pictures from the old ESSA spacecraft.

Figs. 1-3 show some representative visible light output from NOAA 6. The AVHRR instrument scans at 360 rpm with the VHF data formatted for 120 line-per-minute transmission. The first half of each line (channel A) consists of visible light data, while the second half (channel B) carries IR scan data (Fig. 4). The most effective way to display the pictures is to use a 240 line/minute display, producing alternate lines of visible and IR data. One or the other set of data lines can be selectively blanked so that only visible light or IR data are shown.

The Earth scan data are split into five bandwidth (light) windows using a beam splitter and filters and then passed on to five separate detectors (Fig. 5). Two of these—channels 1 and 2—are visible light sensors, while the other three cover various IR windows. Ground command determines which sensor is on-line for generating the visible light data in channel A and the IR data for channel B. One of the visible light sensors is quite good at discriminating fine cloud structure, but relatively poor in terms of differentiating land-water boundaries. The other performs somewhat less well on cloud features, but yields a beautiful distinction in picking out geographic features. The fact that the CDA control station may switch from one sensor to the other, coupled with daily and seasonal light variations, explains why it is possible to see a beautiful coastline one day and miss it the next!

Picture Display

The simplest approach to picture display is to handle the signal in a 240 line/minute (4 line/second) format with provisions to blank the unwanted data lines (IR or visible). The approach is particularly attractive in that this is the line rate used for GOES WEFAX transmission on S-band, and, if we handle things right, we can get double the mileage from our display system.

Let's look first at CRT displays, as they are the easiest to modify. Conceptually, we want to provide a sync divider/trigger circuit that will give us the proper 4-Hz trigger rate while providing a means to blank the unwanted data lines. Two examples from my previously published circuits will show one approach to doing this and should set you on the right track if you are working with another circuit. The video monitor described in chapter IV of the *Weather Satellite Handbook* has been widely duplicated and is easy to modify for TIROS/NOAA display. Most of the relevant circuits are shown in Figures 4.1 on page 23 and 4.2 on page 24.

1. Remove the connection between pin 9 of IC8 and the SR lug on S3A.
2. Connect a jumper between the SR and APT lugs of S3A.
3. Remove R2 from the circuit board and connect a jumper from the SR to the APT lugs on S3C.

4. Switch S3 (mode) to SR and adjust R4 for a vertical sweep time of 400 seconds.

This completes the required changes. GOES WEFAX images are copied in the APT mode position, while TIROS/NOAA pictures can be displayed in the SR position. The PHASE switch is used to properly align either the visible light or IR data when displaying TIROS/NOAA imagery.

The solid-state monitor for GOES picture display is another easy conversion.[7] Four new components, a 1-meg fixed resistor, a 1-meg pc pot, any general-purpose silicon diode, and a DPDT toggle switch (for MODE selection), will be required. The changes are summarized in Fig. 6:

1. Connect a jumper between pin 6 of U8 and pin 14 of U7 on the main circuit board.
2. Connect a wire from pin 12 of U7 and the common lug on one set of contacts on the new mode switch. Solder the cathode of the diode to lug 10 on the main circuit board and connect a wire from the anode to the TIROS lug on the same side of the switch where you wired into the common lug.
3. Make the following connections to the remaining set of lugs on the MODE switch:
   (A)Break the connection between the vertical deflection amplifier. Connect the amplifier input bus to the common lug of the switch.
   (B) Connect the old size pot to the WEFAX lug of the mode switch.
   (C) Take the new size pot and connect one side and the wiper to the TIROS lug of the switch. Connect the other side of the pot to the +15-V bus through a 1-meg resistor

The original size pot is now your WEFAX size pot and should be properly set already. The new pot will be your TIROS vertical size pot. Set the mode switch to TIROS and adjust the pot for a 400-second vertical sweep. You now can switch select for either GOES WEFAX or TIROS.

If you would like to build the monitor just for TIROS display, the job is even simpler. In this case, you will not need a mode switch and you would proceed as follows:

1. Install the jumper between pin 6 of U8 and pin 14 of U7.
2. Solder the anode of the diode to pin 12 of U7 and connect the cathode to pin 10 of the main board connector strip.
3. Adjust the vertical size pot on the main board for a 400-second vertical sweep.
4. Adjust the horizontal size pot as described.

The amount of work required to modify a facsimile machine depends upon a variety of factors, including the line and feed rates for which the machine was designed and whether or not you want the capability for IR display as well as visible light data. Any machine that will handle GOES WEFAX display will do a job of sorts with TIROS visible data during daylight passes.

An example of one such machine is a direct printing recorder for GOES pictures. Minimal requirements include some means to check the phasing of the TIROS/NOAA signal, as the WEFAX automatic phasing circuits will not operate properly with the TIROS video format. The simplest means of phasing is the use of a triggered oscilloscope as a phasing indicator. Connections should be made as follows:

1. Connect a lead from board connector K to a new phono jack (TRIGGER) on the rear apron of the FAX control unit. Use a shielded lead to connect the TRIGGER jack to the trigger input of the oscilloscope.
2. Connect a lead from board lug E to another new phono jack (VIDEO) on the rear apron of the control unit. Use a shielded lead to connect the VIDEO jack to the vertical input of the oscilloscope.

Fig. 7. An NOAA pass displayed on the WB8DQT direct-printing GOES facsimile recorder without changing the 40-rpm carriage drive motor. Note the vertical "stretching" of the display. The use of a 20-rpm motor will provide the proper aspect ratio with this machine (see Fig. 1).

Start the drum of the FAX machine and verify that the oscilloscope is being triggered by the drum. The horizontal sweep frequency should be set to about 4 Hz for optimum results. With a TIROS signal at the FAX input, adjust the scope vertical gain for a usable display of the video waveform. The 832- or 1040-Hz square-wave modulation of the sync pulses will be evident if you study the display on the scope. Press the FAX PHASE switch and hold it until either sync waveform is lined up with the origin (left edge) of the scope trace. At this point, release the PHASE switch and switch the RESET/PRINT switch to print.

What you will get is a picture with the characteristics of Fig. 7. It probably will be low in contrast and may look about right unless you compare Fig. 7 with Fig. 1 — both are taken from the same TIROS (actually NOAA 6) pass. If you compare the two, you will note that the Great Lakes appear stretched vertically in Fig. 7, while they have the proper proportions in Fig. 1. This is due to the fact that the 40-rpm carriage motor in the GOES version of the machine moves the carriage too rapidly for proper aspect ratio display of TIROS/NOAA pictures. If you want to do the job right, you should substitute a 20-rpm type CA motor for the carriage drive. This will yield an excellent aspect ratio for TIROS pictures

Fig. 8. An NOAA 6 pass (orbit #610 on 9 August 1979) showing a picture as it would be displayed on a modified version of the Weather Satellite Handbook *(first edition) FAX machine, using the original carriage drive motor. The vertical compression is plainly obvious if this frame is compared with Fig. 2, displayed with a carriage motor of twice the speed of the original.*

and is precisely what was used to generate Fig. 1.

If you built the FAX machine described in chapter V of the *Weather Satellite Handbook*, you will have a few modifications to make of a somewhat different sort. First, the sync divider section will have to be changed to provide 60-Hz motor drive. The easiest way to do this is to change the reference crystal from 4.8 to 6.0 MHz. The frequency of the 565 PLL will then have to be shifted from 4800 Hz to 6000 Hz. The next step is the substitution of a Hurst type CA 240-rpm motor for the 120-rpm unit used for the old NOAA satellites. If you have built this machine, you already have provision for phasing the picture, so nothing else is needed there. You will have to change the value of C1 in the motor amplifier input circuit to resonate at 60 Hz. If you used the 15-H choke specified, simply replace C1 with a .47-mF, 50-V mylar™ capacitor and you are now in business. If you retain the old carriage drive motor and print pictures, you will get something that looks like Fig. 8. The relatively slow carriage speed will let you fit all of the pass on a single piece of paper, but the vertical rate of travel is too slow, resulting in a "squashed" vertical display. If you add a new traverse motor of twice the speed as the old one, you will get the proper aspect ratio shown in Fig. 2—the same pass shown in Fig. 8.

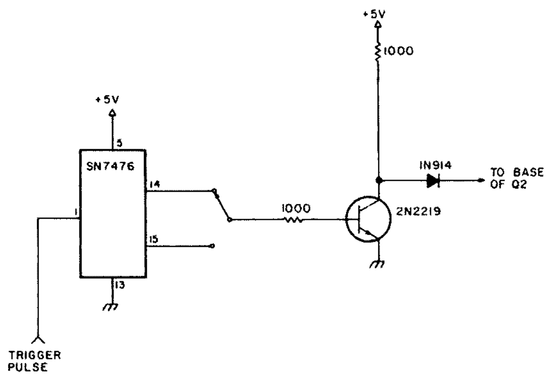

Fig. 9. A video line-blanking circuit for the WB8DQT direct-printing facsimile recorder. Such a circuit is a requirement for printing IR data, but is not needed for visible light display.

One of the major disadvantages of either of these machines in their present form is the need for an external scope to phase the pictures. I am presently at work on an autophase circuit for TIROS that can be switched in to provide autophasing for either GOES or TIROS pictures along with switch selection of the proper carriage motor speed using a dual-speed motor for the carriage drive.

If one wishes to display IR imagery on the direct-printing machine, some means must be provided to blank out the visible data. The problem is that with the required printing polarity, normal visible data or the dark visible channel at night will simply override any IR data. The latter is typically very near white level and the darker visible data simply covers it up.

The hybrid FAX system from the first edition of the *Weather Satellite Handbook* already incorporates line-blanking circuits so that this unit will print out both visible and IR data. Fig. 9 shows a line-blanking circuit for the direct-printing WEFAX facsimile machine. A sample of the trigger pulse is used to toggle a 7476 flip-flop. A switch selects one of the complementary outputs which drives a small switching transistor. Assuming that the signal is properly phased, the collector of the transistor will be high on every other video line. The collector voltage is coupled to the printing transistor through a diode, driving the transistor to white cutoff for the duration of the line. On alternate lines, the collector of the transistor is low and the base of the print control transistor is controlled by the signal from the video detector, permitting the video data to be printed. This particular circuit will have to be added only if you plan to copy IR imagery. Visible light imagery will print quite well without any attention to line blanking.

Summary

Hopefully, this represents most of the essential information required to introduce you to this new satellite series. Conversion of an existing satellite system is quite easy, and it is equally straightforward to incorporate TIROS/NOAA capability into new equipment as it is constructed. Polar-orbiting spacecraft represent the simplest and least costly introduction to weather satellites. Why not tune in and see what's happening? ■

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7. Taggart, R. E. "Attention, Satellite Watchers!—a solid-state monitor for GOES," *73 Magazine*, February, 1979.
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SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, Attn: Social Events.

MORRISTOWN TN
NOV 1

The Lakeway Amateur Radio Club will operate from the David Crockett Tavern, Morristown TN, on Saturday, November 1, 1980, from 1300 UTC until 2200 UTC. SSB-only operation will be on the following frequencies, plus or minus QRM: 28.560, 21.360, 14.280, and 7.235 MHz. Amateurs and the general public are invited to visit the tavern and site, which is the boyhood home of Davy Crockett, during regular operating hours (weekdays, 9:00 am to 5:00 pm, and Sundays, 2:00 pm to 5:00 pm). For a certificate commemorating the event, send $1.00 plus a legal-size SASE or 3 IRCs and an SASE to Davy Crockett DXpedition, Rte. 11, Box 28, Morristown TN 37814.

ST. PETERSBURG FL
NOV 1-2

The Florida Gulf Coast Amateur Radio Council, Inc., will hold the Suncoast Amateur Radio Convention on November 1-2, 1980, at the Bayfront Concourse Hotel, downtown St. Petersburg FL. Close by are the Albert Whitted Airport, the St. Petersburg Marina, bus depots, and many parking lots. Registration is $3.00 each and children under 12 are admitted free. Two award tickets are free with advance registration. Swap tables are $10.00 each for both days (no one-day tables). Double booth space is available and all the swap area will be inside. Featured will be dealer displays, forums, a Saturday luncheon and banquet, and a Sunday luncheon and fashion show. FCC exams will be given. Send to the Tampa office for 610s. Talk-in on 147.96/.36, 147.66/.06, and 146.52. For more information, write FGCARC, PO Box 157, Clearwater FL 33517, or phone (813)-461-4267.

HICKSVILLE OH
NOV 2

The Defiance County Amateur Radio Club is sponsoring its 3rd annual hamfest on Sunday, November 2, 1980, from 8:00 am until 4:00 pm at the Defiance County Fairgrounds at Hicksville OH. Tickets are $1.50 in advance and $2.00 at the gate. Table space is free on a first-come-first-served basis, inside or outside. Hourly drawings will be held, with the main event at 3:00 pm. Talk-in on 147.69/.09 and .52. For more information, write Ed Ballard, Jr., RFD #1, Roland Road, Sherwood OH 43556.

SOUTH FALLSBURG NY
NOV 7-9

On November 7, 8, and 9, 1980, the Hudson Amateur Radio Council will sponsor the ARRL Hudson Division Convention to be held at the Pines Hotel, South Fallsburg NY. The theme is "Good Times at the Pines," with emphasis on a mini-vacation type convention for both families and solo attendees. A full range of forums is planned along with an exhibit hall and flea market. Contact Mike Evans WB2RDD for flea market info at Box 143, White Sulphur Springs NY 12787, or call at night (914)-292-8630.

NEWMARKET
ONT CANADA
NOV 8

The York North Amateur Radio Club will hold its annual flea market on Saturday, November 8, 1980, at the Newmarket Community Centre, Newmarket, Ontario. General admission will be $1.50, which includes a door prize ticket. Admission for exhibitors will be $4, which includes a door prize ticket and *one* table. Additional tables will cost $2. The flea market will run from 0800 to 1400 EST, but doors will be open earlier for exhibitors. The talk-in frequency will be 146.52 MHz simplex; the club call is VE3YNA.

SO GREENSBURG PA
NOV 8

The Foothills ARC will hold its annual Swap & Shop on Saturday, November 8, 1980, at the St. Bruno's Church in South Greensburg PA. Doors will be open from 9:00 am until 5:00 pm. Dealers are welcome. The main prize is a complete HF antenna system, including a triband beam, a 40-foot tower, a rotor, thrust bearing, and cable. Second prize is an Icom IC-2A handheld. Talk-in on 146.07/.67 and .52. For advance table reservations, phone Jim Yex WB3CQA at (412)-256-3531. For more information, phone Chuck Hamman WB3HZM at (412)-837-9194.

WEST MONROE LA
NOV 9

The Twin City Ham Club of Monroe/West Monroe will hold its annual "Hamfest" on Sunday, November 9, 1980, at the West Monroe Civic Center, 910 Ridge Avenue, West Monroe LA. The $1.00 admission includes a chance for the grand prize. Talk-in on .25/.85 and .52/.52. For more information, contact WB5MHU, 94 Birchwood Drive, Monroe LA 71203.

FRAMINGHAM MA
NOV 9

The Framingham Amateur Radio Association will hold its annual fall flea market on Sunday, November 9, 1980, at the Framingham Police Station Drill Shed, Framingham MA. Admission is $1.00 and sellers' tables are $6.00. Sellers are advised to pre-register. Doors will open at 9:00 am. Talk-in on .75/.15 and .52. For more information or to register, contact Ron Egalka K1YHM, FARA, PO Box 3005, Saxonville MA 01701, or phone (617)-877-4520.

SELLERSVILLE PA
NOV 9

The RF Hill Amateur Radio Club will hold its fourth annual hamfest on November 9, 1980, in the Sellersville National Guard Armory, Sellersville PA. Doors will open to sellers at 7:00 am and a $2.00 donation will admit buyers after 8:00 am. Tickets are on sale for the grand prize, a complete low-band station from key to antenna. The radio is the new 9-band Ten-Tec Model 580 DELTA with a 110-volt power supply and filters. The antenna is a model AP-3 from W6TIK. Talk-in on 146.28/.88 and 146.52. For further information, contact the RF Hill ARC, PO Box 29, Colmar PA, or Robert Bentley WB3EWP, RF Hill Hamfest, 334 Railroad Avenue, Souderton PA 18964, or phone (215)-723-8303.

MASSILLON OH
NOV 16

The 23rd annual auction, Auctionfest '80, sponsored by the Massillon ARC will be held on Sunday, November 16, 1980, from 8:00 am until 5:00 pm at the Massillon Knights of Columbus Hall, Massillon OH. The flea market opens at 8:00 am with auction action to start at 11:00 am. Auctionfest '80 will feature three major prizes, plus a long list of door prizes to be given away hourly. Tickets are $2.50 in advance and $3.00 at the door.

AWARDS

from page 20

no charge, it is necessary for the applicant to enclose sufficient postage fees for the safe return of your cards.

Once your initial award is received, applicants may earn a Silver Sticker for any 25 different DX YL contacts within five countries. The same application and postage requirements apply.

North American applicants may submit their cards and applications to Phyllis Shanks W2GLB, 7 Lake Circle Drive, Vicksburg MS 39180, or one of two DX stations may be utilized: I8KDB or DL3LS.

This week I received a very nice letter from Doris Kinney who represents the Green Mountain Awards.

GREEN MOUNTAIN AWARD

The Green Mountain Award is made available to licensed amateurs the world over. To qualify, the applicant must make two-way contact with other amateurs of the State of Vermont. A Bronze Award will be issued for 25 contacts, a Silver Award for 50 contacts, and for 100 contacts with Vermont stations, a Gold Award will be made. Repeater contacts are not valid.

Each applicant must list all contacts made, showing callsign, date and time in GMT, the band and mode, and the signal report. To be valid, all contacts must be made on or after January 1, 1971. Submit your verified list of contacts and award fee of $5.00 to: Green Mountain Awards, Doris Kinney, RFD #2, Brandon VT 05733.

Paralleling the Green Mountain Award is an achievement known as the Worked All Bands Award. This award also is sponsored by Doris Kinney.

WORKED ALL BANDS AWARD

The Worked All Bands Award requires the applicant to work a minimum of 50 Vermont contacts on each band, 10 through 80 meters. There are no mode limitations, but specific modes will be recognized if requested.

List all log entries by band and submit this application with a $5.00 award fee to Green Mountain Awards, c/o Doris Kinney, RFD #2, Brandon VT 05733.

WORKED ALL MAINE AWARD

While we are in the 1st Call District, let's take a look at the Worked All Maine Award.

The requirements are simple and straight to the point. Applicants must work an amateur operator in each of the sixteen counties of Maine. There are no band or mode requirements, but specific recognition can be made if so stated at the time application is made.

Submit your log entries and award fee of $2.00 to: John Blinick K1JB, c/o Portland Amateur Wireless Association, Box 1605, Portland ME 04104.

THE WARREN AMATEUR RADIO ASSOCIATION, INC.
WARREN, OHIO USA
PRESENTS THIS
WTC
WORKED TRUMBULL COUNTY
AWARD
TO ________ OPERATOR OF STATION ________ FOR HAVING SUBMITTED SATISFACTORY EVIDENCE TO W.A.R.A. AWARDS COMMITTEE OF TWO-WAY RADIO COMMUNICATIONS WITH ________ DIFFERENT TRUMBULL COUNTY STATIONS INCLUDING ________ MEMBERS OF WARREN AMATEUR RADIO ASSOCIATIONS, INC.
This Certificate is given in recognition and appreciation of this Excellent Achievement.
Warren Amateur Radio Assn., Inc.
Endorsements
Chairman Awards Committee
Date
No.

WORKED TRUMBULL COUNTY AWARD

The Warren County Amateur Association of Ohio announces its Worked Trumbull County Award (WTC), a program designed to promote increased amateur radio activity among and with Trumbull County amateur radio operators.

To qualify for this award, applicants must make 10 contacts with Trumbull County amateur operators. DX stations outside the United States and Canada must log a minimum of five Trumbull County amateurs. All contacts must be made January 1, 1959, and after to be valid.

To apply, list callsign of the stations worked, the date and time in GMT, and the mode and band of operation for each contact made. Have this list verified by at least two fellow amateurs or a radio club official. Enclose this application and a $1.00 award fee or 13 IRCs to Don Lovett K8BXT, Awards Chairman, WARA, PO Box 809, Warren OH 44401.

NH WAC AWARD

An award is available to those who successfully contact each of the ten New Hampshire counties. There are no band, mode, or time restrictions.

Include an SASE with date, time, frequency, mode, call of station contacted, and county. New Hampshire counties are Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan.

Submit your request for this award to Basil Cutting W1JB, RFD, Suncook NH 03275.

Before concluding this column for another month, I would like to remind our readers to make reference to the September and October, 1980, editions of *73*. Packed within its pages, I have detailed 19 individual awards which constitute the fabulous new *73 Magazine* Awards Program. Each offering its own degree of challenge, there is something in it for everyone!

FINAL RESULTS FIRST ANNUAL 160-METER PHONE CONTEST

For all these years, they said it couldn't be done, so nobody ever tried it—not until January, 1980, when a group of dedicated top-band operators convinced *73 Magazine* to sponsor the First Annual 160-Meter Phone Contest! We believe the comments noted in Feedback tell it all.

The entire program idea took many months of planning from early spring, 1979, right up to the golden hour the contest began. During this preliminary period, over 25 top-band operators from all parts of the United States, Canada, and the Caribbean were drawn together to coordinate their ideas on what was to be a "first" for 160 meters. Many on-the-air schedules were conducted by the group to refine the rules and set the stage for the event. Countless hours were spent by the contest chairman and his dedicated committee to get things set up and conclude any last minute details. We now can see the product of their hard work: probably one of the most promising events in 160-meter history, the results of the First Annual 160-Meter Phone Contest.

From the logs of those entries submitted, over 500 individual stations were found to be on the air for the weekend event. Unfortunately, only 74 of these operators forwarded their scores to the contest chairman. It was a weekend of achievement, however, with over 60 DX stations activated on the band: CO2FA, G3SZA, GD4BEG, HP3FL, KH6CC, KH6ILA, KL7GIH, KL7GKY, KL7JEF, KV4FVS, KV4FZ, PA0HIP, PJ9EE, PY1RO, VP2ML, XE2EJ, YV4TI, ZL1BIL, ZL2BT, ZL3GQ, plus 45 Canadian stations. Hopefully, next year more entries will be submitted from these ever-popular DX stations; they, too, may be eligible for an award. As Chod Harris VP2ML stated, "Chances are I may take high score for Montserrat!"

The race for the championship was a dead heat. Top honors went to K8NG with a total of 139,240 points, followed by only 1240 points by second-place finisher K0GVB with 138,000 total points. WA9EYY managed to capture third place overall with a finishing tally of 131,670 points. For the United States, W4PZV tallied the most multiplier points by establishing contact with 41 states and 12 DX countries, which earned him 77 multiplier points. For DX stations, VE3OCU took top honors with 68,640 points overall. In order of their respective calls,

the following single-operator stations led their region: N1AAR, W2MPK, K3LGC, W4PZV, AE5H, AE6U, N7DF, K8NG, WA9EYY, KØGVB. Multi-operator stations: AI2K, WA3GMS, WA4UNZ, WB7BFK, WD9GGY, and WBØIBT. For the multi-ops, WBØIBT took top contest honors by a margin of less than 50 contacts!

As most of us know, one doesn't pursue a contest without some motive in mind. Maybe it is to add a few states or countries to our totals or just to hand

FINAL RESULTS
FIRST ANNUAL 160-METER PHONE CONTEST
Final results listed in order by total score. Shown are callsign, state or DX, QSOs, QSO points, multiplier points, and total score. (*) State winner in their class. (**) Multi-operator stations.

* K8NG	MI	472	2360	59	139,240
* KØGVB	IA	400	2000	69	138,000
* WA9EYY	IL	418	2090	83	131,670
W8EPT	MI	355	1775	63	111,825
* N1AAR	CT	369	1845	54	99,630
* WBØIBT**	NE	375	1875	53	99,375
* W4PZV	FL	258	1290	77	99,330
* K3LGC	DE	354	1770	51	90,270
* WDØBNC**	KS	328	1640	54	88,560
* N9GT	IN	314	1570	54	84,780
K9QLL	IL	338	1690	49	82,810
KB8EZ	OH	242	1210	83	76,230
* VE3OCU	DX	288	1430	48	88,640
* WA3QMS	PA	315	1575	43	67,725
* W2MPK	NY	271	1355	46	62,330
* W1WCR	NH	249	1245	50	62,250
* AE5H	MS	203	1015	55	55,825
WAØDXZ/5	MS	237	1185	45	53,325
* N7DF	UT	229	1145	46	52,670
AA1K	CT	181	905	53	47,965
* WD4EPX	TN	246	1230	38	46,740
WB8HCV	MI	221	1105	40	44,200
* WB2QLO	NJ	169	645	49	41,405
K8ES	OH	176	880	47	41,360
* W3YOZ	MD	156	780	53	41,340
* AI2K**	NJ	172	860	44	37,840
* N7AM	WA	157	785	46	36,110
N4CMU	TN	170	850	42	35,700
* VE4WR	DX	172	880	41	35,260
K2HPN	NY	162	810	43	34,830
* WB4ASY	AL	145	725	48	34,800
W8QBF	OH	189	845	41	34,645
K3IXD	MD	150	750	44	33,800
* W4WWD	VA	157	785	42	32,970
* AE8U	CA	135	675	47	31,725
* WD9GGY**	IL	172	880	34	29,240
* WB1HIH	MA	173	865	33	28,545
* W7AVD	MT	126	630	45	28,350
* W4YZX	NC	124	620	44	27,280
* K1NBN	ME	146	730	37	27,010
WD9IIX	IL	150	750	34	25,500
* WD5DUD	LA	114	570	44	25,080
WA7OFH	WA	106	530	45	23,850
WD6EQG	CA	135	675	35	23,625
AI7K	WA	133	665	35	23,275
W4WWQ	VA	96	480	47	22,560
N9RC	IN	114	570	39	22,230
* WA4JWS	SC	113	565	33	18,645
K8SIA	MI	111	555	33	18,315
* W7ULC	OR	96	480	36	17,280
* K5MAT	NM	74	370	44	16,280
* W4VKK	GA	66	330	44	14,520
WA9FTU	IL	85	425	33	14,025
* K6BF	CO	79	395	33	13,035
W1BB	MA	79	395	32	12,640
* WA4UNZ**	SC	72	360	31	11,160
WA2GZB	NJ	58	290	35	10,150
* WB7BFK**	WA	76	380	24	9,120
* N7AKU	NV	72	360	24	8,640
K2DWI	NY	85	325	23	7,475
* W7TO	WY	59	295	23	6,785
WB4ZPF	VA	43	215	30	6,450
W2CC	NJ	50	250	25	6,250
AK7H	WA	50	250	24	6,000
WA4JWC	SC	60	300	19	5,780
N8BJU	OH	40	200	23	4,600
* VE5JQ	DX	41	205	21	4,305
* N8ACQ	WV	41	205	20	4,100
WA6EKJ	CA	50	250	16	4,000
KA8CQI	OH	27	135	20	2,700
W5VGC	NM	31	155	17	2,635
AK2E	NY	19	95	18	1,710
AK7H	WA	26	130	12	1,580
VP2ML	DX	17	85	18	1,530

Contest Feedback

"A well-planned, interesting, and fun contest. Only lacked better DX propagation and more respect for the DX window. Congratulations to WB7BFK of *73 Magazine* and the many volunteers who made it all possible!"—W1BB.

"Had a ball in this contest; lots of stations on. Let's do it again as I think it is the best contest on 160—a great bunch of gentlemen and dam good operators—K2DWI.

"Glad to work the contest as I really enjoyed the entire operation. Thanks to *73 Magazine* for the sponsorship."—K2HPN.

"My first contest that I operated from start to finish. Please have it again next year; I'll try to do better."—W2MPK.

"A great contest! Let's have it again next year."—W3YOZ.

"Great that someone finally sponsored a 160 phone event. Enjoyed it very much and sounded like a big success. Hope to do it again next year."—WD4EPX.

"I didn't do terribly well but thought I would submit an entry anyway to help support the contest. Great fun!"—W4YZX.

"Your contest was 59+ and I had a super lot of fun. You can definitely count on me next year, too!"—WD5DUD.

"Fantastic contest. Two great nights for propagation. Worked KL7GKY Friday for #48, KH6CC for #49, and N7GA in Idaho for my 50th state on Saturday evening. Good signals; great fun—but too little sleep."—AE5H.

"Thank you for your first 160 contest. Wish it had been published in all the magazines as many more would have been on. I almost missed it myself."—WA6EKJ.

"Used a Coast Guard 310-foot loran antenna. Was super for transmitting but a bit noisy for receiving. Could only operate the second night and this hurt my score. Was a great experience anyway. Looking forward to next year now."—AE6U.

"This could be a big contest if proper advertising can be realized. Your rules are vague on Canada. Should be separate multipliers for each province. Had a great time."—N7AM.

"My antenna tuner had ice on the capacitor and would arc over if I ran over 25 Watts. Very pleased with my first 160-meter contest."—N7DF.

"Used a 120' longwire out the window, hooked to a transmatch. Very surprised at the result. Hope to do better next year."—AK7F.

"Hard for us in Washington to work DX. My sight is only 1/10 normal vision so had to log each contact on cassette first. Lots of activity—seemed like everyone was having a good time and voiced nothing but praise for *73's* sponsoring of this event."—WA7OFH.

"Enjoyed every minute."—N8BJU.

"Tnx, *73*, for a nice 160 contest. Fantastic turnout on SSB. Had a great time and will be back next year."—KA8CQI.

"QRP contacts were rough at times, but still managed to work all those I heard, I think. Had a great time and will try again next year."—WD8HCV.

"Seems funny that during a CW contest the operators flood the entire 160-meter band, but when a phone 'test comes about, a few soreheads claim we are out of line operating below 1810. Let's count Canadian provinces for multipliers next year. Had a great time and will see you again next year."—K8NG.

"Really pleased with all the activity your contest produced. I'm sure it will set the stage for an even greater event next year. Only negative comment is that I believe Canadian provinces should be separate multipliers."—K8SIA.

"I really enjoyed the contest, more than any other 160-meter event. I hope to see it happen again next year. You might consider including Canadian provinces for multipliers." —WA9EYY.

"Had a fun time on 160 phone and hope I can do it again next year."—WD9IIX.

"This was a great contest. Hope it continues from year to year as it is a good counterpart to the ARRL and *CQ* CW events."—N9GT.

"My first contest. Had rain and lightning the first night. Met some very nice people on 160. Thanks to *73 Magazine* for a fun time."—WDØBNC.

"The rules were unclear on VEs. Didn't know if they should be counted for DX or not. Was a great contest and I hope to compete again next year."—KØGT.

"Very surprised at the high level of activity. Conditions were very good and some surprising DX was heard here, including HP and VP2M. I was appalled, however, at the level of activity in the DX window by American SSB stations. Thanks for a very enjoyable contest and I'll be back again next year."—VE3OCU.

"Thanks to *73* for creating this fun time. There was an area of confusion throughout the contest which I hope is cleared up before next year's event. The subject: Should the Canadian provinces be separate multipliers?"—VE5JQ.

"Didn't hear about the contest until it was happening. Anyway, here is my log. It's bound to be top score for Montserrat! Had a good time, as it seemed everyone did."—VP2ML.

Feedback From Non-Contestants

"This is probably the stupidest idea for a contest I have ever seen. Whoever thought this one up needs a dunce hat."—W8JI. (Tom, do you have one in size 7¼ that I can borrow?—WB7BFK)

". . . listening during the weekend of the new 160 phone contest organized by Wayne Green . . . I found that it generated quite a bit of SSB activity. There was one disturbing factor, however, the malicious QRM from a few CW diehards who resented the invasion of SSB signals in that portion of the band usually occupied by CW operation. I had expected a retaliation by the phone boys the following weekend during our CW contest but it did not materialize; they were real gentlemen."—W1WY. (Quotation from *CQ*, May, 1980, p. 80)

out a few contacts to those who need them. Special congratulations go out to the following stations who each achieved results above the norm: N1AAR worked G3ZSA; K3LGC contacted 5 countries; W4PZV worked 41 states and 12 countries; AE6U worked 6 countries including New Zealand; AK7H worked ZL2BIL and ZL2BT; WB8HCV was the only QRP entry; W8EPT worked all 50 states plus 5 countries; K8NG worked 47 states and 4 countries; KB8EZ worked 47 states and 6 countries; K9QLL worked 46 states and 4 countries; WA9EYY worked 49 states and 4 countries; KØGVB worked all 50 states and 4 countries; and WBØIBT worked 47 states and 2 countries.

The 1980 rules were quite vague in regard to the status of Canadian contacts. Over 45 Canadian stations supported this first annual event and everyone will be pleased to learn that the 1981 rules will reflect a change in which each Canadian province will count as a separate multiplier. Our apologies and most assuredly our heartfelt thanks to the following VE stations who were in support of this year's contest: VE1IC, VE1OC, VE1UM, VE1UW, VO1FN, VE2DC, VE2EV, VE3ABG, VE3BBN, VE3CV, VE3EYK, VE3GPU, VE3HP, VE3IDU, VE3IDW, VE3KH, VE3KQD, VE3KQN, VE3OCW, VE3QA, K8AMJ/VE3, VE4AED, VE4MP, VE4VV, VE4WR, VE5AZG, VE5DNG, VE5DX, VE5JQ, VE5JS, VE5XU, VE5ZZ, VE6TL, VE7CMK, VE7CNY, VE7JUP, VE7KE, VE7SZ, VE7VP, VE7YQ, VE7ZG, 3D6AC/VE7, and G4HBE/VE7.

One of the advantages of gathering contest results is the opportunity to survey the actual equipment and antennas being utilized. For years, one of the restrictive elements which kept many amateurs from operating 160 meters was the availability of equipment. As you'll witness in the survey to follow, it would seem that 160 meters could be considered a "born-again band." We hope you'll find this analysis as interesting as we did. Here's the breakdown of equipment used by contestants in our first annual event:

Yaesu: (36)
FT-101 series (24)
FT-901 series (6)
FT-301 series (3)
FL-101/FR-101 (3)
FT-101/FR-101S (1)
Drake: (17)
T-4XC/R-4XC (6)
T-4XB/R-4B (6)
T-4X/R-4B (3)
TR-7 (2)
Kenwood: (14)
TS-820S (6)
TS-520S (6)
TS-180S (2)
Ten-Tec: (3)
540/240 (1)
Omni A (1)
Omni B (1)
Icom: (2)
IC-701
Atlas: (2)
350XL (1)
215X (1)

Talking with many amateurs, there are those who'd never try 160, as they felt you had to own acres of real estate to erect an antenna. Surveying our contestants, you'll find a variety of antennas being used, most installed on small city lots:

Vertical (20)
(excluding Hy-Towers)
Inverted L (13)
Dipole (11)
Beverage (8)
Longwire (7)
Sloper (5)
Hy-Tower vertical (2)
Horizontal Quad (2)
80-Meter Dipole (2)
Double Zepp (1)
2-el. fixed horizontal beam (1)
3-el. fixed vertical beam (1)
10-80-meter trap dipole (1)
40-meter dipole (1)
Discage (1)

We cannot tie the ribbon on the 1980 event without mentioning some very dedicated individuals who made it all possible. Special recognition should be paid to Dan Murphy WA2GZB who was this year's contest chairman and who has accepted the position for next year. Assisting Dan were fellow top-band operators John Fried W4WWD, Vic Misek W1WCR, Ed Steeble K3IXD, Paul Engle K9QLL, Bill MacDonald W8EPT, and members of both the Top Band SSB Net and the Worked All States Net on 160.

It was a great experience and we all met many new friends as a result. So it is onward and upward, the second annual event is just around the corner. Every effort is being utilized to advertise in all publications. Hopefully, things will see a new beginning and more will join our efforts to make the 160 phone event one of the best on the band! I'll be there, will you join us?

DX

from page 15

possible to explain to a non-amateur about DXing because of the nature of the DXCC entities. In addition, expeditions to the R and Rs accomplish nothing positive except enabling everyone who is interested to advance one notch toward the Honor Roll. R and Rs don't enable visiting amateurs to introduce amateur radio to interested Third-World citizens and they don't produce good public relations. They are simply expensive and unnecessary, a product of affluent societies. R and R expeditions merely make expensive playthings for itinerant DXers.

In the past year or two, attitudes toward the question of R and Rs have subtly swung from the majority being on the pro side to being on the con side. Suddenly, straw polls at conventions are producing more and more hands raised in favor of making DXCC counters *only* countries having a separate government all their own.

This really has nothing to do with how "rare" and entity is for DXers. Kingman Reef, for example, is an uninhabited reef, yet the demand for contacts is satisfied by an expedition every few years. China is the most sought after country, yet it has more people than all of Europe. Those who suggest that China should be struck from DXCC because there has not been amateur activity there for two decades are always hooted off the stage; those who suggest deleting the R and Rs are getting more and more support. Why not ask the question at the next convention or DX meeting you attend? The results may surprise you!

AUGUST HAPPENINGS

Speaking of rocks and reefs, several were on at summer's end. The Radio Club of Bogota, Colombia, mounted a two-part expedition to Bajo Nuevo HKØAB and then Serrana Bank HKØAA in early September. Seventeen Colombian operators participated in the operation, which included all bands 160-10 meters, both phone and CW. QSLs to Edilberto Rojas, HK3DDD, PO Box 584, Bogota, Colombia.

In early September, DXers were awaiting an operation from Juan Fernandez Island, to sign CEØCJA, by the Radio Club of Chile. Their plans for a mid-August operation were foiled by transportation problems—the Chilean Navy is the only way to get to Juan Fernandez.

Dave Gardner K6LPL took a short trip to Tonga in August and signed A35LP for a few days. He will be part of an expedition to Abu Ail, to sign J2ØAA/A for about five days, beginning December 5. Franz Langer DJ9ZB and Pierre Reisian J28AZ are the other operators definitely slated for the operation.

K6LPL is also part of the Heard Island team, which will sign VKØJS beginning about January 15, 1981, if all falls into place. P29JS is heading planning for this very complex and expensive undertaking.

We are pleased to have photos this month of last April's Glorioso Island operation by a group of German amateurs (see story in *73*, September, page 154). This same group was ready to leave in early September for Juan de Nova, to sign FRØRX/J and FRØCIW/J beginning September 14. They also planned some operating from the Comoros as D68AS and D68AT, with another short stop on Glorioso also possible. QSL and logistics manager for the April and September operations, DK9KD, calculates a total cost for the two at nearly $50,000!

Two problem countries in Africa were in August's news: Burundi 9U5 and United Arab Emirates A6. Stations on are 9U5AC and 9U5DS, but their op-

erations are in question at the DXCC desk in Newington. Also, several bootleggers have signed 9U5DS on CW, compounding problems. Several Polish amateurs are presently in Burundi as technical advisors and stand the best chance of anyone of getting actual operating permission.

Several stations also are operating from A6 but their QSLs are not being accepted for DXCC. Amateur radio was banned in the U.A.E. in February, 1979, and the DXCC desk has received inadequate documentation from several A6 operators since that time. The League's policy of requiring documentation from operators that they were actually where they claimed to be and that they had official operating permission is a policy we highly agree with. It may make a few of your QSL cards worthless for DXCC purposes but the value in preventing ill will that can be generated by visiting hams justifies the position ARRL has taken.

N6ZV, AA6AA, and KA6S left California for the Indian Ocean area late in August. They first operated from Mauritius as 3B8ZV and 3B9ZV and then from the Comoros as D68GA and D68XX. Plans called for permission for a Tromelin Island operation. Permission for Tromelin, as well as for Juan de Nova and Glorioso, is obtained at Reunion Island, from which the others are administered. QSLs for all stops by this group are to ZL1BIL, one envelope per operation/callsign please.

Roger Ulsky KB7JX continued his boat trip in the Pacific with August setups on the South Cooks ZK1CF and Samoa 5W1. They aimed for the Fiji Islands 3D2 and New Zealand in September, with a very outside chance for a landing on Kermadec. All QSLs for their operations are to ZL2AQF.

ZL1AMO and ZL1AZV operated from the Pacific in August and early September, first as A35EA and A35TW, then from Niue using ZK2EA and ZK2TW. They followed these with some time on Western Samoa 5W1 and another stop on Tonga. QSLs for CW contacts to ZL1AMO, phone contacts to ZL1AZV.

Corsica was ably represented by a German group the first two weeks of September, seven of them signing FC0FOC. QSLs to DJ3TF. Their location a thousand feet from the beach allowed some serious low band operations, including 160 meters.

Watch for an operation November 2-7 from Fernando de Noronha, with Morris Johnson KB4IT signing PY0ZDX and Carlos Albuquerque as PY0OD. Johnson is a member of the Latin American Committe of the Southern Association of Colleges and Schools and is in Brazil again this year as part of an accreditation program for American schools in Latin America.

Anthony Green VS6EZ should be operating from Muscat, Oman, signing A4XGR. Look for him around 28.550 and 21.300 from 0930 to 2000 UTC. QSLs to PO Box 981, Muscat, Oman, with 5 IRCs or a greenback for airmail return.

A QRP DXpedition to South Point, Island of Hawaii, will be active between 1800 UTC November 29 and 2400 UTC November 30. The Big Island Amateur Radio Club will be operating from the southern most area of the 50 states. Tentative frequencies include 7.115, 21.115, and 28.115 CW; 7.275, 21.375, and 28.750 SSB. A special QSL will be available from the Big Island Amateur Radio Club, Russell R. Roberts, Jr. KH6JRM, PO Box 363, Honokaa HI 96727.

Most of the information in this column comes from *The DX Bulletin*. Thanks for sending the photos, and please keep them coming. Good DX!

HAM HELP

Wanted: Operating and service manuals for the Atlas RX-110 receiver, PS-110H power supply/amp, and service manual only for the TX-110 transmitter module. I will gladly pay postage and copying cost.

Charles Y. Mooney KA5IWF
4905 Walker Drive
Box 92814
The Colony TX 75056

I am a ham and railroad fan interested in starting a radio railfan net. Any interested radio rail-fans can contact me by mail or phone call.

Bill Anderson, Jr. KA6BXS
650 Leo Dr.
Foster City CA 94494

I am looking for a Venus C1 fast/slow scan camera to complement my Venus 552 monitor. These units are no longer being produced by Venus Scientific. Also, I need a good circuit diagram for converting the output of a conventional TV camera to slow scan.

Ira Linderman WB2RXR
89 Dovecote Lane
Commack NY 11725

I need a schematic and instructions for a Valtec Model VS-11 speech integrator made by Valley Technics, Kalamazoo MI (now out of business). Will pay.

Merle Israelson W4NEJ
1425 SW Egret Way
Palm City FL 33490

I need schematics and manuals for a Lafayette HA-90 vfo, Lafayette HA-800 receiver, Sylvania model 216 signal generator, Knight T-60 transmitter, Heath VF-1 vfo, and Elmac PRM6-A receiver. I'll be glad to pay any expenses involved.

Frank Lev WA2LPX
327 Adirondack Drive
Farmingville NY 11738

Needed: Modification data for converting a Hallicrafters SR-42 AM modulated exciter to FM.

Neil Johnson WA4ZTN
PO Box 154
Glenwood FL 32722

I need a schematic for a National HRO-60 receiver and Central Electronics sideband slicer/Q multiplier. I will copy and return promptly. I also need "AC" (15 meter bandspread), "E", "F", and "G" coil sets and dial scales.

M. Crestohl VE2BDM
PO Box 642
Victoria Station
Montreal
Quebec, Canada H3Z 2Y7

I am disabled and find I have a lot of spare time, so if anyone needs a QSL manager, I'm available!

Karl Rietz WB7FAT
4346 S. Boxwood Ave.
Tucson AZ 85730

Can anyone supply me with a used video head for an Ampex VR 5100?

Al Cikas KA9GDL
2112 Stonehenge
Springfield IL 62708

African ham needs 3-kHz (500B-31) and/or 6-kHz (500B-60) mechanical filters for 51J4.

Rod Hallen KB7NK/5T5RH
State Department—Accra
Washington DC 20520

I am looking for schematics, manuals, or information about a Hallicrafters SR-46 and a Hickok model 295X.

Bill Smith K3LF
RD #2
Cold Spring Creamery Rd.
Doylestown PA 18901

Please contact me if you have instruction manuals and/or a schematic for the Allied Knight-kit T-150 transmitter (early 1960s vintage). I would appreciate any assistance in locating same.

R. E. Langford WA4ARK
1320G Scully Road
Aberdeen Proving Ground MD 21010

I need a service manual or schematic for a Collins 310B-1. I also need knobs for a Hallicrafters S-76 or SX-101 receiver.

H. F. Schnur
115 Intercept Ave. North
Charleston SC 29405

We need the manual for a National NCX-3. Or our second choice would be to get just the schematic. We'll happily pay postage both ways and photocopy it or pay postage and copying costs for a good-quality photocopy of same. Thank you.

C.G. Sakowski KA9FIJ
R.J. Sakowski KA9FII
Rt. 1, Box 50
Barneveld WI 53507

I need a schematic diagram for a National HRO-500 receiver. My manual is missing the foldouts. I'll be happy to pay for postage and duplicating costs.

Robert McLeod N4CKP
Rt. 4, Lot 6, Creekside
Moncks Corner SC 29461

LOOKING WEST

from page 12

relaxed to say the least.

Aside from the malicious interference problem, other matters that were discussed included the viability of national repeater directories, 10-meter CTCSS plans, and what to do about 15-kHz tertiary channels. Also explained was the alternative 20-kHz plan adopted in the Pacific Northwest and the overwhelming success it has had. Other than the malicious interference problem, most of the time was spent on the topic of what to do about the 15-kHz tertiaries. I'll share my own ideas with you on this later.

As for repeater directories, it was noted that such volumes cause problems for coordinators because amateurs tend to look upon such books as being akin to bibles depicting all activity. As one panel member pointed out, for his area the things were totally useless because they were at least 75% inaccurate. The problem lies in two places. First, those wishing to put up repeaters many times consult a national repeater directory rather than their local coordinator, coordination council, or fellow amateurs. This then leads to conflicts when a system shows up on the air on a supposedly vacant channel pair and finds that a repeater is already using said channel pair. In fact, the latter may have been in operation for some time, but because of the time lag in the publication and update of national repeater guidebooks, the listing had not appeared.

Then there is the opposite problem: the paper repeater. Since the ARRL, *73*, and all publishers of national listings take input from all sources, they have no way to ascertain whether a system really exists. They can only go by input provided to them by all sources and hope for the best. If some joker decides to send in a listing for a non-existent repeater, there is no way for a publisher to check the validity of the listing. The cost and paperwork involved would be overwhelming. For the coordinator, this poses the problem of convincing the prospective repeater putter-upper that a given channel pair is indeed clear, regardless of what the national book says.

Some repeater councils have petitioned the ARRL's VRAC to only accept input from recognized coordinators and coordination councils. It was pointed out that should this occur, many closed, private and membership-only (this was a new term to me, and it was never defined) systems might go to great lengths to see that a listing of their existence was deleted from all publications. Again, this could lead to coordination problems and confrontation. In the end, the panel seemed to agree that it should be stressed that all such national publications be used only as general guides to possible area activity and that those seeking more accurate information send a self-addressed, stamped envelope to the area coordinator or coordination council for a given geographic area and request a local repeater list. In making this suggestion, Neil McKie suggested that the word "stamped" be underlined. I agree.

What to do about 15-kHz tertiaries between 146 and 148 MHz? First, I think we have to agree that there is no such thing as a 15-kHz tertiary channel. That's a term left over from the mid-'70s that's still haunting us for some unknown reason. A better term for today would be 15-kHz "standard pairs," for indeed that's what they are. Keep in mind that once an area starts coordinating on 15-kHz centers, the 30-kHz standard has gone out the window. 15 kHz has become the standard automatically, regardless of whether you go upright or inverted. So, the first step in solving the 15-kHz question is to start thinking in terms of 15 kHz and totally forget 30 kHz, the same as we did when we went from 60-kHz to 30-kHz separation more than 12 years ago. Once you start thinking in this more positive light, you can also look toward more positive solutions.

The initial solution presented to the ARRL Board of Directors by the VRAC was this: All systems east of the Continental Divide would operate upright on 15-kHz centers, while those west of it would invert except for the Pacific Northwest (which would retain its own 20-kHz plan). Some suggestion. This is one of the few times I find myself in complete agreement with the ARRL Board of Directors. If I were sitting on that august body, I would have vetoed it as well. Why? Because it only endorses the status quo, but does nothing for those caught in a now developing squeeze play in middle America. As I understand it, it was pressure from those in the central area of this nation that brought about the veto. I am with them 100%. They should not be left holding the bag, with inverted systems crawling toward them from the west and upright systems approaching from the east. Eventually, a day will come when somewhere a giant lock-up will occur and you will witness the biggest repeater confrontation in history. Endorsing the status quo solves nothing.

As early as 1975, Bob Thornburg WB6JPI had the answer. He prepared a paper discussing the merits of both upright and inverted 15-kHz centers. He used mathematical extrapolation to explain what would work best where, and supplied this material to all the publishers of amateur magazines. It was never printed. When I was preparing my own book on repeaters and FM, I received permission from Bob to include this work in one of the book's appendices. It's there. Every bit of information needed by any coordinator, council, the VRAC, or the ARRL. Since it is now copyrighted by TAB, I cannot reprint it here, but those of you who need this information can find it in TAB book #1212, pages 527 through 535. Immediately following this is a description of the alternative being utilized in the Pacific Northwest of 20-kHz centers. Again, the information is there, and in both cases is based on solid technological research rather than political consideration.

The answer to the 15-kHz problem lies simply in adopting one of the two 15-kHz standards or opting for total recoordination nationally on 20-kHz centers. The latter would be ideal on technological grounds but impossible to implement in many areas. This is due to already overcrowded conditions. This leaves us with the two 15-kHz alternatives and I urge all to read Bob Thornburg's work on the subject before reaching any conclusions. One thing is for certain: With the current growth patterns on two meters, the current status quo won't last much longer. A solution must be found.

The afternoon session was a User's Forum in which repeater and non-FM users posed questions to the panel; we tried our best to provide intelligent answers. I think we succeeded and feel the hours spent on this particular panel were constructive. There are some top minds in the world of FM relay technology to be found in the Pacific Northwest. I was proud to have been able to spend this time with them. By far, they are some of the most dedicated amateurs I have ever met.

The next forum I was part of was the Media Relations Forum chaired by John Brown W7CKZ. Many of you have heard of John in regard to the Mt. St. Helens disaster. He is the Washington State ARES Public Information Officer who was interviewed by many news services. John had put together a top-notch panel which featured representatives of the local print and broadcast media, network radio and television, and even the amateur media. On this one, the panel consisted of John as moderator, Roy Neal K6DUE, Milt Furness K7JKH of KOMO-TV News, Kerry Webster WB7AKE of the Tacoma *News-Tribune*, George Garrett AC7X, News Director of KMPS AM/FM radio, Ted McGee of National Cable Television, and again yours truly.

Matters covered were simple in appearance but very complex in actuality. What makes an amateur radio story newsworthy? To what type of news outlet? How do you obtain news coverage? How should you plan for it? These things were covered in depth at the discussion. I have a complete audio tape of the session, and if you are a club public relations director or an ARRL Public Information Assistant and need a copy of the seminar itself, just mail me a high-quality (Scotch AVM Studio Master or equivalent) C-120 cassette with a self-addressed, stamped mailer and I will duplicate my tape and re-

turn yours to you. A C-120 will cover most of what was discussed without you missing much. All I ask is that you pay the return postage and be patient. The duplication can only be done when the equipment is not in use for producing the weekly Westlink newscasts.

SEANARC '80 was a good convention by all standards. It was not a Dayton in size or scope nor did it have the totally fun atmosphere I found rampant at ARCH '80. SEANARC '80 was, however, a good show that provided yours truly with a rather fun-filled though busy weekend. By the way, the final highlight came about 15 minutes after we departed on the return leg of the trip to Los Angeles. As we were climbing to altitude in our 727, the captain came on the intercom to announce that off the right side of the aircraft was the now infamous Mt. St. Helens. We were at about 25,000 feet and 60 miles east of the volcano, yet from my window seat I could clearly see the steam billowing forth and the devastation on what had once been the north slope. It was both chilling and awe-inspiring in its grotesque beauty. As I raised my camera to photograph it, I could not help but remember that a number of my fellow amateurs had given their lives on that mountain.

On Tuesday, July 22nd, Lou was tuning across the DX portion of the 432-MHz band when he noted the KH6HME beacon transmitter. For those of you who are not familiar with what beacons are, I will digress for a moment to say that they are automated transmitters placed into operation by individuals or groups worldwide for the purpose of propagation study. Another friend of mine in North Hollywood operates such a device from his home on 10 meters. Perhaps some of you have heard the W6IRT 10-meter beacon. In recent years, it's become one of the popular ways for DXers to see if 10 meters is open. The KH6HME operation in Hawaii is a similar undertaking on the 432-MHz band.

It was about 8:45 pm Pacific Time when Lou first spotted the beacon, but having heard it on numerous occasions from his San Diego QTH, Lou was not overly excited by the happening. To quote Lou: "I had heard this happen on many occasions, but usually it didn't hold in for very long." This time it did, and by Wednesday afternoon others were hearing it as well. This was mainly because Lou had alerted other VHF/UHF Dxers that the beacon was audible in southern California. Also alerted that the UHF path was open between Hawaii and the mainland was Al Pachicko KH6IAA in the Island State. Unfortunately, Al was suffering from a severe cold at the time and was unable to make the trek to the top of 8000-foot Mauna Loa. Al did try to make the path to Lou on Wednesday evening from his home in Hilo, but he had no luck.

HAWAII ON 220

In 1959, K6NLZ worked KH6UK on 220 MHz CW for a few fleeting moments. Considering the equipment of the era, it was a true triumph of technology and just plain human perseverance. In late July of this year, Hawaii was again finally worked on 220 MHz, but this time it was a phone contact on 220 MHz FM. Here is the story from one of those who took part in this monumental achievement.

I doubt if the name Lou Anciaux or the callsign WB6NMT requires very much of an introduction. Many know Lou from his fine line of VHF and UHF equipment marketed under the name Lunar Electronics. Others know Lou as a member of the League's VHF/UHF Advisory Committee or as one of the nicest people you can meet or talk with on the air. You might say that Lou typifies the devoted amateur of today, and one of his most avid interests is VHF/UHF weak-signal DXing. The details of this story came to me from Lou, but there were other amateurs involved who all deserve credit. As this story progresses, you will see who they are and, moreover, witness something not found very much elsewhere in amateur radio these days, a willingness to cooperate regardless of who might be the one whose name goes down in the record books. I am firmly convinced that the last true vestige of old-time amateur spirit is found among the VHF/UFH DX crowd. You will soon see why.

Al was feeling better on the 24th, and agreed to drive up the mountain if Lou could be home around noon Pacific Time to try the path. Al went up the mountain, but no contact was made until about 5:30, when Lou and Al made the path on 432-MHz SSB. Among those alerted to the opening had been Dr. Wayne Overbeck N6NB. You might remember that Wayne was recently named "Ham of the Year" by the Dayton Amateur Radio Association. Wayne had made a trek of his own to a hilltop in Orange County and was also able to work Al on the 432-MHz path.

Shortly after 6:00 pm, Lou heard Al come onto 220-MHz FM, and was able to QSO him on 223.5 MHz. Lou's contact was followed by one between Al and Wayne, and then Wil Anderson AA6DD also was able to make the 220-MHz FM path. At this time, both sides of the path were running horizontal polarization. Al then switched to vertical and, although he was heard in Santa Barbara, California, no QSO could be made. At 8:00 pm Al showed up on 2 meters SSB and again Lou was able to QSO him. At times, he was peaking S-9 into San Diego. The next hour was spent in trying to get KH6IAA in contact with as many mainland stations as possible, but few could hear him. At 9:00 pm the operation was secured, but in its wake a new record had been set: Hawaii to the mainland on three bands, one of them 220-MHz FM for the first time.

I have related this story as told to me on the phone by Lou. It's ironic that more amateurs do not recognize what can be done with a bit of time, patience, and cooperation. Above all, these were the ingredients that made this event possible. I think that even the most avid HF DXer can learn a lot from the VHF weak-signal enthusiast.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

of souvenir shops clustered around an old castle on top of a hill. I don't think I've ever seen so many virtually identical souvenir stands all in one tiny area...and that includes the tourist meccas of Mexico, Pisa, and the peak of Mt. Washington.

The tourist areas which attract the more affluent travelers tend to have boutiques rather than souvenir shops. These start out with leather belts, belt buckles, leather handbags, and get into designer clothes and furs on the high end. Vail and Aspen are packed with these more expensive stores.

The restaurants tend to reflect the income levels of the visitors, too, with the busload and souvenir shop areas featuring hot dog stands and Aspen about one hundred restaurants, most of them in the $10 to $20 per dinner bracket. Sherry and I have learned how to deal with that situation...as well as the overloaded plate syndrome. We normally order one meal and two plates and find that we have no problem getting more than enough to eat...and at considerably lower cost. You have to watch out for us tight Yankees.

I've often wondered who buys all those souvenirs. I've bought a few coffee mugs with place names on 'em, but that's about the extent of my souvenir purchases. There are tens of thousands of such stores, so obviously there are millions of people buying stuff. Not that boutiques do any better with me... I'm just not a spender.

Yes, I know that I can't take it with me...so I'm not going.

I hope that many of the industry people will come to the Vail meeting this January 10-17th and help to make our industry grow.

MILLER MAKES FORTUNE

Old-timers in the DXing game will tell you stories about the legendary Don Miller who, some 15 years ago, was moving around the world to one rare

spot after another, in the greatest DXpedition of all time. Oh, there were some spoilsports who were claiming that Don wasn't perhaps always exactly where he claimed to be, but then a country worked was a country earned, and it was better not to look too closely at things like that.

Besides, if Don was cheating a bit, he wasn't the first, by any means. More than a few well-aimed questions had been asked of Dick McKircher WØMLY and his North African DXpedition as well as of good old Gus Browning W4BPD, the immediate predecessors of Don ...and perhaps his mentors, in a way.

Miller got a bit careless in his work and was exposed in *73 Magazine*, for which he brought a $650,000 suit, claiming that *73* had deprived him of his means of making a livelihood as a DXpeditioner. Never mind that it is illegal to make money this way. Miller was proven a liar about one expedition and more than serious questions were raised about many of his other operations, so he dropped out of sight for a while.

The next I heard he was a very successful doctor and was opening up clinics in California to reap the Medicare funds... and was worth millions. Having known Miller pretty well, this seemed likely.

Miller recently made the news for several things, with a nice piece in *Fortune* magazine (August 25th issue, page 28). First, it seems that he had brought suit against a hospital for refusing to accept him on its staff and the Jerry Brown majority of the California Supreme Court had ordered the hospital to reconsider his application, feeling that just because Miller was known to be abrasive, hypercritical, outspoken, controversial, litigious, and personally offensive to some of his colleagues was no real reason to blackball him.

On the same day that the Supreme Court story broke in one paper, another headlined a story about Miller being sentenced to 25 years in prison for conspiring to murder his wife, with another trial pending on charges that he had burned down his own clinic for insurance fraud. Presumably the Supreme Court of California will back down, liberally minded though they are.

The Miller DXpedition story was a wonderful one. Miller wanted to write a series about it for *73 Magazine* at one time, but after looking into it, I begged off and *CQ* went along with the story for many, many months. During the time when Miller was on speaking terms with me, he called one day to ask if I would be interested in accompanying him on a forthcoming trip to the Indian Ocean. That sounded like fun, so I listened a bit more. His plan, as he outlined it, was to operate from a number of rare spots. The only kicker was that he would always sign the call of the last place he had operated ...thus never signing the call of the actual operating spot. I lost interest.

Miller blamed the ARRL for his weird plots. He had cooked up a DXpedition to some place not far from Japan while he was in the Army there. He asked the ARRL whether this would be considered a new country or not. They said they thought so, but would make the final decision later. He kept pushing them and they finally gave him a verbal okay. He went to the spot, put on a great DX operation, and later found that the League had decided it was not a new country, but had neglected to tell him about this. The news, he claimed, arrived via a letter sent by sea mail.

From then on, Miller was bent on getting even with the League. He set out to destroy their DXCC Honor Roll. He charged the higher up listees $25 a country to work him... or else lose out and forever be one down from their lifelong won spot on THE LIST. Many famous DXers got fed up with this and quit the fight rather than have to pay for every Miller operation.

Questions as to the authenticity of more and more Miller operations arose. Bearings were taken of operations from islands and reefs which showed him to be thousands of miles from where he claimed. I got word that he had visited Canberra and swiped some pictures of Heard Island from the archives. These were later published in *CQ* as proof that he had been there. Never mind that he was known to be half a world away a couple days before he went on the air signing the Heard Island call. Gus claimed that Miller *had* called him *and* asked if he would like to work with him on the Heard Island operation...to actually take place not far from Vancouver, Canada.

I went to Burma and checked to see how he had managed to operate from there. The officials and local hams said "no way." It appeared that he had probably set up in Thailand and signed the Burma, Cambodia, Laos, and Spratly Island calls. Thousands of us got nice QSL cards from these operations and ARRL dutifully counted them just as if they were authentic... so everyone was happy.

Things began to go wrong in bunches for Miller. He claimed that he was making over $50,000 a year...tax free...in donations from DXers. After talking with a lot of the top men in the hobby, I don't think Miller was exaggerating. But his falsified credentials, vagueness about documentation, and a growing list of countries refusing to allow him entry began to catch up with him. Miller set back U.S.-Indian ham relations years when he apparently forged a letter giving him permission to operate from their ultra-rare Laccadive Islands. He went on the air, claiming to be there and to have a license. India investigated and said the license was a fraud and that he had not even been near the islands.

The Colvins, who have gone out of their way to put on the cleanest DXpeditions on record, also put the lie to some of Miller's claimed operations. They provided a good deal of hard-to-get documentation which showed several Miller DXpeditions to be fakes.

73 Magazine reported this at the time and suffered a protracted law suit by Miller as a result. This cost thousands of dollars, though much of the expense was covered by insurance. One of the results of that is our having a whole box full of old Miller logs taken as an exhibit in the case. Miller *was* a wonderful operator.

I don't know how long a 25-year sentence takes to do, but judging from a ham murderer who got a similar conviction, Miller may be out again in a few years. The medical profession may not want him practicing again, so perhaps Miller will take up DXing in the late 80s. He certainly knows how to make it pay off handsomely.

YOU CAN'T FIGHT CITY HALL

Yes, you can! And the time seems to be here for a bit of a tussle if we want to preserve some of our long-accepted privileges. We are so used to our "right" to own an all-band receiver that we tend to forget that amateurs in many other countries are forbidden to even own equipment which is capable of tuning in *many* non-ham frequencies.

We've had frequent efforts by city and state governments to make laws prohibiting the use of radio receivers and, in each case, *when* the matter was fought, the FCC's posture has been to protect the Communications Act of 1934 wherein anyone is permitted to tune in *any* radio channels. Section 605 does prohibit the divulging or using for commercial benefit the information contained in radio signals, but there are and have been no restrictions on receiving.

Unless we permit our government to start setting up limitations on reception, we will continue to be free to buy or build and use receivers for any of the radio channels. If we let our city, state, or even the federal government pass laws restricting reception, we will be on the road to ever more restrictions. Laws prohibiting the personal use of receivers in cars capable of receiving police channels are not valid laws. The prohibition of receivers for 10 GHz (radar) is clearly illegal.

Now comes Representative Richard Preyer (D-N.C.) with a bill to change the Communications Act of 1934 so as to prohibit the reception of certain radio communications. The bill says it is "to protect the privacy" of some telecommunications users. The bill seems to have been written by the pay TV people for the benefit of the pay TV companies, and to hell with the interests of over 30,000 hams and thousands more experimenters.

We have already seen the HBO crowd using their lawyers to harass amateurs who dare to write and have articles published which describe microwave receivers for a ham band near the HBO channels. A current suit is costing amateurs tens of thousands of dollars... with the result that the fear of more such frivolous harassment suits has stopped the writing

and publishing of information on several of our microwave ham bands.

This group also tried to get the FCC to take away the amateur licenses of writers of articles on equipment which even *could* be used to intercept their signals. . . even though there is no law prohibiting such reception. They also tried to get the FCC to further punish both the authors and the magazine editors and publisher by asking that they be fined by the Commission for the publication. The FCC turned all these demands down. . . reiterating their policy that all radio channels are open to the public and are not owned by corporations.

But, with the pay TV people all pushing hard through every means at their disposal and with billions of dollars riding on the development of this market, you may be sure that these firms will not spare any expense in legal harassment or intimidation. Unless amateurs make a concerted effort to fight back every try at taking away our rights, we will lose them.

If you live in any of the following states where a congressman is on either the Interstate and Foreign Commerce Committee or the Judiciary Committee, then start putting on the screws. Make sure you call them when they are at their home office and tell them you don't want more freedoms given up for the sake of protecting the profits of the pay TV people. Write them, at the House of Representatives, Washington DC 20510.

HOUSE COMMITTEE ON THE JUDICIARY

Rodino (D-NJ)	Danielson (D-CA)
Brooks (D-TX)	Drinan (D-MA)
Kastenmeier (D-WI)	Holtzman (D-NY)
Edwards (D-CA)	Mazzoli (D-KY)
Conyers (D-MI)	Hughes (D-NJ)
Seiberling (D-OH)	Hall (D-TX)
Gudger (D-NC)	Railsback (R-IL)
Volkmer (D-MO)	Fish (R-NY)
Harris (D-VA)	Butler (R-VA)
Synar (D-OK)	Moorhead (R-CA)
Matsui (D-CA)	Ashbrook (R-OH)
Mikva (D-IL)	Hyde (R-IL)
Barnes (D-MD)	Kindness (R-OH)
Shelby (D-AL)	Sawyer (R-MI)
McClory (R-IL)	Lungren (R-CA)
Sensenbrenner (R-WI)	

HOUSE COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE

Staggers (D-WV)	Ottinger (D-NY)
Dingell (D-MI)	Waxman (D-CA)
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Murphy (D-NY)	Sharp (D-IN)
Satterfield (D-VA)	Florio (D-NJ)
Eckhardt (D-TX)	Moffett (D-CT)
Preyer (D-NC)	Santini (D-NV)
Scheuer (D-NY)	Maguire (D-NJ)

96TH CONGRESS
2D SESSION

H. R. 7747

To amend the Communications Act of 1934 to prohibit the unauthorized interception and use of subscription telecommunications and to protect the privacy of the users of such telecommunications.

IN THE HOUSE OF REPRESENTATIVES

JULY 2, 1980

Mr. PREYER introduced the following bill; which was referred jointly to the Committees on Interstate and Foreign Commerce and the Judiciary

A BILL

To amend the Communications Act of 1934 to prohibit the unauthorized interception and use of subscription telecommunications and to protect the privacy of the users of such telecommunications.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Communications Act of 1934 (47 U.S.C. 15 et seq.) is amended by inserting after section 5 the following new section:

"UNAUTHORIZED INTERCEPTION AND USE OF SUBSCRIPTION TELECOMMUNICATIONS

"SEC. 6. (a)(1) Except as provided in paragraph (4), a person who—

"(A) knowingly carries out an unauthorized interception of a subscription telecommunication; or

"(B) knowingly attempts to carry out, or conspires to carry out, an unauthorized interception;

shall be liable for civil penalties under subsection (b) and shall be subject to criminal penalties under subsection (c)(1).

"(2) Except as provided in paragraph (4), a person who—

"(A) knowingly carries out an unauthorized interception of a subscription telecommunication; and

"(B) knowingly uses the subscription telecommunication for his own commercial advantage or financial gain, or for the commercial advantage or financial gain of any other person;

shall be liable for civil penalties under subsection (b) and shall be subject to criminal penalties under subsection (c)(2).

"(3) For purposes of this subsection, the interception of a subscription telecommunication by any person shall not be considered an unauthorized interception if—

"(A) such person is the originator of the subscription telecommunication, or his agent;

"(B) such person has agreed to pay a fee or charge to the person originating the subscription telecommunication, or his agent, for the use of the subscription telecommunication;

"(C) such person has entered into any other contractual arrangement or any other agreement under which such person is entitled to receive the subscription telecommunication from the person originating the subscription telecommunication, or his agent; or

"(D) such person has reasonable cause to believe that such person is entitled to receive the subscription telecommunication from the person originating the subscription telecommunication, or his agent.

"(4) The provisions of paragraph (1) and paragraph (2) shall not apply to any interception which is authorized under chapter 119 of title 18, United States Code.

"(b)(1)(A) Except as provided in subparagraph (B), any person who is aggrieved by any violation of subsection (a) may commence a civil action for actual damages, for damages under paragraph (2), and for equitable relief against the person who is alleged to have committed the violation.

"(B) No civil action may be commenced under subparagraph (A) after the end of the 2-year period following the date of the discovery of the alleged violation, or the 7-year period following the date of the occurrence of the alleged violation, whichever occurs first.

"(2) Any person who violates subsection (a) shall be liable to any aggrieved person for damages in the amount of $100 per day for each day in which the violation occurs, except that any damages awarded under this paragraph shall not be more than $1,000.

"(3) In any civil action under this subsection in which the court determines that the plaintiff has substantially prevailed, the court may assess against the defendant reasonable attorney fees and other costs of litigation reasonably incurred, and the court may award, for a violation of subsection (a)(2), such punitive damages as it considers appropriate. Any punitive damages awarded by a court under this paragraph shall be in addition to any other damages or equitable relief awarded by the court under this subsection.

"(4) Any civil action under this subsection may be commenced in any United States district court of competent jurisdiction, without regard to the amount in controversy, or in any other court of competent jurisdiction.

"(c)(1) Any person who violates subsection (a)(1) shall be fined not more than $25,000, or imprisoned for not more than 1 year, or both.

"(2) Any person (other than an individual) who violates subsection (a)(2) shall be fined not more than $1,000,000. Any individual who violates subsection (a)(2) shall be fined not more than $250,000, or imprisoned for not more than eighteen months, or both. If the conviction is for a violation committed after the first conviction of the individual under this paragraph, the individual shall be fined not more than $250,000, or imprisoned for not more than forty months, or both.

"(d) The penalties established in this section shall be in lieu of any penalties established in any other provision of this Act.

"(e) For purposes of this section:

"(1) The term 'basic telecommunications service' means that basic two-way switched voice telephone service which is provided as an interstate telecommunications service on the effective date of this section and which is provided on a universal basis to the general public. Such term includes any other interstate telecommunications service which the Commission, from time to time, determines by rule is recognized as an essential part of an efficient nationwide system of basic telecommunications.

"(2) The term 'interception' means the receipt of any subscription telecommunication.

"(3) The term 'subscription telecommunication' means any telecommunication, other than basic telecommunications service, which is intended for receipt in intelligible form only by a person who has agreed to pay a fee or charge to the person originating the telecommunication, or his agent, and any other telecommunication incident to such telecommunication.

"(4) The term 'telecommunication' means any transmission, emission, or reception of signs, signals, writings, images, and sound or intelligence of any nature by wire, radio, optical, or other electromagnetic systems.".

Russo (D-IL)
Markey (D-MA)
Luken (D-OH)
Walgren (D-PA)
Gore (D-TX)
Mikulski (D-MD)
Mottl (D-OH)
Gramm (D-TX)
Swift (D-WA)
Leland (D-TX)
Shelby (D-AL)
Devine (R-OH)
Broyhill (R-NC)
Carter (R-KY)
Brown (R-OH)
Collins (R-TX)
Lent (R-NY)
Madigan (R-IL)
Moorhead (R-CA)
Rinaldo (R-NJ)
Stockman (R-MI)
Marks (R-PA)
Corcoran (R-IL)
Lee (R-NY)
Loeffler (R-TX)
Dannemeyer (R-CA)

Clubs can create considerable force, too. . . particularly by making those cheapskate misguided members who are not reading *73* aware of what is going on and getting them, their families, and friends to add their weight to our cause. Let's protect the rights of amateurs (and everyone else) to tune into anything we want without having Big Brother looking into our ham shacks to make sure we are not breaking the law.

Remember that first comes the small restriction. . . then comes the police to make it stick with the enforcement. With each step of the way along this path, we lose *freedom*. Next come further exceptions to the things which can or cannot be listened to. . . and since the precedent is there, this step is simple compared to the first one. This will bring further policing of the laws and more intrusion into our lives and hobby.

The mess with the ten-meter linears should serve as an example of what can happen when we don't make an effort to protect ourselves.

EGO REPORT

Someone apparently commissioned a report on the "ego count" in the 1979 ARRL Annual Report. This is a count of the use of the words "I" and "my" by the various people reporting. At first the analysis seemed as if it must have been contrived, but no, it turned out to be reasonably accurate.

The top ego award goes where all who know him would expect: Harry Dannals won hands down with a score of 30 in his modest report. He was followed by Stan Zak, who managed to cram 22 "I" and "my" references into his one-page report. . . possibly an all-time record. Harry Thurston was close on his heels with 18 in his one-pager, which will be no surprise to hams in the Northwest where his ego is legend.

On the positive side of the ledger is one single use of "I" by Baldwin in 27 pages. That shows what *can* be done.

In general, the ARRL report, which is worth the buck, grumbled about a downturn in membership, was excessive in applause for winning everything single-handedly at WARC (a position not shared by other national amateur radio societies), and a unanimity of concern over the long-range pursuit of amateur interests both nationally and internationally, which many directors seem to feel is inadequate.

FUN!

from page 30

ELEMENT 4—MATCHING

Match the past and present 2-meter rigs in Column A with the manufacturers in Column B.

Column A	Column B
1) 13-510A	A) Tempo
2) FM144-10SXRII	B) VHF Engineering
3) Carfone	C) Drake
4) FT-221	D) Yaesu
5) 1402 SM	E) Satan Electronics
6) Voice Commander III	F) Heathkit
7) HR-2A	G) Kenwood
8) TRX 144	H) Azden
9) VHF-1	I) RCA
10) FM-2X	J) Motorola
11) FM-DX	K) Midland
12) GTX-202	L) General Electric
13) Brimstone 144	M) Icom
14) Multi 11	N) Collins
15) IC-22	O) Swan
16) TR-2200	P) KLM
17) HW-2036	Q) Wilson
18) Metrum II	R) Genave
19) Marker-Luxury (ML-2)	S) Regency
20) PCS-2000	T) Clegg
	U) KDK

ELEMENT 5—TRUE-FALSE

	True	False
1) Facsimile (F4) transmissions are legal on 2-meter repeaters.	______	______
2) F-layer propagation is common on 220 MHz.	______	______
3) "Rubber Duckies" are a type of HT antenna.	______	______
4) Most repeater antennas are horizontally polarized.	______	______
5) Ham jargon for a fluttery mobile signal is "picket fencing."	______	______
6) "Duplexer" and "cavity resonator" are different words for the same unit.	______	______
7) The 220-MHz National Simplex Frequency is 222.50.	______	______
8) On crystal-controlled rigs, channel 9 is reserved for emergencies.	______	______
9) You may not use a vfo-equipped rig on a repeater.	______	______
10) The standard ATV repeater split is 439.25/427.25.		
11) An "alligator repeater" is a nickname for a machine that transmits over a further distance than it can receive.	______	______
12) Another name for a COR is "squelch relay."	______	______
13) The term "autopatch" originally got its name from the fact that you used it from an automobile.	______	______
14) Hard-line is cheaper than coax.	______	______
15) PL-259's are called "UHF connectors" because they work well above 400 MHz.	______	______
16) If King Kong were to climb the Empire State Building today, he would find a repeater antenna on the way up.	______	______
17) The standard 220-MHz repeater split is 1.6 MHz.	______	______
18) AM repeaters are illegal.	______	______
19) Frequency coordinator appointments are subject to approval by the local FCC Field Office.	______	______
20) No repeaters are allowed on 6 meters due to TVI problems.	______	______

THE ANSWERS

P	R	O	G	R	E	S	S	L	I	N	E
H	O	P		E	L		P	I	N		R
A	M		F	L		P	L		T	O	P
S	S	B		A			I	B	E		
E			R	Y	S		T		R	C	
		H	U			H			M	I	C
C	H	A	N	N	E	L	S		O		R
L		M					T	O	D	A	Y
O				P			A				S
S	U	R	P	L	U	S		H	A	A	T
E	S			A		U		I	R		A
D	E	S	E	N	S	E		T	A	I	L

Element 1:
See illustration.
Element 2:
1-2 Transmitting on the old 5-meter band, W1AWW (no connection to W1AW) relayed AM transmissions over distances as far as Boston and New York.
2-3 As the name implies, the original "Captain Crunch" whistles were found in Cap'n Crunch cereal boxes.
3-4 Still faithfully serving many "unsynthesized" FMers, the Motorola HT-220 was once known as "The Collins of 2 meters."
4-1 Although you had to file a separate (and very complicated) application with the Commission, you still used the trustee's call. Within a decade, knowing the FCC, we'll probably be back using WR calls.
5-3 As a part of the FCC's postwar amateur band realignments, the old 2½-meter band (112-118 MHz) was shifted to today's familiar 144-148-MHz position in 1945.
Element 3:
(Reading from left to right) deviation, duplex, jammer, transmitter; autopatch, control, whip, squelch; timer, site, machine, spur; oven, mobile, mast, amplifier; cor, portable, station, rejection.
Element 4:
1-K, 2-U, 3-I, 4-D, 5-Q, 6-L, 7-S, 8-B, 9-A, 10-O, 11-T, 12-R, 13-E, 14-P, 15-M, 16-G, 17-F, 18-J, 19-C, 20-H.
Element 5:
1) False—FM FAX is not allowed on 2 meters, but AM FAX is.
2) False—F-layer propagation rarely even makes it to 6 meters.
3) True—They're those little black antennas that often end up poking other hams in the eyes.
4) False—Vertically polarized.
5) True—Sounds like you're talking while running past a picket fence.
6) True—A duplexer by any other name would still cost a bundle.
7) False—It's 223.50.
8) False—What do you think this is, CB?
9) False—Why not?
10) True—Wide split for a wide mode.
11) True—And the opposite is a "rabbit-repeater."
12) True—Obsolete.
13) False—Means an automatic phone patch.
14) False—And a KWM-380 is cheaper than an HW-101.
15) False—Back when 50 MHz was UHF perhaps; today you better get some BNCs.
16) True—WB2IMT/R, 222.66/224.26.
17) True—Nice, wide spacing. Helps lessen desense.
18) False—Not at all.
19) False—No way.
20) False—Tell that to your local 6-meter repeater group.

SCORING

Element 1:
See illustration. Twenty points for complete puzzle, or ½ point for each question you got.
Element 2:
Each correct answer nets you four points.
Element 3:
One point for each word successfully unscrambled.
Element 4:
Give yourself one point for each rig you correctly matched to its manufacturer.
Element 5:
One point for each correct answer.

Total up your points and see how you rank in the repeater pecking order:

0-20 points—Jammer
21-40 points—Kerchunker
41-60 points—Mail-order Tech
61-80 points—Control operator
81-100 points—Repeater trustee

Next month: Specialized Modes

LETTERS

from page 26

anything about aircraft mechanics, how to read instruments, how to navigate, or any of the rules and regulations of the sky. Will you be publishing a manual on FAA tests soon? If so, I do not want to hear you scream when my Piper Cub accidentally flies through your house because I don't know anything about it—I just want to fly.

John F. Hauser KA4DLC
Pensacola FL

MORE 10 FM

The 29-MHz FM Club has gained another member with my new Comtronix FM-80 operating off an OMNI-D or battery pack.

Your magazine has wisely pushed this mode on ten, suggesting channel 29.6 MHz as a DX listening/calling frequency. Puget Sound has quite a number using this frequency for a variety of purposes, including transfer of computer programming data as well as rag chewing. As activity congests it, we will want to police things, leaving 29.6 for initial contacts, shifting to the generous handful of alternate channels nearby.

I would appreciate hearing from other users of FM on ten, particularly from FM-80 owners. An alternate listening/DX channel to 29.6 could possibly be 29.2—the FM-80 allows an instant switch from one to the other by pressing the Band A to Band B push-button. It's just a thought.

Using our Daiwa CN-620 power meter, we get 11 Watts into the antenna (whether longwire or whip) with 1:1 swr. The rig can be shoulder-strap supported with Gel-cell battery pack feeding a 53" ETCO Electronics 99¢ surplus whip through a miniaturized outboard-mounted transmatch network secured to the right side of the clamshell case, making an ideal spot to anchor the whip base.

F. W. Anderson W7AR
Seattle WA

NEW DX REPEATER

The first European 10-meter FM repeater started operation under the callsign DB0QK in Mainz, FGR, 20 miles southwest of Frankfurt (Main), in August, 1980.

The callsign is transmitted automatically every 45 seconds on an output frequency of 29.670 MHz for identification purposes. The station is intended for local and DX traffic use. Power output is currently 3 W, but will be increased to 15 W very soon. Antennas include two separate ground planes for receiver and transmitter.

Daily operating hours are from 6:00 am to 8:00 pm. The repeater is activated by a 1750-Hz tone burst on an input frequency of 29.570 MHz. Peak deviation should be less than 3 kHz. Repeater specifications are similar to US standards.

Interested amateurs are invited to try the FM repeater during band openings. Correspondence should be directed to address given below.

Amateur Radio DB0QK
Postbox 4040
D-6500 Mainz
Federal German Republic

AUTOMATED DX

I am firmly opposed to your idea of automating DX contacts. By putting this type of operation into use, the whole concept of DXing will be totally destroyed. The human element would be removed for the sake of expediency—radio will be conversing with radio. All of the emotional highs and lows associated with DXing would be totally eliminated; operator skill would be unnecessary.

I am curious as to how you reached the conclusion that most rare DX operators QRT rather than face the DX hunters? Did you take any type of survey

or poll to support these conclusions? If this *is* the case, I wonder why DXing itself has lasted so long as an integral part of our hobby. In my opinion, most DX station operators are quite skilled and capable of holding a rag-chew if they so desire. True, there are some lids who will resort to low operating ethics to bust a rag-chew and work the DX station, but the majority of the DX hunters I have heard in operation are not of that nature. Also, by using a firm hand when dealing with lids, this idiotic type of operation will ultimately be ended.

DXing is one of the most interesting and exciting facets of amateur radio. To me, watching an automated radio work DX would be about as exciting as watching a lawn sprinkler.

Charles E. Daum WA4YZF
Lutz FL

TAKE A BROMO

I just had to write and tell you how much I enjoyed both the old-time broadcasting articles and the feature stories on some of the older ham gear. It is sort of a break in the writing and was very enjoyable. I would like to see more of it. The articles from the August issue are "Notes from Big Sky Country" and "Those Fabulous Fifties."

Incidentally, Wayne, I read your editorials, take a bromo, and go to bed (hi), but I do like the magazine in spite of that.

Jack Golden WA2YPW
Portville NY

HAVE SOME FUN

I would like to encourage all radio amateurs to stop for a moment and think about their hobby. In particular, reflect a bit on your use of the spectrum.

Do you operate 2m FM from dawn until midnight, mostly on, say, .22/.82? Maybe you park your 6m SSB rig on 50.110 and never move. Perhaps you live on 14.205 MHz or even 3.850 and your bandswitch has not been touched since you last renewed your license.

Why not try something new? If 75m phone is where you usually are, why not work up a 15m dipole some afternoon and pound a little brass? It is easy to go slow, and fairly easy to find a clear spot in the band!

Don't forget about 10 meters, either. Besides being good for DX, it is good for some local groundwave, too. It can be a solution to some awkward problems. For example, a bunch of guys wanted a local channel at a lake to use as an intercom between cabins, the boats, and a few vehicles. It was too expensive to buy 2m FM rigs that would be left in the cabins, so converted CB rigs were used, providing the desired service at a fraction of the cost of a 2m system. One fellow even homebrewed a crystal-controlled rig for 29.335 MHz. Hooray for him! So, in a few years when sunspots are rare, keep up the activity on 10 meters via this mode.

If you find 2m FM boring, consider getting on 6m, 1¼m, or even 0.7m with some home-built transmitters and converters for your present 2m rig. All are good bands for local work, so do some exploring, even if it means QRP operation on one channel for a while. It can even have some good points. Suppose you and some buddies like to work DX on 20 CW most every evening. You can trade tips on who is where on the band on some UHF gear. Cook up something on 425 MHz. The band is big at 0.7 meters.

There are plenty of opportunities to build or modify rigs when expanding your horizons. As a club project, your group may acquire four or five of the toy-type 49-MHz HTs and put them somewhere on 6 meters. The club members could borrow them as needed to save lung power when doing antenna work requiring ground coordination. It takes only a few milliwatts to do the job. Start with a pair and add units as required by popular demand.

We have the spectrum; let's have some fun.

Jim Swaters WB0IXI
Kansas City MO

GETTING STARTED

Do you really mean everything that you write about? I wonder. You bemoan the need for more amateurs and the slow growth of the hobby in nearly every issue. Yet you have increased the price of *73* by 67%, which will probably scare off more people who might have been attracted to the hobby. Of course, I rushed to extend my subscription at the old price and crossed my fingers that the computer will not mess up.

Even though I am not yet a ham, I find *73* interesting, but it is poorly lacking in articles directed toward the beginning ham or those of us who have yet to get started. Why not start a major effort in this direction? If the hobby is to grow, something must be done now.

One last complaint: Please, if you need to hire more staff, I would like you to search quietly, rather than tell of your need in *73*. As one of your neighbors in a nearby town, I would rather that the world did not learn about our area.

Frederick Breton
Surry NH

WINNERS

The Foundation for Amateur Radio announces the 1980 winners of the seven scholarships which it administers.

John W. Gore Memorial Scholarship ($900)
Darryl F. Mihalek WB4JZT
Charleston SC

Richard G. Chichester Memorial Scholarship ($900)
Katherine Hevener WB8TDA
Franklin WV

QCWA Silent Key Memorial Scholarship ($900)
Maureen Porter KA0BSR
Denver CO

Radio Club of America, Inc., Scholarship ($500)
Brian D. Miller KA0DGT
Englewood CO

Edmund B. Redington Memorial Scholarship ($500)
Gregory Polanchyck N3GP
Frackville PA

Edwin S. Van Deusen Memorial Scholarship ($350)
Nicholas A. Ferro, Jr. WA2SFS
Lake Placid NY

Young Ladies Radio League (YLRL) Scholarship ($300)
Ann Walnes KA8CSM
Shelby OH

These scholarships were open to all radio amateurs holding at least a General class license or equivalent. This year's applications were received from 31 states and Denmark. The Foundation is a nonprofit organization representing fifty-one clubs in Maryland, the District of Columbia, and northern Virginia. It is devoted exclusively to promoting the interests of amateur radio and to the scientific, literary, and educational pursuits that advance the purposes of the Amateur Radio Service.

Hugh A. Turnbull W3ABC
College Park MD

RESPONSIBILITY

I'm writing about your little column in the August issue of *73* pertaining to the NARA.

Frankly, I'm surprised that you have not heard about its formation. I hope the skunk you refer to as a rip-off specialist is not the guy listed as national director—he seemed pretty sincere and honest. That's only an observation, not a fact. Apparently, you have several *facts* relating to this individual. I hope if it's bad you can blow his cover and I hope if it's OK you will support it. But either way, I'm sure you will find out.

I responded to an article that was in *HR Report* in April, but if this guy is a bad egg, I'd like to see him fry. From what Bob Stankus said in a letter to me, he was getting 50 letters a day and you can realize what this brings to the surface. Why don't *HR Report, 73, QST* and all the other magazines investigate or qualify the sincerity and integrity of an advertiser other than simply accepting a check? Other than the profit gained for the magazine by taking an ad, where does the responsibility lie in recognizing a rip-off from a sincere advertiser with integrity? Does it lie with the magazine for not screening a company or does it lie with the magazine's subscriber who is simply supporting the advertisers in the magazine and he is the one who takes the beating and loss?

Personally, I don't think it's fair, and although the magazines claim that they're not responsible for the companies that advertise, maybe they should be totally responsible since they have taken the ad and been paid first. That proves that they are responsible for themselves— maybe they should be responsible for their subscribers *not* getting ripped off.

Examine the number of quick-buck schemes that come up. Most of them come from advertisements in magazines. If the magazine was stringent in accepting ads, most quick-buck

schemes would never reach the amateur community.

The above is a thought you may or may not agree with, but think of it for a moment and eliminate *blame* from your thought.

Tony Musero K3UKW
Philadelphia PA

Well, Tony, some of the magazines (one, at least) go to a lot of trouble to try to protect readers from rip-offs. I do write about this every now and then, explaining the situation, but it is not a happy one. There are known rip-off firms and some of the ham magazines are running their ads . . . knowingly.

One of the several strains between HR *and* 73 *has to do with some of the advertising they accept and by inference endorse. When a firm is trying to sell a lousy product or is providing unforgivable service, I cut them off and refuse to run their ads. It is frustrating to see their ads in* HR *and* CQ*. . . and even in* QST*. Right now, we are passing up several thousand dollars a month in advertising revenue by trying to be good guys and I see no sign that anyone really gives a damn. I see the ads for these rip-off firms in the other magazines and though they are not able to screw as many people as they could if I permitted them to advertise in 73, they are doing well enough to stay in business, at least for a while.*

Now, when a new firm comes out of the woodwork with no history, that presents some problems which are difficult to surmount. Let's say some chap in Seattle sends in a quarter-page ad. How can I find out if he is straight or a rip-off? This is complicated by one other factor . . . the inadvertent rip-off. I can't jump on a plane and zip out to Seattle and see what is happening. What we do is request bank and other financial references. We try to follow up on these as best we can. We also demand prepayment for the first ads, having found that rip-offs usually try to rip off the magazines, too, and this gets many of them out of our hair.

But let me give a horrible example. We had a firm advertising in Kilobaud Microcomputing *a couple of years ago. . . World Power. We went through all the regular procedures, with bank references and prepayment for the first ads. Their bank refused to give us any information at all, good or bad. I called a chap I knew in Tucson and asked him to trot on over and check 'em out. He called back a couple of days later and said they looked legit. He had a friend of his check, too. . . another positive report.*

The World Power ads ran in all of the computer magazines and looked awfully good. The firm ripped off the industry for over half a million dollars. The chap who pulled it off is in prison now, but he not only fooled the magazines and the local computerists, but even the people working for his firm. This disaster has made the industry jumpy and brought out the Captain Queeg in at least one industry leader who got wind of the problem early.

On the other hand, there are the rip-offs which are not intended. I can't even complain about that because 73 has been a terrible offender in the past. It is exceedingly frustrating to try to run a business and find that employees are lying and covering up their own bad performance. Right now, we are getting QSL card orders out within a few days of receipt, but at one time they were months behind, with everyone responsible shrugging their shoulders and passing the buck.

Even worse were the subscription problems we had as a result of our Prime computer problems. Thousands of readers had their subscriptions screwed up, with virtually no help whether they called in or wrote. The chap who managed the customer service response to the computer disaster is now with another magazine, bless him. I was assured that all was okay and not to worry, while the complaints went from dozens to hundreds to thousands.

There still has been no solution to the Prime computer situation, despite promises by Prime of cooperation. Well, I'll see them at NCC again next year and see what they say. Their plant is almost an hour's drive from the 73 headquarters so I can see why they might not be able to get to see me for a couple of years or so. After three years of regular complaints at the NCC shows and many letters, they are beginning to recognize me and blanch when they see me coming.

Getting back to advertiser rip-offs, again I want to say that I plead with all readers to let me know as soon as possible of any spotted. If you run into bum products or lousy service, I want to know about that, too, but in a different form. Here, I want you to write to the offending firm and give the details, with a copy marked to me. I'll see that we follow up on it. We usually get results.

I don't know how to let you know when a firm is under suspension of ads. So far, my lawyers refuse to let me publish our list of blackballed firms and there are a few companies not advertising in 73 out of choice, usually because they hate my editorials more than they like the sales they would get by advertising. That doesn't influence me in the slightest and it makes them pay dearly in lost sales, so I'm not sure what they think they are proving.—Wayne.

NEW PRODUCTS

from page 41

plifier, keep looking! If what you need is an attractive, inexpensive table to fit into a small space and hold a reasonable amount of compact gear, check out the Radio Shack Space-Saver Desk!

For further information, contact *Radio Shack, a division of Tandy Corporation, 1300 One Tandy Center, Ft. Worth TX 76102*. Reader Service number 487.

Paul Grupp KB0NV/1
***73 Magazine* Staff**

MFJ ACTIVE ANTENNA

With the new resurgence in interest and equipment for shortwave listening, new accessories for the SWL are popping up as well. Hopefully, this is a positive growth sign for the industry.

Because modern shortwave receivers boast incredible sensitivity when compared with their tube-type forebears, small antennas are now just as effective as the skywires of decades ago.

One outstanding innovation in shortwave reception is the active antenna. A small signal-collecting "voltage probe" dipole or whip, usually only a few feet in length, delivers its tiny signal to a matched amplifier which, in turn, presents a whopping signal to a receiver. The system is as effective—often more so—as a hundred-foot longwire!

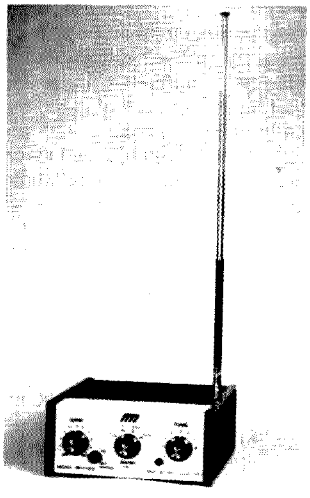
While several manufacturers are now advertising active antennas, one of the most compact and effective is the new model 1020 from MFJ.

Designed to cover all received signals from 300 kHz through 30 MHz, the 1020 is a very compact handful (5 × 2 × 6 inches) and may be powered by an internal 9-volt battery (clip provided), external 12 volts dc, or an ac adapter (provided).

Advantages of such a receiving system are obvious: It is tiny and unobtrusive with its 22" whip extended; it is not lightning-prone as would be an outside antenna; no cumbersome, insulated, wind-prone, corrodable eyesore need be erected with its vulnerable down-lead. And the 1020 is tunable, providing a measure of preselection as well.

Naturally, if the listener already has an outside antenna which works well, resistance to purchasing an active antenna is understandable. However, even a ham will find benefit with such a receiving system. For one thing, the antenna may be swiveled to optimize the incoming signal. For another, the 1020 has an rf gain control which controls receiver overload to help reduce intermod and images. And for yet another, the high-Q preselection can get rid of unwelcome noise which often overpowers even high-quality receiving equipment.

The common drawback for any indoor receiving antenna is its vulnerability to ac line-radiated electrical noise. Housing wiring surrounds the listener and his antenna, and noisy appliances can raise the background level of interference while receiving. But the swivel



The MFJ-1020 active antenna.

antenna may take care of that; experimentally try manipulating it through its various planes until a noise null reduces the interference and you have now turned a disadvantage Into an advantage: You can't rotate that skywire for minimum noise pickup!

The 1020 has a bright LED which alerts the user that it is on. A push-button functions dually as a power switch and antenna bypass so that the 1020 may be used alternately as an active antenna or controlled-amplification preselector.

Five bands comprise the continuous tuning; calibration is close, although the loading effect of a large external antenna will reduce dial accuracy. Since tuning is done more with the S-meter and ear than by dial readings, the calibration error is insignificant.

The Innards

As often happens with modern solid-state equipment, the inside of the 1020 is mostly empty space. A small 2-3/4"-square circuit board occupies a front corner of the Ten-Tec cabinet, while the remainder of the box provides rigid support for the extended whip and fat fingers which must manipulate the controls. Rubber feet cushion the cabinet on a desk or radio.

The circuitry is very straightforward: Two series 2N5486 FETs drive a bipolar 2N5179 for the preamplifier circuitry. Gain is controlled by a potentiometer between the second FET and the base input of the output transistor.

A 320-pF variable tuning capacitor is alternately switched between five different inductances for the bands of coverage.

Our Test

The MFJ-1020 active antenna was extremely simple to use. There is a natural inclination to ignore reading the instructions and just plug it in and use it. Resist the temptation; all owner's manuals contain *something* worth reading!

We found that although the 1020 did raise the noise floor of our receiver, signal strength improvement more than compensated for the increased background hiss.

The active antenna was compared with a 135-foot Windom dipole elevated some 30 feet above ground. In more than 90% of the discrete frequencies compared from 2-30 MHz, the MFJ-1020 active antenna equalled or exceeded the reception on the mammoth dipole! And even on the remaining few percent where the Windom provided slightly higher signal levels, signals on the 1020 were perfectly readable. At night, when high-level shortwave signals can be a nightmare, the 1020 consistently outperformed the Windom, especially at the higher frequencies, due to excessive signal voltages at all frequencies coming from the Windom.

We found the 1020 to be useful as a preselector as well. While modern communications receivers have high i-f selectivity and rf sensitivity, they are often vulnerable to spurious signals resulting from front-end overload. The sharp high-Q tuning of the 1020 sharply reduced strong images from shortwave powerhouses. Some juggling of the 1020's gain control and the receiver's rf gain or attenuator will optimize the desired signal.

If you are debating the possibility of improving your receiving antenna, you might wish to give serious consideration to an effective active antenna like the 1020 from MFJ. The MFJ-1020 active antenna/preselector/preamplifier lists for $79.95. For information, write *MFJ Enterprises, PO Box 494, Mississippi State MS 39762.* Reader Service number 478.

Robert Grove WA4PYQ
Brasstown NC

NEW SHURE MODEL 444D FIXED-STATION MICROPHONE

Serious amateur radio operators, who have long regarded the Shure Model 444 as the "standard" among fixed-station microphones, now have a new candidate upon which they may bestow the title.

It is the new Shure Model 444D, which retains all the performance characteristics that made the Model 444 popular, but also offers added features amateurs will find especially appealing.

For one, the Model 444D has a new impedance selector switch located on the bottom of the base, which allows selecting either high or low impedance operation.

A second easy-to-use slide switch is provided for switching between normal or VOX operation. These new convenience features join the unit's easy-to-use, momentary or locking, push-to-talk switch bar, which actuates the microphone and an external relay or control circuit with fingertip action.

Other added features of the Model 444D are a coiled cable, the availability of a free, personalized nameplate imprinted with an amateur's station call letters, and a new wiring guide with instructions for wiring the microphone to major brands of ham equipment.

Field-proven features retained in the design of the new Model 444D include a rugged, Controlled Magnetic[R] microphone element, speech response tailored for maximum intelligibility, height adjustment for operator comfort, and a tough, Armo-Dur[R] case that is impervious to rust and deterioration.

For more information, write: *Shure Brothers, Inc., 222 Hartrey Avenue, Evanston IL 60204.* Reader Service number 480.

NEW 1981 AMATEUR RADIO THEORY REVIEW

Micro-80 Incorporated, a cas-

Shure's Model 444D fixed-station microphone.

sette and computer software manufacturer, has designed an excellent computerized Amateur Radio Theory Review for each operator class. The entire program package for each license class consists of over 95,000 bytes. It is split up in 12 "byte-size" pieces so it will load into the TRS-80 Level II (16K) computer system, the only system for which it has been developed.

The first portion of each program is an introduction to Micro-80 Incorporated, telling the purchaser more about the firm, where it is located, who the owners are, and what their goals appear to be.

The second part of the program is a table of contents and a brief outline telling you what to expect from the progam and how to use it. All instructions are placed in the program itself. It was felt that instruction booklets which accompany most software programs usually get thrown out with the newspaper when it's clean-up time.

Each course covers 10 general subjects:

Part 1	Rules and Regulations
Part 2	Signals and Emissions
Part 3	Electrical Principles I
Part 4	Electrical Principles II
Part 5	Circuit Components
Part 6	Practical Circuits
Part 7	Operating Procedures
Part 8	Antennas and Feedlines
Part 9	Radio Wave Propagation
Part 10	Amateur Radio Practice

Once each program is up and running, there is no need to utilize the ENTER key as the INKEY$ function is used throughout the course. Personally, I have always felt this particular routine belongs in almost every program for the convenience of operation.

Since this course was designed to simulate the actual FCC exam, you are cautioned to read all questions and answers very closely! Quite a few of the questions are just plain tricky; the answers are not much easier. Some are nearly right, but not close enough, as the instructions very explicitly tell you to select the "most correct answer" or it will be counted wrong. All very nasty of course, but it keeps you on your toes when it comes time for the actual examination.

If you choose to cycle through the program once again, you can't help but notice that the format has been shuffled each time. This feature should keep you from memorizing the answer locations and/or corresponding letter.

I loaded all the theory programs several times, not only to get the information for this review, but to also see how well I could do the test! Absolutely no load difficulties or drop-outs were encountered at all. I attribute this fact to the excellent brand of tape utilized. Micro-80 markets its own line of professional data cassettes which are wholesale priced and have proven to be 100% error-free.

When I first acquired the course, I talked with the founder of Micro-80, Bill Gosney WB7BFK. Bill is an Associate Editor of *73 Magazine* and an avid contest and DX operator. Bill indicated that all software creations from Micro-80 were the efforts of in-house programmers as well as associate programmers the world over. I was especially surprised to learn that Micro-80's staff of in-house programmers consisted of at least a half dozen licensed amateurs. I learned that each study package took over 6 months of research and preparation to ensure that it is consistent with the actual FCC examination being administered at this time. While each course covers all that is needed to successfully pass the FCC exam, it never hurts to over-prepare. One should consult other study materials such as those found in the *73 Magazine* Radio Bookshop and through the various advertisers in *73*.

According to Bill at Micro-80, his corporation will soon have a Morse Code Training Course that will be useful to the beginner as well as the expert. Additional information about Micro-80 products and services may be obtained by writing *Micro-80 Incorporated, S-2665DF North Busby Road, Oak Harbor WA 98277*. Reader Service number 477.

Dave Fisher KA0BYS
Bettendorf IA

HAM HELP

I would like to get in touch with anyone who has made the SSB squelch mod to the IC-211. This modification was described in the June, 1980, issue on p. 69. I completed the two wiring changes shown in the article and could not detect any change in the operation of the radio. Help!

Robert Parker
1226 May Street
Shelton WA 98584

I need help finding information to connect an IBM Selectric typewriter to a Radio Shack 64K computer. This will include the interface and mechanical connections to the typewriter.

Irwin M. Schmuckler
Box 244
Graterford PA 19426

CONTESTS

from page 16

send "IPA," 2-letter state abbreviation, RS(T), and serial number.

FREQUENCIES:

CW—3575, 7025, 14075, 21075, 28075.

SSB—3650, 3775-3800 (European DX), 7075, 14295, 21295, 28650.

SCORING:

Every completed QSO counts 2 points on 80 and 40 meters, 8 points if DX on 80 or 40 meters, and 4 points for all contacts on 20/15/10 meters. The multiplier is the total number of IPA countries and states worked per band.

For IPA members only, an IPA country and each US IPA state will be counted for multiplier and QSO only if an IPA station in that country/state has been worked. QSOs with DXCC countries or US states which are not listed in the IPARC membership list count only 1 point and do not count as a multiplier.

ENTRIES & AWARDS:

Each IPA member, non-member, and SWL with the highest score will receive a certificate and will be honored in the Award Chronicle of the International Police Association Radio Club. Entries must be postmarked no later than December 31st and sent to: IPARC Secretary, Richard A. Ridley G3UTX/G4IPA, 23 Greenacre, Worlebury, Weston-Sup-Mare, BS22-9SL, Great Britain.

For US hams, contest logs along with SHA rules, IPARC world membership list, and SHA application sheets are available from: Vince Gambino WB4QJO, 7606 Kingsbury Road, Alexandria VA 22310. Please include a large envelope with $.28 postage.

EUROPEAN DX CONTEST —RTTY

Starts: 0000 GMT November 8
Ends: 2400 GMT November 9

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operation out of the 48-hour period are permitted for single-operator stations. The 12 hours of non-operation may be taken in one, but not more than three periods at any time during the contest. Operating classes include single operator, all band, and multi-operator, single transmitter. Multi-operator, single-transmitter stations are only allowed to change band one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 through 28 MHz. A contest QSO can be established between all continents and also one's own continent. Each station can be worked only once per band.

EXCHANGE:

Exchange the usual six-digit number consisting of RST and progressive QSO number starting with 001.

SCORING:

Each QSO counts 1 point. Each QTC (given or received) counts 1 point. Multipliers will be counted according to the European and ARRL countries list. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. The final score is the total QSO points plus QTC points multiplied by the sum total multipliers.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to another station, the general idea being that after a number of stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported, i.e., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. Only 10 QTCs to a station are permitted. You may work the same station several times to complete this quota, but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the Contest Committee are final. It is suggested that the log sheets of the DARC or equivalent be used. Send a large SASE to get the wanted number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than December 15th. North American residents may send their applications and logs to: Hartwin E. Weiss W3OG, PO Box 440, Halifax PA 17032 USA.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HBØ, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OHØ, OJØ, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1346, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, 9H1.

INTERNATIONAL OK DX CONTEST

Starts: 0000 GMT November 9
Ends: 2400 GMT November 9

Participating stations work stations of other countries according to the official DXCC country list. Contacts between stations of the same country count for multipliers, but have no QSO point value. Each station may be worked once on each band. Use all bands, 160 through 10 meters, on phone or CW. Cross-band or cross-mode contacts are not valid. Operating categories include: A—single operator, all bands; B—single operator, one band; C—multi-operator, all bands. Any stations operated by a single person obtaining assistance, such as in keeping the log, monitoring other bands, tuning the transmitter, etc., is considered a multi-operator station. Club stations may work in category C (multi-op) only.

EXCHANGE:

RS(T) and 2-digit number indicating the ITU zone. Please note the ITU zones are quite different from the ARRL zones! For a list and map of the ITU zones, send 2 IRCs to the entry address listed below.

SCORING:

Each QSO counts one point, or 3 points if with an OK station. Final score is QSO points times the total number of ITU zones worked on each band.

ENTRIES:

A separate log must be kept for each band and must contain the full data. The log must contain in its heading the category of the station (A,B,C), name, callsign, address, and band(s) used. Also show the total number of contacts, QSO points, multipliers, and total score. Each log must be accompanied by the following declaration: "I hereby state that my station was operated in accordance with the rules of the contest as well as all regulations established for amateur radio in my country, and that my report is correct and true to the best of my belief."

A certificate will be awarded to the top-scoring operators in each country and each category. The "100 OK" Award may be issued to stations for contests with 100 OK stations, and the "S 6 S" Award or endorsements for individual bands may be issued to a station for contacts with all continents. Both awards will be issued upon a written application in the log and no QSLs are required. Logs must be postmarked no later than December 31st and sent to: The Central Radio Club, PO Box 69, 113 27 Praha 1, Czechoslovakia.

DARC CORONA 10-METER RTTY CONTEST

Contest Period: 1100 to 1700 GMT November 15

This is the last of four tests during the year sponsored by the DARC eV to promote RTTY activity on the 10-meter band. Use the recommended portions of the 10-meter band.

EXCHANGE:

RST, QSO number, and name.

SCORING:

Each station can be contacted only once. Each completed 2-way RTTY QSO is worth 1 point. Multipliers include the WAE and DXCC lists and each district in W/K, VE/VO, and VK. Also count each different prefix as a multiplier. The final score is the total number of QSOs times the total multiplier.

AWARDS:

Plaques will be awarded to the leading stations in each class with a reasonable score present. Operating classes include: Class A for single or multi-op, and Class B for SWLs.

ENTRIES:

Logs must contain name, call, and full address of participant. Also show class, times in GMT, exchange, and final score. SWLs apply the rules accordingly. Logs must be received within 30 days after the test. Send all entries to: Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee, West Germany.

FCC

FCC BEGINS PHASE II OF FEE REFUND PROGRAM

Millions of Americans are eligible to apply for approximately $31 million in fees to be refunded by the Federal Communications Commission under Phase II of its refund program, according to an announcement by the Commission.

Individuals who paid to the Commission fees of more than $4 but $20 and less between August 1, 1970, and February 28, 1975, may be eligible for a partial refund.

However, the Commission emphasized that the CB (Citizens Band) licenses that cost $4—granted March 1, 1975, or later—*do not* qualify for a refund.

Since June 1979—under Phase I of this program—the FCC has refunded more than $49 million in fees collected from broadcasters, common carriers, electronic equipment manufacturers, aviation and marine radio users, and certain amateurs.

Fees to be refunded in Phase II include those collected for amateur radio, aviation radio, land mobile, maritime radio microwave and CATV systems, restricted radio telephone permits, type certification requests for equipment operating under Part 18 of the Commission's rules, and cable television notifications under Section 74.1105.

The refund program was developed in response to four decisions by the U.S. Court of Appeals for the District of Columbia Circuit in December, 1976. The court held that fees collected by the FCC between August 1, 1970, and December 31, 1976, were not valid. The FCC was directed to recalculate those fees and make refunds.

To request a refund under Phase II, licensees must obtain a copy of the Fee Refund Program request form and instructions (Phase II). It is available at FCC Field Offices or by mail from the FCC Refund Program Office, PO Box 19209, Washington DC 20036.

Licensees should be certain they are due refunds before filing for them. Complete information is contained in the request form and instructions.

For specific details about the fee refund program, licensees may call the toll-free number: 800-424-2901. This number is not to be used for other FCC business or complaints.

REVIEW

Vertical Users: Novice to Extra
by Charles "Doc" Schwartzbard AF2Y
Danrick Enterprises, Clifton NJ

"What actual advantage, if any, does height above ground of a vertical play in working DX? Can rf obstacles be overcome to allow success with a vertical under crowded city conditions? Can a low ground-plane installation with a few radials surpass a grounded installation using twice as many radials?" It is these kind of questions that AF2Y's book, *Vertical Users: Novice to Extra*, tries to answer.

You won't find impedance charts or directional plots in this thin 35-page volume. The author presents the results of the hundreds of on-the-air tests for you to analyze and then decide what kind of vertical setup is best. "Doc" AF2Y makes no claim that his methods or results are scientific. Instead, he bases his conclusions on the comparative signal reports given by operators on the other end of a QSO.

Vertical Users: Novice to Extra contains three separate reports. One compares the performance of roof-mounted verticals versus a ground-mounted vertical with and without radials as well as a pole-mounted Hustler 5BTV with radials. A second study looks at the differences between two ground-mounted verticals, one with radials, the other without. The final report compares pole- versus ground-mounted verticals.

Each set of conclusions is based on at least 100 QSOs, and every band, 80 through 10 meters, is covered. Don't forget that the data is based on antennas at one particular location and you may or may not be able to apply the findings to your requirements. The results, in some cases, are startling and there is no way to generalize them for all bands and distances.

It wouldn't be fair for this review to divulge the conclusions reached in *Vertical Users: Novice to Extra.* Suffice it to say that a trap vertical needn't always have the reputation of being a compromise antenna. *Vertical Users: Novice to Extra* is available for $3.95 from more than 20 dealers nationwide or from Danrick Enterprises, 213 Dayton Ave., Clifton NJ 07011.

Tim Daniel N8RK
Terre Haute IN

HAM HELP

I am looking for a power supply transformer for a Globe King transmitter, model 500-A.

R. Keys WØDDF
1525 Roslyn Street
Denver CO 80220

I am trying to convert a clock to 24-hour format and need a schematic of the external wiring to a Texas Instruments TMS 1952 clock chip.

Rex D. Taulkva KA3FTN/4
3413 Covington Drive
Augusta GA 30904

I need an antenna changeover relay for a G. E. pre-Progress FM rig. I also need a schematic or manual for an AN/ART-13 transmitter.

B. Carling AF4K
5131 Raywood Lane
Nashville TN 37211
(615)-331-8461

Thanks to all those who sent copies of the *Handbook* article I needed to rebuild the "5 Band 50 Watter" I first built long ago.

Bill Graham N8BNK
Paris KY

I have a Flexowrite paper tape recorder and reproducer Model FL which I would like to use for RTTY with my TRS-80. If anyone can give me information about how I should interface this unit, I would be very pleased.

Bro. Nicholas Lorson WB3HDJ
St. Anthony-on-Hudson
Rensselaer NY 12144

Wanted: Diagram or instruction book for a Premier Signal Generator. You find it, I'll copy it!

Louis Albizati
8312 SE Skylark Ave.
Hobe Sound FL 33455

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Your ham headquarters located in the heart of the midwest. **Hoosier Electronics, Inc., 43B Meadows Shopping Center, P.O. Box 2001, Terre Haute IN 47802, 238-1456.**

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The ham store of N.E. you can rely on. Kenwood, ICOM, Wilson, Yaesu, DenTron, KLM amps, B&W switches & wattmeters, Whistler radar detectors, Bearcat, Regency, antennas by Larsen, Wilson, Hustler, GAM. **TEL-COM Inc. Communications & Electronics, 675 Great Rd., Rt. 119, Littleton MA 01460, 486-3040.**

Laurel MD

Kenwood, Drake, ICOM, Ten-Tec, Swan, Dentron, Tempo and many ham accessories. Also computers by Apple and Exidy. **The Comm Center, Inc., Laurel Plaza—Rt. 198, Laurel MD 20810, 792-0600.**

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the January issue must be in our hands by November 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

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J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7A	14	21A	21
ARGENTINA	14	7A	7	7B	7B	7	14	21A	21A	21A	21A	21A
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14B	21	21	21A	21A
CANAL ZONE	14	14	7	7	7	7	14	21A	21A	21A	21A	21
ENGLAND	7	7	7	7	7	7A	14	21A	21A	21	14	7A
HAWAII	21A	14	7B	7	7	7	7	7B	14	21A	21A	21A
INDIA	7	7B	7B	7B	7B	7B	14	21	14	14B	7B	7B
JAPAN	14	14	7B	7B	7	7	7	7B	7B	7B	7A	21
MEXICO	14A	14	7	7	7	7	7	14A	21A	21A	21A	21
PHILIPPINES	14A	14	7B	7B	7B	7B	7B	14B	14	14	14B	14
PUERTO RICO	14	7	7	7	7	7	14	21	21A	21A	21	14A
SOUTH AFRICA	14	14	7	7B	7B	14	21A	21A	21A	21A	21A	21
U.S.S.R.	7	7	7	7	7B	7B	14	21A	21	14B	7B	7
WEST COAST	21	14	7	7	7	7	7	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21A	14	7	7	7	7	7	7	7A	14	21A	21
ARGENTINA	21	14	7	7B	7B	7	14	21A	21A	21A	21A	21A
AUSTRALIA	21A	14A	7B	7B	7B	7B	7B	14B	21	21	21A	21A
CANAL ZONE	21	14	7	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7	7	7	7	7	7	14	21	21A	21	14	7
HAWAII	21A	14A	14	7	7	7	7	7	14	21A	21A	21A
INDIA	14	14	7B	7B	7B	7B	7B	14	14	14B	7B	7B
JAPAN	21A	14	7B	7B	7	7	7	7	7B	7B	14	21A
MEXICO	14	7	7	7	7	7	7	14	21A	21A	21	14
PHILIPPINES	21A	14	7B	7B	7B	7B	7B	7	14	14	14B	21
PUERTO RICO	14	14	7	7	7	7	14	21	21A	21A	21	21
SOUTH AFRICA	14	14	7	7B	7B	7B	14	21A	21A	21A	21A	21
U.S.S.R.	7	7	7	7	7B	7B	7B	14	21	14B	7B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21A	14	7	7	7	7	7	3A	7	14	21	21A
ARGENTINA	21A	14	14	7B	7B	7	7A	21	21A	21A	21A	21A
AUSTRALIA	21A	21	14	14	7	7	7B	7	14	21	21A	21A
CANAL ZONE	21A	14	7A	7	7	7	7	21	21A	21A	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	14	21A	21	14	7B
HAWAII	21A	21A	14	14	7	7	7	7	14	21A	21A	21A
INDIA	14	14A	14B	7B	7B	7B	7B	7B	14	14B	7B	7B
JAPAN	21A	21	14	7	7	7	7	7	7	7B	14	21A
MEXICO	21	14	7	7	7	7	7	14	21A	21A	21A	21
PHILIPPINES	21A	21A	14	7B	7B	7B	7	7	14	14	14B	21A
PUERTO RICO	21	14	7A	7	7	7	7	14A	21A	21A	21A	21
SOUTH AFRICA	14A	14	7	7B	7B	7B	7B	14	21A	21A	21A	21
U.S.S.R.	7B	7	7	7	7B	7B	7B	14	21B	14B	7B	7B
EAST COAST	21	14	7	7	7	7	7	14	21A	21A	21A	21A

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

november

sun	mon	tue	wed	thu	fri	sat
						1 G
2 F/SF	3 P/SF	4 P	5 F	6 G	7 G	8 G
9 G	10 G	11 F	12 F	13 F	14 G	15 G
16 G	17 G	18 G	19 G	20 G	21 G	22 G
23/30 G/G	24 F	25 G	26 G	27 G	28 G	29 G

December 1980 $2.95

73 MAGAZINE

FOR RADIO AMATEURS

Who Really Invented Radio?

INFO

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Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the 73 editorial offices. "How to Write for 73" guidelines are available upon request.

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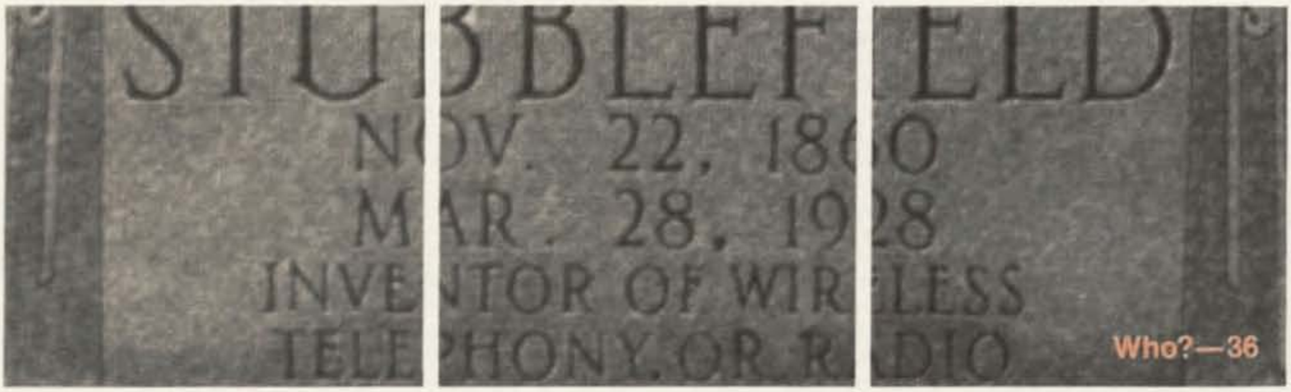
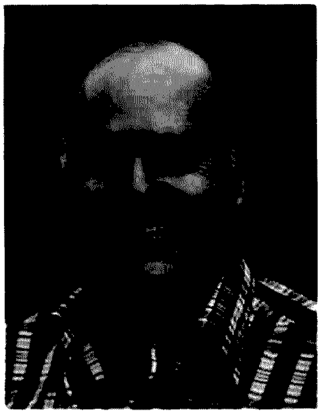
73 MAGAZINE



Who?—36

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



SHADES OF THE PAST!

The year was 1950 and Wayne Green, not very long out of college, was fresh from a job in Dallas as a television producer-director (the damned station went from live productions to all film, throwing the entire production crew out of work). I was looking for something temporary to tide me over until I could find work in television again.

Having a first class ticket and experience as an announcer, I put an ad in *Broadcasting*, looking for a combination spot: engineer-announcer. There was a big need for that kind of experience at that time and I was soon sitting there sorting out telegrams from over 50 broadcast stations with good jobs open. One of the best bets was from WSPB in Sarasota, Florida.

I loaded my ham gear into my old 1941 Ford . . . NBFM kilowatt for all bands, dipole antenna, SX-28A receiver . . . and drove down to Sarasota, the "Air Conditioned City." It was pleasant there temperaturewise, but the mosquitos were worse than those in New Jersey or the swamps of Brooklyn.

It didn't take long before I settled into a comfortable routine, opening the station mornings, lying on the beach afternoons, and hamming evenings. One of the chaps who popped in to do a radio show daily was Bandel Linn, also a ham. We hit it off right away. Linn lived nearby on one of the keys and his mailbox said, "Corporal Bandel Linn." This was in retaliation for all the other mailboxes with retired colonels, generals, and such.

One of Bandel's best friends was a little known writer, McKinley Cantor. He became better known after his book, *Andersonville* was published. He's had a peck of best sellers down through the years. McKinley would come by the station occasionally with Bandel and we'd talk. I think the thing I enjoyed the most about both of them was their sense of humor.

McKinley did a number on Bandel one time. He went out and bought an enormous number of old books from a defunct used book store. He had a stamp made up which said, "If found, please return to Bandel Linn" . . . etc., along with Linn's address. McKinley traveled a lot and would drop off these books in stores everywhere he went. Bandel was soon up to here in returned books, arriving with every mail from all over the country . . . or people driving up to bring them back personally.

When I decided to start a ham magazine in 1960, I got in touch with Bandel, who in addition to being a great radio personality was also a nationally known cartoonist, and got him to do the cover for issue #1. Bandel is still cartooning and broadcasting, holding forth from Pensacola these days. I get to see him every now and then when I get down to Mobile for the reunion of my old submarine crew.

There are a few people I've known who have really been enjoyable to talk with . . . such as Jean Shepherd, John Campbell, and Linn. All are hams, oddly enough, though I seldom talked hamming with any of them. John is gone now, but he left a raft of admirers. I'm sure it was his editorials in *Astounding Science Fiction* . . . and later in *Analog* . . . which got me started writing long editorials. I enjoyed them for years and it just never occurred to me that an editor would do anything other than write long editorials. I don't think I gave it much thought until a couple of months ago when it suddenly dawned on me that I'm probably the *only* editor writing these damned things.

Of course the pressures of writing editorials for three big magazines a month, plus a fourth just for the microcomputer industry, and the shadow of two more magazines getting started all helped to focus my awareness on a good thing overdone. Now, with a month-long trip coming up to Asia, the managing editors are pushing me to write a month ahead. Hells bells, I can hardly get 'em done for one month, much less two.

We've got a series of cartoons by Bandel starting in the magazine. I hope you enjoy his humor as much as I do.

THAT ARKANSAS WARHEAD

Those of you who read the fine print on the silo explosion in Arkansas may have noticed that the newspapers were able to print a transcript of a tape-recorded Air Force radio conversation about the search for the warhead. Some chap has receivers tuned to Air Force and other channels with recorders ready in case of any emergency . . . then he is able to sell the information to the papers. If ever there was a case where the FCC rules in Section 605 regarding the privacy of radio transmissions was being broken, it is here. If the FCC lets this go untouched, they are turning their heads when their rules are clearly being broken.

It is against the law to sell information gotten over the air from anything other than broadcast stations. This is the heart of 605. The reception is not prohibited, only the *use* of the information. What are you going to do about this, FCC?

SAROC SHOOTS SELF IN FOOT

The pitiful shreds of what was once a halfway decent hamfest will be aired again in January. This, I believe, is a commercial exploitation of hams for the personal gain of one chap, who the last I heard was disavowed by all ham clubs which had ever tried to work with him. At the last of these hamfests I attended, the technical sessions were a joke and the exhibits few. The advanced registration for this disaster is $16, if you are that eager to throw your money away.

The hamfest has been bounced from one hotel to another, presumably for some good reason. Now it is at the Dunes and filling a date obviously unwanted by any sane group: January 1. Bring playing cards, if you are so totally desperate on New Year's Day as to go to this silly thing . . . so at least you'll have *something* to do.

One of the major ham dealers tried exhibiting at the show not long ago and went away totally disgusted. Other than some free booze courtesy of *Ham Radio* magazine, apparently out to help create more alcoholics, the dealer felt ripped off.

If you are absolutely desperate to go to Vegas, wait a couple days and catch the Winter Consumer Electronics Show, starting January 8th. Then, if you still have time on your hands, why not come up to Vail for the ham industry convention January 10-17th?

NARA EVAPORATED

A couple of months ago, I wrote about what appeared to be a scam to fleece hams, with the only action I could see coming from a chap with a bad record . . . convicted of conning hams. If there was anyone who did not get his money back from NARA, I'd like to hear from them.

I first heard of this one while at a hamfest in Wiesbaden, Germany, last May. A chap there had just come from the Dayton Hamvention and mentioned that NARA was there, taking memberships. I was at a loss to understand how a group could get started without being in touch with me . . . if they were legiti-

mate. The story of a group of ten hams putting up $35,000 each in seed money didn't ring true either. I know many of the hams with a spare $35,000 and I can't believe they would put out that kind of loot without checking with me.

Then, I found out who the chap was behind the whole thing and remembered his previous record. Ask the ARRL about it; *QST* ran his ads which brought about the troubles and the conviction. But if something like this was afoot, why no word from the ARRL? They certainly couldn't say they didn't hear about it. . .or that they didn't know the chap. I have no explanation for this.

Once my editorial piece appeared, NARA seemed to disappear. I got a letter from a ham who had joined, saying he had gotten his $10 back and that the NARA telephone number had been disconnected, with no forwarding number. He did some sleuthing and found that the chap had moved to Virginia and was now operating under the name of Keswick Sales, with ads in the yellow sheets. The report went on to say that over two hundred orders had been received with payments, but nothing had been shipped and no payments had been returned. No explanation by mail to the customers. It appears that the FTC rules on back orders has already been broken. Will he move on again, leaving mulcted hams in his wake?

ELECTRONIC DESIGN BUNK

I really hate it when I see another magazine print a letter from some uninformed person and it puts down amateur radio. Thanks to W5IFH for sending me a clipping from the September 13th issue of *Electronic Design*, wherein is a letter from a Collins man, a program engineer named Roe. He fears that amateurs now are "nothing more than hobbyists and gadgeteers, lacking the inquisitive and inventive spirit which made the early days of amateur radio so productive. Now, the only innovations come from the R&D labs of the amateur equipment manufacturers."

Amateur radio needs this type of hogwash like another Incentive Licensing attack. The facts are quite otherwise, as Roe would know if he were a reader of *73*. It is true that the FCC has been doing all in its power to prohibit amateurs from experimenting and pursuing the FCC's own regulations (see 97.1c), but despite this, amateurs have been building more than ever before in history and have been developing new circuits and modes of communications.

In case you think that hams are not building . . . and I get that crap a lot from old-timers who

Continued on page 189

Well . . . I Can Dream, Can't I?

by Bandel Linn K4PP

"I live next door and I came over to thank you for those little squiggles and lines on my TV—They're very interesting!"

LOOKING WEST

Bill Pasternak WA6ITF
24854-C Newhall Ave.
Newhall CA 91321

OPEN REPEATERS DON'T EXIST DEPARTMENT

There is no such thing as an "open" repeater—at least not in the eyes of the Federal Communications Commission. This came about as the final result of a well-intentioned rulemaking request filed some three years ago by a Texas amateur. Jones Talley W5TJE had requested that closed and private repeater operation be outlawed. In addition, Mr. Talley felt that much on-channel interference between repeaters could be eliminated by lowering all repeater power levels.

I recently interviewed Mr. Talley for Westlink and found him to be a most delightful person. Moreover, he is a very dedicated amateur. He told me that the reasoning behind his twin petitions (There were two, but the FCC elected to combine both into one rulemaking action.) was that he and many others felt that repeater operations that required membership in an organization were not in the spirit of the amateur service. Further, that with the large number of repeaters currently operating, there was precious little spectrum left for new operations. By lowering the power levels, there would be less chance of on-channel interference as new systems came into being. I should add that Mr. Talley is a broadcast engineer with many years of experience behind him. He understands very well the many technical aspects of radio communication.

So, Mr. Talley elected to file his petitions to lower maximum power levels for repeater operation and also to gain acknowledgement for the concept of the open repeater, a concept that we as amateurs have understood for years. For many moons, things sat quiet in Washington—not a peep on the topic. Most amateurs, including me, had all but forgotten that such a rulemaking request was on file with the Commission.

Then, in late July, came the blockbuster. It was all but unnoticed by most hams since it was merely a dismissal order on two rulemaking requests, one of which belonged to Mr. Talley. It was only after reading the order several times that the implications came to light, that in the eyes of the FCC, no such thing as an open repeater existed. In fact, the text you are about to read is that of the order itself. I suggest that you pay close attention to the first portion of Section 2, because this may well set a precedent.

Before the
Federal Communications Commission
Washington, D.C. 20554
PR
FCC 80-351
27525

In the Matter of

Rulemaking petitions
requesting "open" repeaters; and,
to require license endorsement
authorizing repeater operation.
RM-2844 and RM-3461

ORDER

Adopted: June 17, 1980;

Released: July 2, 1980

By the Commission:

1. Rulemaking petition RM-2844, submitted by Jones P. Talley (W5TJE), of Dallas, Texas, proposed that Section 97.85 of the Amateur Radio Service rules be amended by adding a provision that no repeater be operated as a "closed" repeater. In support of his petition, Mr. Talley offered these reasons. He said that, in the majority of the country, there are no longer any available frequencies for new repeaters. Further, according to the petitioner, no one, in the history of the Amateur Radio Service, has ever had an assigned or a closed frequency. Mr. Talley feels that the Amateur Radio Service should remain open and clear for all properly licensed Amateur radio operators. In addition, petitioner suggested that Section 97.67 of the Commission's Rules be amended to lower the maximum amount of power that Amateur radio stations in repeater operation could use. For example, on frequency bands above 52 MHz, the power would be 50 Watts, rather than 100 Watts, where the antenna height above average terrain is below 100 feet. His reason for the proposal is that he believes that most repeaters are covering more area than just the local area, thereby causing interference between repeaters in surrounding areas. This, in turn, he alleges, is why the surrounding areas have no available frequencies. Mr. Talley says that lower maximum power levels will correct this problem. Only one comment was filed in RM-2844. The Amateur Radio Club of the Veterans Administration Medical Center, Montrose, New York, supported the petition saying that closed repeaters violate the spirit of Amateur radio communications.

2. With respect to the matter of forbidding a station in repeater operation to be closed to anyone, we do not agree that such a stance is desirable. The control operator of the station must be in a position to deny access to any person who is violating our rules. Any other view would be construed as our approval of unlawful acts. Moreover, a fundamental principle is at stake here. At all times, the control operator of a station in repeater operation is responsible for the proper operation of the station. Open repeaters would militate against that basic operator accountability. Further, we do not concur in Mr. Talley's suggestion to lower the maximum power levels for repeaters. The maximum power levels specified in the present rules are not mandatory. Less power may always be used. In fact, we expect Amateur radio operators to take appropriate means to avoid interfering with each other's transmissions. Amateur radio licensees have always been known for self-disciplining and a cooperative spirit in the use of Amateur radio frequencies. There is no reason to believe that they have relinquished working together to solve mutual usage problems.

5. Accordingly, in view of the reasons herein given, it appears that the public interest would best be served by dismissing the instant petitions. Therefore, IT IS ORDERED, That RM-2844 and RM-3461 ARE DISMISSED and that these proceedings ARE TERMINATED. For further information, contact Maurice J. DePont, 2025 M Street, N.W., Washington, D.C. 20554, (202)-254-6884.

FEDERAL COMMUNICATIONS COMMISSION
William J. Tricarico
Secretary

Now, before you run out and tell all your users that they must immediately purchase some form of CTCSS generator if they intend to continue operating on your repeater, sit back a moment and permit me to point out why this is not necessary. We must go back into the archives a bit, but I think you will enjoy the trip, especially if you are a newcomer to FM.

In the late 1960s, amateur radio FM and repeater operation took off like the proverbial bat out of you know where. After a while, some amateurs who just could not leave well enough alone decided that what repeaters needed were rules, and a number of petitions were sent to the FCC requesting these. As usual, time went by, and in the interim, the problems inherent to the implementation of anything new were solved. In this case, the solution took the form of individuals and groups providing voluntary coordination for repeater operations. Then, with the arrival of the 1970s, came something known as Docket 18803. 18803's implementation brought FM relay growth to a screeching halt. The regulations were *that* restrictive. They also were not needed—the problems had been solved.

For a number of years, amateurs from all over the nation worked hard to try to initiate some relief from the restrictions of 18803. Among these was Capt. Richard McKay K6VGP. Dick owned a "private" category repeater located in Palos Verdes and was able to obtain "Special Temporary Authority" to operate his repeater without 24-hour-a-day, full-time control operators on hand.

The success of this experiment on WR6AAD convinced the Commission to issue another "Special Temporary Authority" to the Palisades Amateur Radio Club of Culver City, California, for a similar experiment. After a year's time and many filings with the Commission detailing progress of the experiments, a petition was filed to permit what was termed "automatic remote control" over amateur repeaters.

One of the first actions taken in the deregulatory process was the adoption of two control standards based upon the classification a repeater operated under. A closed or private repeater could operate under the doctrine of "fully automatic remote control," while open repeaters were given limited relief in the form of "semi-automatic remote control." I won't go into the details of each at this time; it would take pages to do so. An exact account of the entire deregulatory process can be found by going through back issues of *73* containing this column. We lived it and we reported on each step in the long process.

What is important is the contention that this first step in deregulation of amateur relay activity initially gave FCC recognition of both open and closed/private repeater operation. This being the case, the report and dismissal order on RM-2844 is a direct contradiction of what has been stated in the past. Additionally, while we in amateur radio have developed our own definitions concerning relay system operation categorization, the FCC never has done likewise. You and I know what constitutes an open, closed, or private repeater, but the Commission has never seen fit to offer any definitions of their own.

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DX

Jim Cain K1TN
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Vernon CT 06066

THE NEW BREED

Comments made here the past few months have brought some interesting letters, most reinforcing our own attitudes about DXing today compared to a decade or more ago. As very little of life in 1980 is like life in 1960, it comes as no particular surprise that amateur radio in general and DXing specifically often leave many old-timers somewhat cold.

For example, the FCC has just announced that the CW portion of their exams is changing again, with the exams to be only ten questions, fill-in-the-blank instead of multiple choice, and a passing grade will be only seventy percent instead of eighty. This is a test?

On the same sheet where we read that FCC news was the story of a Conditional class amateur who was traversing the court system because he had not, for some obscure reason, been grandfathered to General class. The FCC had called him in to take a 13-wpm code test and he refused. Obviously, he doesn't know the code, probably cheated on his original Conditional test (with the aid of another amateur, sorry to say), and that's that.

Aside from the FCC making it possible for people to operate kilowatt transmitters on the HF bands with little or no knowledge of what are recognized as basic radio techniques, the actual styles of operating today often add to the confusion and lowering of standards on the bands. Here's a case:

An American operated last autumn from Africa, on CW only, from a fairly rare country. Great, you say, at least he knows the code! True, but his methods frustrated many who also know the code. Operating split, this DXer listened up in frequency, often as much as 50 kHz. In addition, he immediately moved his receiving vfo after each contact, making it nigh impossible for the good operators to ply their trade of finding his last contact, zeroing the frequency, and making one short call on his known listening frequency—not "tail-ending," mind you, but just being where the DX is listening is operating at its best. It was not to be in this case.

It used to be that when the neophyte DXer discovered he could not always crack the pileups with a hundred Watts and a dipole, pennies began going into the bank for an amplifier, and a safety belt was purchased for future antenna work. Learning to trust the belt, lean back, and use both hands on the tower was part of the process whereby one became a "real ham," a "true DXer," or whatever. It was simple: If you couldn't get through to the station you wanted, either your signal was too weak or your operating technique was not appropriate. And the solutions were equally straightforward: Build a better station, practice operating, and be patient. As a result, the bands continually witnessed new crops of hams who became proficient by their own efforts. (Made it without using the word "bootstraps!")

Now that this hole has been dug, I might as well just climb on in. Today's saviors of the bands have found new solutions to the devastating blow of not being able to work your favorite DX station. Those solutions are called "nets" and "lists." They have ruined DXing for what it once was: the second most competitive aspect of amateur radio (after contesting).

It seems unlikely that anyone reading this column does not know the net and list style; either one uses it or hates it or, occasionally, both. Let's look at the implications of this new breed of operator and the possible future in store if the trends continue.

The list and net operator (L/N) will tell us that the new style enables the weaker stations to work through to the DX, that L/N maintains order on the bands, that it gives everyone a fair shake, and, hoo-boy, here it comes, that new DX operators are spared the massive pileups which had previously driven a few of them into other pursuits, such as stamp collecting. We are sure to hear from some of you with other justifications, such as that there are just too many hams on the bands now when compared to 1960 and new techniques are consequently required, or that maybe not everyone can afford a second vfo in order to operate split.

Of course, it will be said that if an operator wishes to use L/N because he is an inexperienced amateur on Island X (which everyone needs), it is his own decision and those who don't like it can lump it. Those who play his game will be rewarded with a contact (often despite the fact that they can't hear him). Those who refuse to play the game will go away empty-handed.

A parallel: The US national speed limit is now 55 mph, on highways designed for 70 mph + driving. This was instituted in 1974 to "save gas," and was later further justified by a contrived set of statistics "proving" the reduced speeds resulted in fewer highway accident deaths. Voilà! The temporary law becomes permanent.

The fact is that L/N has driven off more avid DXers in a couple of years than pileups ever did in forty years. L/N has raised a cacophony of tooth grinding by those with beams, amplifiers, and savvy. L/N is what brought the "frequency policemen" and catcallers to their heyday, as they trash the frequencies in anger at their inability to just jump in there and call until they work what they want.

In fact, highway deaths have not gone down, particularly on the limited-access interstates. As for fuel consumption, guzzlers do use less fuel at 55 than at 70; so do, for that matter, all autos. Now here's the point: Say you are driving, oh, a diesel Rabbit at 50 mpg and are restrained to 55 mph so the Cadillacs can produce 18 instead of 15 mpg. You have gone the full mile to conserve fuel; you have reacted to the situation in the most efficient, intelligent manner. Yet, you are punished because you are in the minority.

Back to the new DX station on the band. You wrenched your back getting that new beam up, smelled up the entire house smoke-testing your new amplifier, but now you're LOUD. Further, you have practiced your ham radio hobby, not expecting to set the world on fire your first couple of years on the bands, but now you're a "good operator." Now you've found that DX station, but they've already taken calls from your call area and you might just as well turn off your radios. So mail your postcard to the list taker for the next time, take down your beam, and sell your amplifier, because when your turn comes, you won't need them. You won't need your brain, either.

What's coming in the future? Unfortunately, probably more of the same, as mediocrity breeds mediocrity. As more and more new DXers come to know no operating style other than L/N, they will demand, verily, that L/N becomes the norm. New, inexperienced operators may be easily enticed into the rut, during that period of time when they need a sheet to determine whether it is the plate current or the output that is supposed to be peaked. As L/N grows, additional DXers will be driven from the bands only to be replaced by still more L/N operators.

Make no mistake about it! It already is happening, and the pace is accelerating. Blame it on the lax FCC exams, on the Welfare State, on the "Me Decade," on the weather, on the Democrats, the Republicans, the hippies. The only ones who can reverse the trend and make DXing what it once was—a competitive activity—are you and me. DXing was never supposed to be easy, from the first time Hiram Percy Maxim used a relay in Windsor Locks to work from Hartford to Massachusetts. DXing has been the true spirit of amateur radio. If it ceases to be so, many will find new hobbies and hamming will be the less for their loss.

One thing L/N has done is given amateur radio column writers and bulletin editors some cannon fodder, as they stake their claims on one side of the issue or the other. You may disagree violently with this column's

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CONTESTS

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Atco NJ 08004

CONNECTICUT QSO PARTY
Starts: 2000 GMT December 6
Ends: 0200 GMT December 8
Rest period: 0500 to 1200 GMT December 7

Sponsored by the Candlewood Amateur Radio Association (CARA). Phone and CW are considered to be the same contest. Stations may be worked once on each band and each mode. Out-of-state portables and mobiles operating in Connecticut are requested to identify themselves as such as are Connecticut mobiles operating in other counties.

EXCHANGE:

Send QSO number, RS(T), and ARRL section or Connecticut county.

SCORING:

Out-of-state stations multiply total QSOs by the number of Connecticut counties worked (8 maximum). Connecticut stations multiply total QSOs by the sum of ARRL sections and provinces. Additional DX contacts count for QSO points, but only one DX multiplier overall is allowed. W1QI, the club station, will be operating CW on the odd hours and SSB on the even hours, and counts as 5 points on each band and mode. Novice contacts count as 2 points each and OSCAR contacts count 3 points each.

FREQUENCIES:

CW—40 kHz up from the bottom of each band.

SSB—3927, 7250, 14295, 21370, 28540.

Novice—3725, 7125, 21125, 28125.

ENTRIES & AWARDS:

A Worked All Connecticut Counties certificate will be awarded to each station working all Connecticut counties. Other awards given as usual, minimum of 5 QSO points! Logs must show category, date/time (GMT), stations, numbers, bands, QSO points, and claimed scores. Enclose a large SASE for results. Logs must be postmarked by January 2nd and sent to: CARA, c/o Steve Grouse KA1ECL, 3 Queens Court, Danbury CT 06810.

CANADA CONTEST
Starts: 0001 GMT December 28
Ends: 2359 GMT December 28

Sponsored by the Canadian Amateur Radio Federation, the contest is open to all amateurs. Use all bands from 160 to 2 meters, CW and phone combined, and everybody works everybody. Classes of entry include: single-operator, all band; single-operator, single-band; and multi-operator, single-transmitter, all band. All contacts with amateur stations are valid. The same station may be worked twice on each band: once on CW and once on phone. No cross-mode contacts and no CW contacts in the phone bands allowed.

EXCHANGE:

Signal report and consecutive serial number starting with 001. VE1 stations will also send their province (NS, NB, PEI).

SCORING:

10 points for each contact with Canada, 1 point for each contact with others. 10 bonus points for each contact with any CARF official news station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band and mode (12 provinces/territories × 8 bands × 2 modes for a maximum of 192 possible multipliers).

FREQUENCIES (as applicable):

Phone—1810, 3770, 3900, 7070, 7230, 14150, 14300, 21200, 21400, 28500, 50100, 146520.

CW—1810, 3525, 7025, 14025, 21025, 28025, 50100, 144100.

Suggest phone on the even hours (GMT), CW on the odd hours.

AWARDS:

The CARF Canada Contest Trophy will be awarded to the highest scoring single-operator entry. Certificates will be awarded to the highest score in each entry class in each province/territory, USA call area, and DX country, to the highest score from a Canadian non-advanced amateur (no phone on 3.5-21 MHz), and where participation warrants.

ENTRIES

A valid entry must contain log sheets, dupe sheets, and a summary sheet showing a chart of multipliers per band/mode and score calculation. Send your entry with comments to: Canadian Amateur Radio Federation, 203-1946 York Avenue, Van-

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CALENDAR

Dec 6-7	**ARRL 160-Meter Contest**
Dec 6-8	**Connecticut QSO Party**
Dec 13-14	**ARRL 10-Meter Contest**
Dec 28	**Canada Contest**
Jan 3-5	**Zero District QSO Party**
Jan 10-11	**Hunting Lions in the Air**
Jan 17-18	**73's International 160-Meter Phone Contest**
Jan 17-18	**Michigan QRP Club CW Contest**
Jan 17-19	**QRP SSB QSO Party**
Jan 18	**FRACAP Worldwide Contest**
Mar 7-8	**1981 SSTV Contest**
Mar 21-22	**Bermuda Contest**
Aug 8-9	**European DX Contest—CW**
Sep 12-13	**European DX Contest—Phone**
Nov 14-15	**European DX Contest—RTTY**

RESULTS

BERMUDA CONTEST 1980 RESULTS

West Germany

DK9WB	383,295
DK5EZ	343,600
DL7SU	113,220
DF6UO	109,410
DF9ZP	78,715
DK8OP	32,065
DF6JX	22,100
DF1JI	19,450
DF6AT	15,795
DL2OY	14,740

USA

W3MA	128,975
N1ZZ	125,775
KB8JF	71,225
K3DH	39,600
WA2RUX	31,510
W3HNK	25,415
K6SVL	16,260
KA1EP	15,900
W9RE	14,880
W2FFQ	12,500

United Kingdom

G4DSE	532,740
G3VPW	484,560
G3VOF	267,930
GI4ELQ	102,600
GI4ISR	72,080
G3TKF	56,140
G2FXQ	16,290
G4FJT	13,910
G4HQN	7,370
G4GFH	5,680

Canada

VE5RA	100,270
VE3HGZ	99,000
VE1AIH	72,450
VE3NE	45,560
VE2NL	43,520
VE3DJX	13,870
VE3KK	8,550
VE4ADS	2,520

Bermuda

VP9IB	3,025,000
VP9IX	1,128,245
VP9IW	557,230
VP9JQ	68,370

Check Logs

DFØHX	VP9CP
DLØJK	VP9HL
HI3DJP/W2	VP9II
VE3PE/VP9	VP9IJ
VE7VX	VP9KL
VP9AD	W3ARK

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

December would be a bleak month indeed, if it were not for the holidays at the end. Whether you celebrate Christmas or Hanukkah, or just enjoy exchanging gifts, the season provides a warm flicker in the middle of winter. This month, we will look at some gift ideas for the amateur involved in RTTY. Perhaps this will give you an excuse to let this copy of *73* sit around where someone else can see it!

At the outset, let me make it clear that I am not describing expensive or exotic items. Most of these will be under ten dollars, and many far less than that. Several of them are not even exclusively amateur radio items, which will make it that much easier for the spouse or child to find. Above all, I have tried to compile a list of unique gift ideas that are affordable, useful, and obtainable, any one of which would delight the heart of the recipient.

As any of us in RTTY know, it is the little things that mean a lot. A trip to any stationery store will turn up many items useful to the RTTYer. Ribbons are always needed by the hard-copy devotee. There is no need to look far and wide for Teletype® ribbons; standard Underwood typewriter ribbons are a perfect fit and are usually much more available. For hard usage, heavily inked cotton ribbons, specifically made for teleprinter applications, are best, and these may often be found at larger office supply houses.

What do we type on but paper, and this is another item often in short supply in the shack. I have found that standard roll paper, 8.5 inches wide, is available from most business form suppliers at a fairly reasonable price. Look in the Yellow Pages for a supplier near you and check several out. While you are asking, check on the availability of 11/32-inch paper tape. This is another perpetual "need" of the teleprintophile, especially one who is involved with RTTY art or traffic, both of which are quite popular this time of year. Although hamfests are usually the most economical places to stock up on these paper goods, they can be had, albeit at list price, from dealers in most areas.

Maintenance items for the mechanical teleprinter are often overlooked and fall into the "make-do" category. How about a big can of grease for the type bars? Lubriplate is one popular make and is available at most large hardware stores. Don't forget the oil for the felts. I use automobile oil; get something expensive for snob appeal—it goes a long way! Is the print all mucked up? Get back to the stationery store for some type cleaner. All kinds of products are available, from liquids to gobs of sticky stuff to press into the type. The kind I have found most useful is a sheet designed to be placed into the machine, like a piece of paper, with the ribbon off. Run all the characters a few times on tape and the type is clean! A sure winner for anyone.

Perhaps the ham is interested in keeping the shack looking tiptop (obviously never saw mine!). Black wrinkle finishes, such as are found on many kinds of RTTY equipment, perk up nicely under a coat of black liquid shoe polish. When you're getting a bottle, pick up some paste wax, the old-fashioned kind, for other equipment finishes around the shack. A bottle of spray-on glass cleaner would round out a "spic-and-span" gift package.

Another item, the need for which is obvious to anyone who ever worked on a teleprinter away from running water, is a box of pre-moistened hand wipes, like "Wash-n-Dry." Certainly not expensive, but throw it into any of the above packages, or by itself, and it will be appreciated the first time something breaks down.

For the RTTYer who is using a computer, consider a supply of cassettes or diskettes. Neither is very expensive, but they come in handy when you need to make a record of something. Diskette cases, which are now stocked by many office supply houses, come in useful for organizing the disk-based shack; cassette racks, which are available in a wide variety of styles at audio and discount houses, do the same for the taper.

Consider reading material. Subscriptions to *73 Magazine*, *RTTY Journal*, or other amateur radio publications may be just the ticket. If computers are involved, try *Kilobaud Microcomputing*, *80 Microcomputing* (for the TRS-80 addict), *68 Micro Journal*, or any of the other computer magazines. Look through the *73* Bookshop ad in the back of this magazine for many titles of interest to the RTTYer, computerist, and ham in general. There is surely one there to delight any ham.

In the realm of reading material that may be more difficult to come by, is there a set of manuals to the RTTY machine in your life? The Teletype Corporation put out extensive manuals on the Model 15, Model 19, Model 28, and other Teletype machines in common use. If you, or your ham, do not have them, check the ads for suppliers who may. Finding them may be difficult, but there will be real joy in the eyes when they detail the way to deal with a problem.

Want to spend a little more money? How about a low-priced demodulator? Monitors are available for those computer nuts who are still using converted TV sets. Other kinds of gizmos are out there, any of which would be eagerly received by a hungry ham. Logic probes, breadboard kits, and gift certificates at a local emporium on up to hundred-dollar counters, single-board computers, and disk drives, there is something to delight the ham's heart from pennies up. I hope these suggestions help.

Now let's pick up a letter from Wayne Hall WB4OGM from Colorado. Wayne writes that he has acquired a MITS 680b microcomputer, which has all of 1K of RAM in it, and wonders if there is any way to add more memory. For those who are not familiar with the 680b, this was a machine that MITS, whose first machine, the Altair 8800, started this computer craze, brought out to exploit the then-new Motorola 6800. Although it used the same CPU as the more-successful Southwest Tech 6800 machine, it used a bus unique to itself. Thus, neither S-100 boards nor SS-50 boards will fit.

Well, this problem was tackled in an article in *Kilobaud* (that's all it was called then!) in its third issue, March, 1977. In fact, there are two articles on the 680b in that issue. The first, by Anthony R. Curtis, describes building the 680b and is a sketchy review of the box. The other article, entitled "Make Your 680b Smarter," describes the efforts of Stu Mitchell and Phil Poole to design and build an S-100 adapter that fits inside the 680b case. This allows the use of S-100 memory. Although an 8K board was considered hot stuff back in 1977 (my, how time flies), you can get quite a bit more on a board now. The article includes a printed circuit layout of the board and full details on implementing the augmentation.

More reviews on the way, with whatever I can lay my hands on as the target. Reader questions and more fun, here in RTTY Loop in eighty-one!

AWARDS

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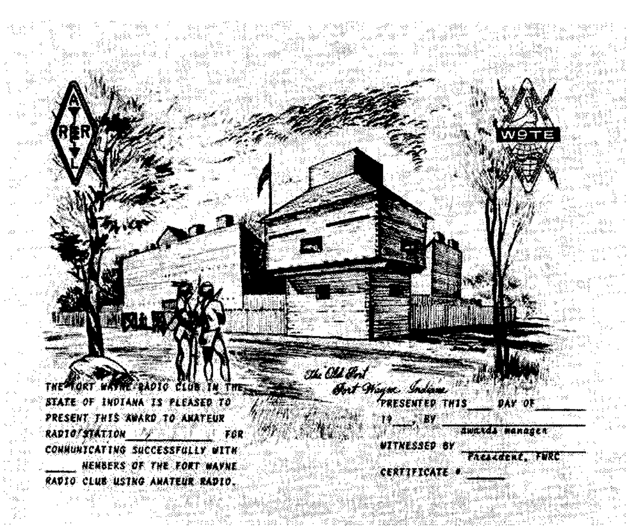
FORT WAYNE RADIO CLUB AWARD

This week, I was pleased to receive a very nice letter from Bernard Holm K9JDF, who is the Communications Manager for the Fort Wayne Radio Club out of Fort Wayne, Indiana. In his letter, Bernard provided details of an awards program sponsored by their club station, W9TE. Here are the award program details.

To qualify for the Fort Wayne Radio Club Award, applicants within Allen County, Indiana, must work 25 individual members of the Fort Wayne Radio Club. Applicants located elsewhere in the United States must work a minimum of 5 Fort Wayne Radio Club members. There are no band or mode restrictions, but all contacts must be made after January 1, 1979, to be valid.

To apply, prepare a list of claimed contacts in order by callsign. Include the name of the station operator, the date and time worked in GMT, and the mode and band of operation. Have this list verified by at least two other amateurs or by a radio club official, stating that QSL cards were in your possession at the time verification was made.

Enclose your application with an award fee of $1.00 or 2 IRCs to: Fort Wayne Radio Club, Inc., PO Box 15127, Fort Wayne IN 46885.



Last month, I featured a couple of awards from our amateur friends in Brazil. Not realizing the popularity of these programs, I received two more that I would like to share with you now.

GPCW AWARD FROM BRAZIL

Sponsored by the Grupo Praiano de CW, this award is made available to amateur operators throughout the world.

To qualify for the GPCW award, applicants must establish two-way contacts with at least 5 members of the Group. These contacts must have been made after November 5, 1973, to be valid. All authorized amateur bands may be utilized, but only CW contacts with a minimum report of 338 may be claimed.

To apply, prepare your list of contacts, listing the usual logbook information, and have it authenticated by a local radio club or at least two fellow amateurs. Enclose your application with at least 5 IRCs to: GPCW, Box 556, 11100 - Santos, Brasil, South America.

GPCW members who qualify as contacts are: PY2ARX, BBO, BKT, BOP, CE, CJW, CSI, CYE, CZL, DBU, DHP (YL), DYX, EQR, EW, EWB, FYF, EXD, FDO, FNB, FPE, FRW, GUN, GYJ, RG, TT, YON, ZY, and PY1DG/2.

AN OPEN LETTER TO CLUBS AND ORGANIZATIONS

Each year, literally thousands in our fraternity of radio amateurs seek ultimate recognition by accomplishing the many levels of operating excellence. And, thus, "award hunting" has become a unique aspect in amateur radio operation.

To achieve the many goals established by them, amateurs rely almost entirely on publications such as *73 Magazine* to inform them of the various award incentives. Each month, I dedicate a special multi-page Awards column to over 150,000 readers throughout the world. With every edition, this figure grows.

Should your own organization have an awards program, I would like to extend a personal invitation for you to share its contents with our many readers. What an excellent opportunity this will be for you to gain worldwide recognition at absolutely no cost to you whatsoever!

To obtain this free service, please forward 1) rules for each award being offered and 2) a sample copy of each award certificate.

Perhaps your organization doesn't have an awards program yet? Allow me to encourage your officers to consider such an endeavor. Not only will it bring immediate recognition, but it can serve as a reliable source of revenue for your organization.

Good luck and my sincere thanks for your dedicated support!—Bill Gosney WB7BFK

PPC AWARD FROM BRAZIL

Radio amateurs the world over are invited to become eligible for the PPC Award, sometimes referred to as the "Carioca Woodpecker's Award."

To qualify, applicants are required to establish two-way CW contact with different PPC members. Brazilian amateurs must make 10 contacts, while amateur operators located outside the country of Brazil must conduct 5 individual QSOs on the CW bands.

To be valid, all contacts must be made after March 1, 1965, which is hailed as Rio de Janeiro's 4th centenary. A minimum signal report of 338 must have been logged for each claimed contact.

To apply for the PPC Award, have your contacts verified by at least two fellow amateurs or by a radio club official. Enclose this list along with an award fee of 5 IRCs addressed to: PPC Bureau, PO Box 2675, 20000 Rio de Janeiro, RJ, Brazil, South America.

This award also may be earned by SWLs and the same rules apply.

PPC members are: PY1AFA, ARS, AVV, AZ, BHO, BIR, BLG, BOA, CBW, CC, CCE, CFS, CIP, CMT, CTP, DDI, DMZ, DNL, DNS, DOG, DUB, DUJ (YL), EFX, EHF (YL), EHN, EIR, HO, JN, KO, LA, LG, MB, RJ, SJ (YL), PY2EW, PY2FWT, PY2RG, PY4CZ, PY6HL, PY7CGV (YL), and the following list of Silent Keys: PY1AIF (1966), PY1BXO (1968), PY1DB (1977), PY1TC (1977), and PY1DNN (1977).

Traveling abroad, we learn of a very challenging award from Sardinia. At least from a DXer's standpoint on the west coast of the states, this one ain't easy, my friend!

GOLD SARDINIA AWARD

Sponsored by the URS Club of Sassari, Sardinia, the Gold Sardinia Award is granted to any licensed amateur or shortwave listener who has made contact with or heard stations in Sardinia since January 1, 1976.

To qualify, European applicants must accumulate a total of 20 points, while amateurs outside Europe must gather 15 points total. The points are figured this way: Each contact with a URS Club member counts 4 points on HF and 5 points on the VHF bands. A contact with ISØLYN counts 6 points regardless of the band. All other Sardinian contacts count 1 point on the HF bands and 2 points on the VHF bands. The same station may be worked on the same band on different days or the same day on different bands for award credit. For example, should you be fortunate enough to work ISØLYN on all three

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LEAKY LINES

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Tired of knocking your brains out in DX pileups? Frustrated by the sheer idiocy of self-appointed monitors and vigilantes who congregate on the DX station's exact frequency and QRM the action with bickering and other abuse? Turned off by selfish operators who either refuse to abide by the DX station's instructions or who don't bother to listen to them in the first place?

If any or all of these examples fit your present frame of mind toward DX chasing, I may have a solution for you. It may not put you on the Honor Roll, but it will afford you the satisfaction which comes from genuine accomplishment. But let me tell you of the circumstances which led to the idea.

When i finally made the coveted Honor Roll after years of dedicated effort, I was faced with a gloomy prospect. I'd grown so used to chasing DX that i'd become bored with other facets of the hobby. DX had become the *ne plus ultra*, and it was all I thought about in connection with ham radio. This feeling of dreariness devolved out of the realization that only four countries remained on my want list, and while there did exist some slight possibilities that those four would eventually be activated, this did not appear likely in the immediate future.

I had to find some new interest to take the place of DX; this was clear.

Never much of a constructor, I couldn't envision starting to build at this late date. That possibility was out.

Slow scan television and moonbounce had never "put bubbles in my blood," nor had amateur satellite communications. Mind you, I do not criticize them. But they are just not my cup of tea.

I had never enjoyed participation in traffic nets, and with the exception of a few years of MARS activity, I was not overly attracted to the prospect. (I believe that my distaste was inspired by one of those simulated emergencies back in the 50s, when, as part of an AREC group which I'd joined, I observed one of my colleagues calling Net Control with the astonishing news that Yonkers, New York, had been hit simultaneously with a devastating nuclear attack and a cholera epidemic. I threw up my hands.)

No! The sudden and abrupt realization that DX was about to become a thing of the past for me was a shock. And I could not find a way to cope with it.

Then one day an inspiration hit me like a bolt out of the blue. I was idly thumbing through the *Callbook*, and my eye was suddenly captured by one of those special entries; you know the sort I mean...the listing was separated from all the others and printed in bold type. And this particular callsign had the same suffix as my own. I had never worked anyone with my own suffix, and I thought it might be nice to hook up with a few and to exchange QSLs. I began writing down in my notebook the prefixes of the various AGZ stations, and I started listening for them on the air. Eventually I latched on to a couple. The first was KØAGZ, and others followed after a few months.

I even ran into a few foreign ones, and this prompted me to investigate the possibility of writing to several and proposing on-the-air schedules. They were all over the map, in all countries. For the most part, they showed up at the suggested time and frequency; we established contact and ultimately exchanged cards. In some cases, we have continued to meet on a regular basis ever since the first contact.

To shorten the story, I now have over 75 AGZ cards, and I'm sure that I will eventually have 100 of them.

The best part of this, of course, is that notwithstanding the fact that all the other AGZ stations are desirable from my point of view, there is absolutely no competition from anyone else. I don't have to worry about pileups or the loonies who have begun to make a shambles and fiasco out of DX. I can chase AGZs to my heart's content, and there's not another soul who's going to give me a hard time. Others with my suffix seem just as desirous of working me, and there hasn't been a single instance of QSL difficulty: The cards generally arrive by the quickest route.

Some are in Europe, some are in South America; there are many in Canada and in the Antipodes. I have quite a few from the West Indies and from Africa. And, as I mentioned, it's my own game and I can play it to my heart's content. The only limits are dictated by my own energy and willingness to exert myself.

I found that whenever I mentioned this activity, it seemed to elicit interest among others. And the thought occurred that this might be a new and different radio-sport that could be adopted by others who may have become bored with the usual and commonplace and are looking for a novel and unique pursuit.

I thought: Suppose the game could be organized, with certificates, endorsements, annual listings, and the like? Suppose it were possible to send out a computer printout of every applicant's callsign counterparts throughout the world, together with mailing addresses? And suppose there were a quarterly newsletter listing standings, profiles of the top contenders, and the like? And suppose there were special awards for multiband and multi-mode?

The idea began to feel exciting. In sounding out friends, I found more than casual interest. I had the feeling that perhaps it might meet with general enthusiasm, both here and abroad. Why not?

The only fly in the ointment, of course, is that if all these supplementary adjuncts were to be incorporated in the game, it would cost some initial money to get the thing off the ground. The printing of a suitable certificate would be costly, and the computer readout would cost several bucks as well. While an awards program can be managed at minimal cost, it cannot be done for peanuts. Perhaps the applicants themselves would be willing to help to underwrite these costs by paying a moderate fee of, say, five dollars or some equally modest sum. No one would get rich on the proceeds, that is certain. But no one would go broke either.

What to call the award? How about WYOS, Work Your Own Suffix? Not too bad. But perhaps it would be better if the initials formed an acronym such as do VISTA, Volunteers In Service To America, or NOW, the National Organization for Women. Unfortunately, my background as a professional songwriter and creator of comedy material invariably bubbles to the surface, and I find that every acronym that occurs to my mind turns out to be a four-letter word of questionable taste. Amateur Suffix Society, Callsign Radio Amateur...oh, well, you get the idea, I'm sure. Out there in the vastness of ham radio land, there are enterprising and creative minds; there must be someone who can come up with a unique name in keeping with the spirit of the thing.

But please, I beg you, don't send in your suggestions at this time. And don't send in any applications or money. If and when the program is inaugurated, an appropriate announcement will be made in this space. In the meantime, I urge you to try chasing your own suffix in the same way that I do...on your own and at your own pace. There's no reason why you should have to wait for this activity to be organized.

In fact, it might be better if it remained an off-the-cuff thing without all the hoopla of certificates and competition of standings and listings. Since there is no competition in it now, why introduce it anyway? And if it happens that some of you should happen to amass a total which you think unusually high, you might let me know about it. I'll be happy to mention it here so that you can gain the recognition that the achievement deserves.

But let me warn you: Despite the lack of competition, it is not the easiest thing in the world to accomplish. It will take dedication and persistence.

Go to it, and the very best of luck to you all.

LETTERS

LEARNING THE CODE

I just wanted to drop you a quick note to say how much your *73* code course helped me. I have sporadically attempted to get my ticket for seven years now. The theory is no problem (I have a commercial 1st phone and have worked in RF for five years), but that code practice would get me every time. I tried manuals and the ARRL code course, but I would memorize the code sent on the cassettes, or, with the manuals, I'd stay on the first few pages and never move on, until I lost interest.

I honestly can't say this about the *73* cassette. I couldn't memorize the code groups, and it introduced new characters so fast and furious that before I knew it, I was through the whole alphabet.

Anyway, I passed the exam for my Tech ticket yesterday, after practicing with the cassette for two weeks! Before, I'd have practiced for a month or so before losing faith. Your code course is great. Now I'll work on my Advanced ticket in my spare time. Tnx again!

Grant Howes
Jackson MI

Grant, you should have started with the 13 per... it's no more difficult to learn the code at that speed than at 5 wpm, so why horse around and extend the agony?—Wayne.

BUT THEY WORK

I wish to congratulate you and your staff on a job well done regarding your *73* code cassettes. They are indeed the most mind-boggling, frustrating, teeth-gnashing, high-blood-pressure-causing pieces of recorded material I have ever purchased...but they work!

I used your 21 wpm tape most recently to help me achieve the elusive Amateur Extra class ticket. I don't know how many times I have personally told others of the virtues of your cassettes, but I firmly believe yours are the best on the market, and I have heard them all.

I found that after a month and a half with your tapes, I could copy plain English code at better than 25 wpm. Considering that a year and a half ago I didn't know a dit from a dah, I've made pretty good progress.

I believe in giving credit where credit is due; therefore, thank you for helping me to enjoy a great hobby. By the way, your ad states, "...you'll almost fall asleep copying the FCC stuff..." This was not exactly the case, but your point is well taken. Thanks again.

Steve Lewis KF8G
Rossford OH

CHRISTMAS DX

The Clark County Amateur Radio Club (Jeffersonville IN) will go on a DXpedition to Bethlehem IN from 1700 UTC December 13th until 1700 UTC December 14, 1980. Using the callsign W9WWI/9, they will operate phone on 3.900, 7.235, 14.285, 21.360, 28.510, and 147.300 simplex. Special Christmas season cards will be sent to all stations and the envelopes will be stamped with the unique Bethlehem IN postal stamps consisting of the Three Wise Men and the Star of David. QSL (with SASE) to Clark County Amateur Radio Club, PO Box 352, Jeffersonville IN 47130.

John W. Shean N9TV
Jeffersonville IN

SATISFACTION

On my return from an extended vacation, I found the August issue of *73 Magazine* in the mail, with my article ("Over There") on page 86.

I must compliment whoever was involved for some very fine editorial work. It is not uncommon these days for a writer, in looking at the printed version of his work, to wonder, "Why did they slip those commas in *there*?" or "What happened to the last two words of that sentence?" or even "Don't the damn fools know that 'the' is spelled 't-h-e?'" But then, I have frequently remarked on the quality of the magazine and its editorial standards in the past few years.

Likewise, I was amazed by the quality of the photo reproduction. The negatives are, of course, close to 40 years old. The prints I made late one night, a Sunday, of course, when I could not get paper and had only a few odds and ends of various grades left.

In all, I am pleased (and I know that you will accept this in the proper light) that *73* printed the article...payment aside. It is a source of real satisfaction to an author when everything comes out right.

It may also interest you to know that I've received two letters from old friends who learned of my whereabouts from the piece.

Julian N. Jablin W9IWI
Skokie IL

It's nice to have someone notice the superb job Jack has been doing with the editing and production of the magazine... thanks for the bouquet. By the way, it's good to get an article from one of the old guard in New York. I remember contacts and seeing you at radio clubs 30 years ago.—Wayne.

NOT ONE?

GOOD LORD!! Wayne Green in Mensa for 20 years?? It's strange I haven't agreed with one *73* editorial. (Congrats.)

Robert Rolther WDØFDK
Florissant MO

All of which goes to prove that brains and common sense are not necessarily parallel endowments.—Wayne.

HORSE HOCKEY

At the present time I am stationed with the military in West Germany, where we have the largest American population outside the United States. In the past, the FCC has dispatched examiners to Germany twice a year and many individuals have taken advantage of this. They've traveled from all over Germany and its neighboring countries ...they came by plane, by train, and by car. Examination rooms were jam-packed with more people than you could shake a stick at. Now, all of a sudden, someone in a higher echelon of the government decides that "excessive" travel must come to a halt. And the result? Many people will be denied the opportunity of obtaining or upgrading an FCC license whether it be amateur or commercial. It's a damn shame! These same people are the ones putting their lives on the line defending this country and ensuring the preservation of peace. As Colonel Potter of M*A*S*H would say, "horse hockey!"

Before I go any further, let's go back to the basics. One of the first things we all learned in our study of amateur radio was its basis and purpose. This can be found in Section 97.1 of Subpart A of Part 97. Listed there are "five" principles of our radio service. To print them here would use too much valuable space, so I will extract some of the finer points for you. Principle number one talks about the recognition and advancement of the Amateur Radio Service and emergency communications. Numbers two and three contain key words such as encouragement, improvement, and advancing skills. Expansion of the existing reservoir of trained operators, technicians, and electronics experts is outlined in number four. And, finally, principle number five mentions our unique ability to enhance international goodwill. This drastic measure taken by the FCC will impede the exercise of these very principles! It's simple arithmetic.

As for us here in Germany, look under the "Delta Alpha" callsigns in the latest edition of the DX *Callbook*. You will find approximately 600 amateurs, of which 85% are Americans. Isn't this enough "clout" to warrant resumption of FCC testing? The number 600 may not seem like much, but with our current problem of a stagnant growth rate, the FCC's policy could show adverse affects. With dwindling numbers and no encouragement from or improvement in the operations of our governing body, the FCC, how are "we" supposed to expand, become "encouraged" and "improved"? We are a public service, dammit! When a natural disaster strikes, hams are usually the first ones on the scene ready to help. And when we do, we are praised and glorified...sometimes. But

Continued on page 193

FUN!

John Edwards WB2IBE
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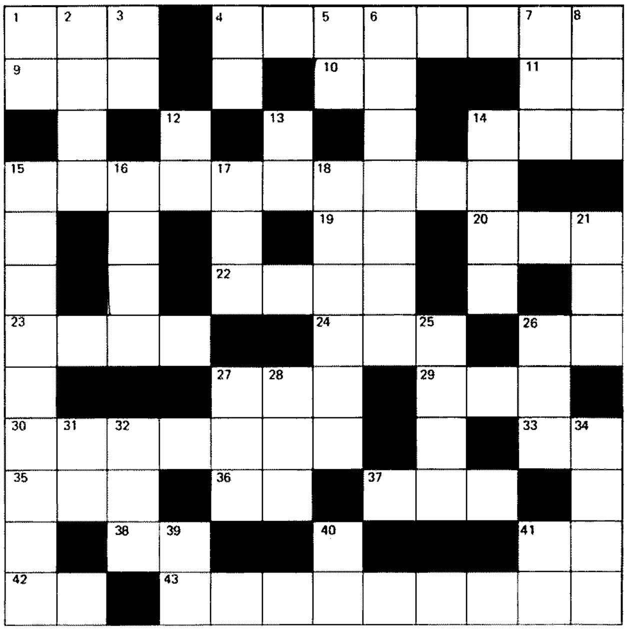
ELEMENT 1—CROSSWORD PUZZLE

Across

1 A microcomputer memory (abbr.)
4 RTTY machine
9 Radio users (abbr.)
10 Greenland prefix
11 Cable prefix
14 Something to chew
15 Scientific test
19 A prosign
20 Teletype (abbr.)
22 Automatic Picture Retransmission (abbr.)
23 What a signal usually carries (abbr.)
24 Keyboard Send-Receive (abbr.)
26 Soviet space satellite (abbr.)
27 A Model 15 is extreme in this
29 HW_______?
30 A display medium
33 Sudanese prefix
35 Moonbounce (abbr.)
36 Tough WAS state (abbr.)
37 Formal shack title (abbr.)
38 Old repeater prefix
41 Pakistani prefix
42 "Idiot Box" or fast scan (abbr.)
43 Pictures via radio

Down

1 RTTY Read-Only (abbr.)
2 Vertex
3 Meteor scatter (abbr.)
4 Transmitter-distributor (abbr.)
5 Opposite of Hi
6 Proficient hams
7 Public Relations Assistant (abbr.)
8 Code of Ethics laid one
12 Morse "from"
13 Code Chuckle
14 Radioteletype (abbr.)
15 Specialized modes require lots of this
16 RTTY tape unit
17 Radio Corporation of America (abbr.)
18 Crystal use
21 Soft hams (abbr.)
25 "Ears" (abbr.)
26 RTTY test string
27 Amateur television (abbr.)
28 Past of "get"
31 Ham salutation (abbr.)
32 What most specialized modes are
34 Recording or paper (mylar, too)
39 Transmitter power (abbr.)
40 FCC country (abbr.)
41 Familiar battery (abbr.)



SPECIALIZED MODES

Have you ever been accused of being an "appliance operator"? Are you a complete blockhead when it comes to doing anything more technical than shouting into a microphone or tapping a key? When the other guys talk about slow-scan television, do you think they're referring to the instant replays on last Sunday's football broadcast? If so, this month's puzzles are for you.

While RTTY, SSTV, ATV, EME, ASCII, and MSTV may just sound like a bowl of alphabet soup to many of us, there's a whole class of fellow amateurs out there who consider these modes to be the *real* amateur radio—a place for experimenting, not just communicating. So, for those of you not yet hooked on an exotic operating mode, and even for those who are, grab a pencil and see how much you know about ham radio's other side.

ELEMENT 2—MATCHING

Match the specialized mode in Column A with the appropriate equipment in Column B.

Column A	Column B
1) Slow-scan television	A) Horn antenna
2) Meteor scatter	B) Murphy receiver
3) Digital communication	C) Stylus
4) Fast-scan television	D) Keyer (CW)
5) Facsimile	E) Model 33
6) Satellite communication	F) Wideband 10-meter receiver
7) Moonbounce	G) Steerable dish antenna
8) Microwave communication	H) 2-meter transmitter/10-meter receiver
9) Radioteletype	I) Stock Robot 400
10) Medium-scan television	J) Model 15
	K) Commercial TV set and converter

ELEMENT 3—TRUE-FALSE

	True	False
1) Eleven meters was the first amateur band opened to slow-scan television.	_____	_____
2) One of the inventors of the teleprinter was Joy Morton, owner of the Morton Salt Company.	_____	_____
3) AF2M is the official FCC designation for frequency-shift telegraphy.	_____	_____
4) The Geminids are a December meteor shower.	_____	_____
5) The ARRL sponsors both RTTY and SSTV DXCC awards.	_____	_____
6) Amateur 10-GHz signals have spanned the English Channel.	_____	_____
7) Most moonbounce activity takes place on 144 and 432 MHz.	_____	_____
8) The facsimile DX record is from New York, N.Y., to Seattle, Wash.	_____	_____
9) Medium-scan television's frame rate is 2 per second.	_____	_____
10) To operate a mode not permitted under amateur rules, one can request an "STA" from the FCC.	_____	_____
11) Most RTTY enthusiasts gain their WAS awards from "cards" printed on their Teletype.	_____	_____
12) Maximum radioteletype shift is 900 kHz.	_____	_____
13) "NBVM" stands for Negative Bias Voltmeter.	_____	_____
14) ASCII is permissible on 160 meters.	_____	_____
15) FSK is allowed on all CW bands, even Novice.	_____	_____
16) Many amateurs call moonbounce "EME" in honor of the late K6EME.	_____	_____

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OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR DECEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
27653	1	0010:49	79.8
27666	2	0113:04	93.4
27678	3	0012:22	78.3
27691	4	0106:36	91.9
27703	5	0005:54	76.7
27716	6	0100:09	90.3
27729	7	0154:23	103.9
27741	8	0053:41	88.7
27754	9	0147:56	102.3
27766	10	0047:14	87.2
27779	11	0141:28	100.8
27791	12	0040:46	85.6
27804	13	0135:00	99.2
27816	14	0034:18	84.0
27829	15	0128:33	97.6
27841	16	0027:51	82.5
27854	17	0122:05	96.1
27866	18	0021:23	80.9
27879	19	0115:37	94.5
27891	20	0014:55	79.3
27904	21	0109:10	92.9
27916	22	0008:28	77.8
27929	23	0102:42	91.4
27941	24	0002:00	76.2
27954	25	0056:14	89.8
27967	26	0150:29	103.4
27979	27	0049:47	88.2
27992	28	0144:01	101.8
28004	29	0043:19	86.7
28017	30	0137:33	100.3
28029	31	0036:51	85.1

OSCAR 8 ORBITAL INFORMATION FOR DECEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
13969	1	0013:32	59.6
13983	2	0018:18	60.8
13997	3	0023:04	62.1
14011	4	0027:50	63.3
14025	5	0032:35	64.5
14039	6	0037:21	65.7
14053	7	0042:06	66.9
14067	8	0046:52	68.1
14081	9	0051:38	69.4
14095	10	0056:23	70.6
14109	11	0101:09	71.8
14123	12	0105:54	73.0
14137	13	0110:39	74.2
14151	14	0115:25	75.4
14165	15	0120:10	76.7
14179	16	0124:55	77.9
14193	17	0129:40	79.1
14207	18	0134:26	80.3
14221	19	0139:11	81.5
14234	20	0000:44	56.9
14248	21	0005:29	58.2
14262	22	0010:14	59.4
14276	23	0014:59	60.6
14290	24	0019:44	61.8
14304	25	0024:29	63.0
14318	26	0029:14	64.2
14332	27	0033:59	65.4
14346	28	0038:44	66.7
14360	29	0043:29	67.9
14374	30	0048:13	69.1
14388	31	0052:58	70.3

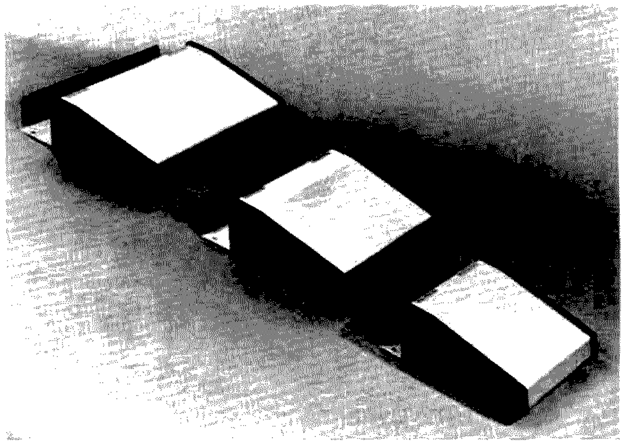
OSCAR 7 ORBITAL INFORMATION FOR JANUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
28042	1	0131:05	98.7
28054	2	0030:23	83.5
28067	3	0124:38	97.1
28079	4	0023:56	82.0
28092	5	0118:10	95.6
28104	6	0017:28	80.4
28117	7	0111:42	94.0
28129	8	0011:00	78.9
28142	9	0105:14	92.4
28154	10	0004:32	77.3
28167	11	0058:46	90.9
28180	12	0153:01	104.5
28192	13	0052:18	89.3
28205	14	0146:33	102.9
28217	15	0045:51	87.7
28230	16	0140:05	101.3
28242	17	0039:23	86.2
28255	18	0133:37	99.8
28267	19	0032:55	84.6
28280	20	0127:09	98.2
28292	21	0026:27	83.0
28305	22	0120:41	96.6
28317	23	0019:59	81.5
28330	24	0114:13	95.1
28342	25	0013:31	79.9
28355	26	0107:45	93.5
28367	27	0007:03	78.4
28380	28	0101:17	91.9
28392	29	0000:35	76.8
28405	30	0054:49	90.4
28418	31	0149:04	104.0

OSCAR 8 ORBITAL INFORMATION FOR JANUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
14402	1	0057:43	71.5
14416	2	0102:28	72.7
14430	3	0107:12	73.9
14444	4	0111:57	75.2
14458	5	0116:41	76.4
14472	6	0121:26	77.6
14486	7	0126:10	78.8
14500	8	0130:55	80.0
14514	9	0135:39	81.2
14528	10	0140:23	82.4
14541	11	0001:56	57.8
14555	12	0006:40	59.1
14569	13	0011:25	60.3
14583	14	0016:09	61.5
14597	15	0020:53	62.7
14611	16	0025:37	63.9
14625	17	0030:21	65.1
14639	18	0035:05	66.3
14653	19	0039:49	67.5
14667	20	0044:33	68.8
14681	21	0049:17	70.0
14695	22	0054:01	71.2
14709	23	0058:45	72.4
14723	24	0103:29	73.6
14737	25	0108:13	74.8
14751	26	0112:57	76.0
14765	27	0117:40	77.2
14779	28	0122:24	78.4
14793	29	0127:08	79.7
14807	30	0131:51	80.9
14821	31	0136:35	82.1

NEW PRODUCTS



Jameco's desk-top enclosures.

AEA'S MODEL CK-1 ELECTRONIC KEYER

The new AEA Model CK-1 iambic electronic keyer incorporates virtually all of the features of the renowned AEA MorseMatic, with the exception of the trainer and beacon modes. The CK-1 keyer also has two preset speeds for fast recall and a stepped variable speed control for fast contest operation. The speed range is 1- to 99-wpm in one-wpm increments. The unit operates from 12 volts dc (plus or minus 3 volts dc) for maximum DXpedition flexibility. An optional ac adapter is available from AEA.

The keyer offers the contest operator a competitive edge with a flexible automatic serial number generator. The memory has a storage capability of approximately 500 Morse characters. AEA's exclusive soft partitioning™ of the memory means that all of the memory can be allotted to one message or divided up into as many as ten separate messages of varying length as long as the total is no more than the 500 characters. If you make a mistake loading the message, it can be easily corrected by using exclusive AEA editing. The edit mode can save the CW operator time and frustration, especially in loading a long message. The CK-1 memory can be loaded in the automatic word/character space load for easy flawless memory loading or in the real-time load mode. In either case, memory load does not initiate until the first character is sent so that there is no undesirable delay in playback. The memory playback can be halted in the middle of a message for manual keying by tapping the paddle and resumed where interrupted, or from the beginning. When loading memory, a significant drop in sidetone frequency signals a "memory full" condition.

The CK-1 keyer features a serial number generator that was designed after analyzing suggestions from many successful contest winners. The serial number automatically increments each time a message preprogrammed with a serial number is sent. The serial number can even be repeated several times (in another message) if the exchange was not made the first time. The serial number is not restricted to the same position in a message. It can be placed anywhere within a message and as many times as desired, and it does not increment until a message is repeated. Any new serial number may be selected in less than three seconds. The serial number can be loaded with as little as one character space between it and the preceding character.

AEA's CK-1 electronic keyer.

Like all other keyers in the AEA computerized electronic keyer line, the CK-1 features independent dot and dash ratio adjustment (full weighting). Also, dot and dash memories can be independently turned on or off. For the operator who enjoys operating with a bug, the CK-1 features semi-automatic operation. In the semi-auto bug mode, an operator can even load the message memories. The CK-1 will key any modern transceiver and features a single output jack (RCA phono type) for keying either plus or minus keyjack voltages to ground. The CK-1 also features an automatic tune mode which can be halted by tapping any keypad button, or the paddle.

The CK-1 is packaged in a high-impact plastic case, ideal for placing next to the keyer paddle without wasting valuable operating desk space. AEA engineering has provided maximum rf protection to avoid frustrating false keying. All ICs are socketed and, like all AEA products, each unit is fully tested and burned in at 50° C to "shake out" component failures. Mating power and paddle connectors are provided.

The CK-1 is easy to learn and easy to use, providing the operator the maximum amount of enjoyment with CW.

For further information, contact *Advanced Electronic Applications, Inc., PO Box 2160, Bldg. O&P, 2006-196th SW, Lynnwood WA 98036; (206)-775-7373/524-7374.*

NEW DESK-TOP ELECTRONIC ENCLOSURES

Jameco Electronics has announced a new Designer Series of desk-top enclosures to accommodate electronic equipment. These stylish enclosures are designed to blend and complement today's modern computer equipment and can be used in both industry and home.

The unique four-piece construction of the series enables easy access for servicing while providing strong protection. The end pieces are precision-molded high-strength epoxy with an internal slot (all around) to accept both top and bottom panels. The aluminum panels (.080" thick) are fastened to ¼"-thick mounting tabs inside the end pieces to provide maximum rigidity. For service, the rear/bottom panel slides backward on slotted guide tracks.

The aluminum panels are coated with an alodine type 1200 finish for best paint adhesion. The molded end pieces are mocha brown, matte finish, but can be painted to match any color scheme.

The Designer Series enclosures are available in three

Continued on page 186

Who Really Invented Radio?

—the twisted tale of Nathan B. Stubblefield

Larry Kahaner WB2NEL
73 Associate Editor

I decided to buy the $3-a-day collision insurance for my Avis rent-a-car. It might be that kind of assignment.

When they send you to unravel the twisted tale of Nathan B. Stubblefield—who Murray, Kentucky, residents insist invented radio while Marconi was just a lad—you're bound to run into trouble.

As I neared town, I first heard it on the AM radio. The country-western station played, appropriately enough, "Stand By Your

Photo A. Family and friends gathered (date unknown) at the home of Nathan B. Stubblefield on North 16th Street, Murray, Kentucky. From left, Sam Stubblefield, the black man, and then, identified by numbers, (1) Mr. John P. McElrath; (2) Mrs. John P. McElrath; (3) O. T. Hale; (4) John H. Keys; (5) Mrs. John H. Keys; (6) James M. Cole; (7) Solon Higgins; (8) Mrs. Solon Higgins; (9) O. J. Jennings; (10) Mrs. Ella Hale Woodruff; and then, (1) Pattie Stubblefield; (2) Helen Gould Stubblefield; (3) Oliver Stubblefield; (4) Victoria Stubblefield; (5) Mrs. Hattie Keys Beale; (6) Bernard Stubblefield; (7) Isaac W. Keys; (8) James H. Coleman; (9) Abe Thompson; (10) Ben B. Keys; (11) George Gatlin; (12) Tip Wilcox; (13) Nathan B. Stubblefield, and (14) Mrs. Nathan B. Stubblefield. (Photo courtesy of Murray State University.)

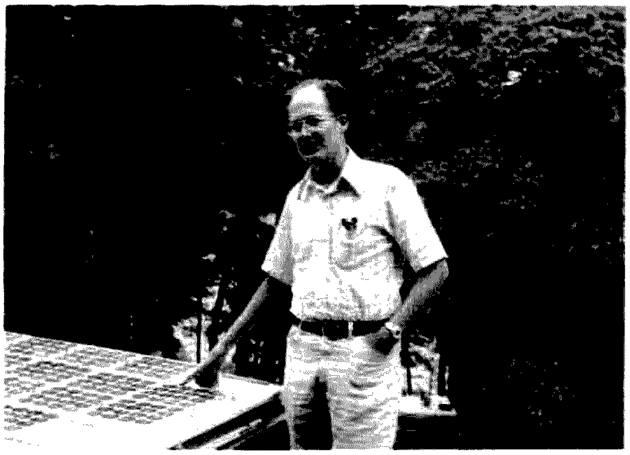


Photo B. William Call KJ4W, vice president and trustee of the Murray State University Amateur Radio Club, pointing out his solar panel employed for Field-Day operation this year. "It may have been magnetic induction. But you won't find that opinion around here much because it offends people. They want to believe he invented radio."

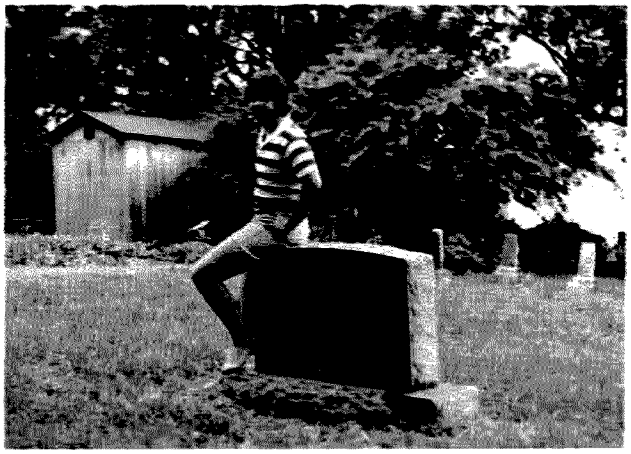


Photo C. Ronnie Outland, 22, lives next to the private cemetery where Stubblefield is buried. "Until recent years the grave was not kept up. There were weeds all around and I used to play here when I was younger. There was a big controversy about whether he invented radio. Now they think he did."

Man," and its call letters were WNBS: **N**athan **B**. **S**tubblefield. These folks were serious.

When I arrived in Murray and called the motel, I saw it in the phone book. Right there on page III was a photo of Nathan B. standing in the woods, head cocked to one side, holding the wireless device to his ear. The text called him the inventor of the radio.

Add to that the granite monument in front of his homesite and the state highway market pinpointing his birthplace, and there was little doubt left.

Murrayites meant business.

Who was that man with the bowler hat and handlebar moustache? And why, if he invented radio, has he been largely ignored outside of Murray? And why, if he had willing financial backers for his invention, did he die a pauper, found locked in his cabin outside of Murray where a pet cat seeking moisture had licked out his dried eyes? And why was it that the hundreds of articles written about Stubblefield, a PhD thesis, and a play about his work failed to halt the controversy and contradictions surrounding this eccentric genius?

It was frustrating enough to make me aim my silver Chevette for the nearest telephone pole and take advantage of that $3-a-day coverage.

Instead, I headed for Murray State University where Dr. Keith Heim, head of special collections, had gathered a respectable file of information. Unfortunately, most of it was secondary source material.

In the journalism biz, information is divided into primary and secondary sources. Primary sources are best because they include government documents, photographs, taped and transcribed interviews with people who witnessed an event, and so on. Secondary sources include magazine, newspaper, and other pieces written about an event. They are not as reliable as primary sources because they are secondhand information. Primary sources are the writers' mother lode.

MSU's Stubblefield files contained materials (even from highly touted publications) that contradicted each other. I saw differences in simple items such as names, dates, spellings, and attribution. Even Stubblefield's middle name was argued. Smart money is on Beverly, but some pieces list it as Bowman (his mother's maiden name) or Bedford. Each additional article I read only muddled the issue.

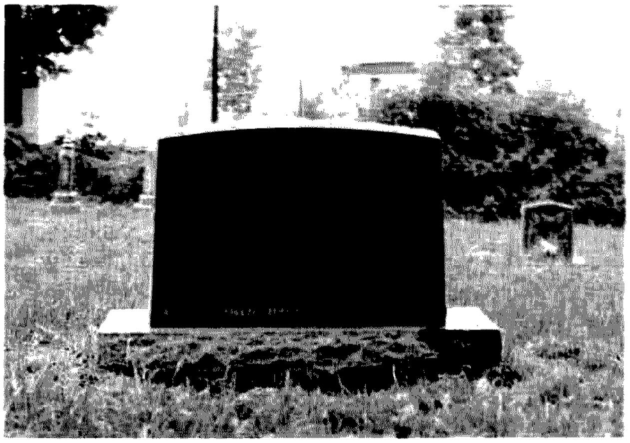


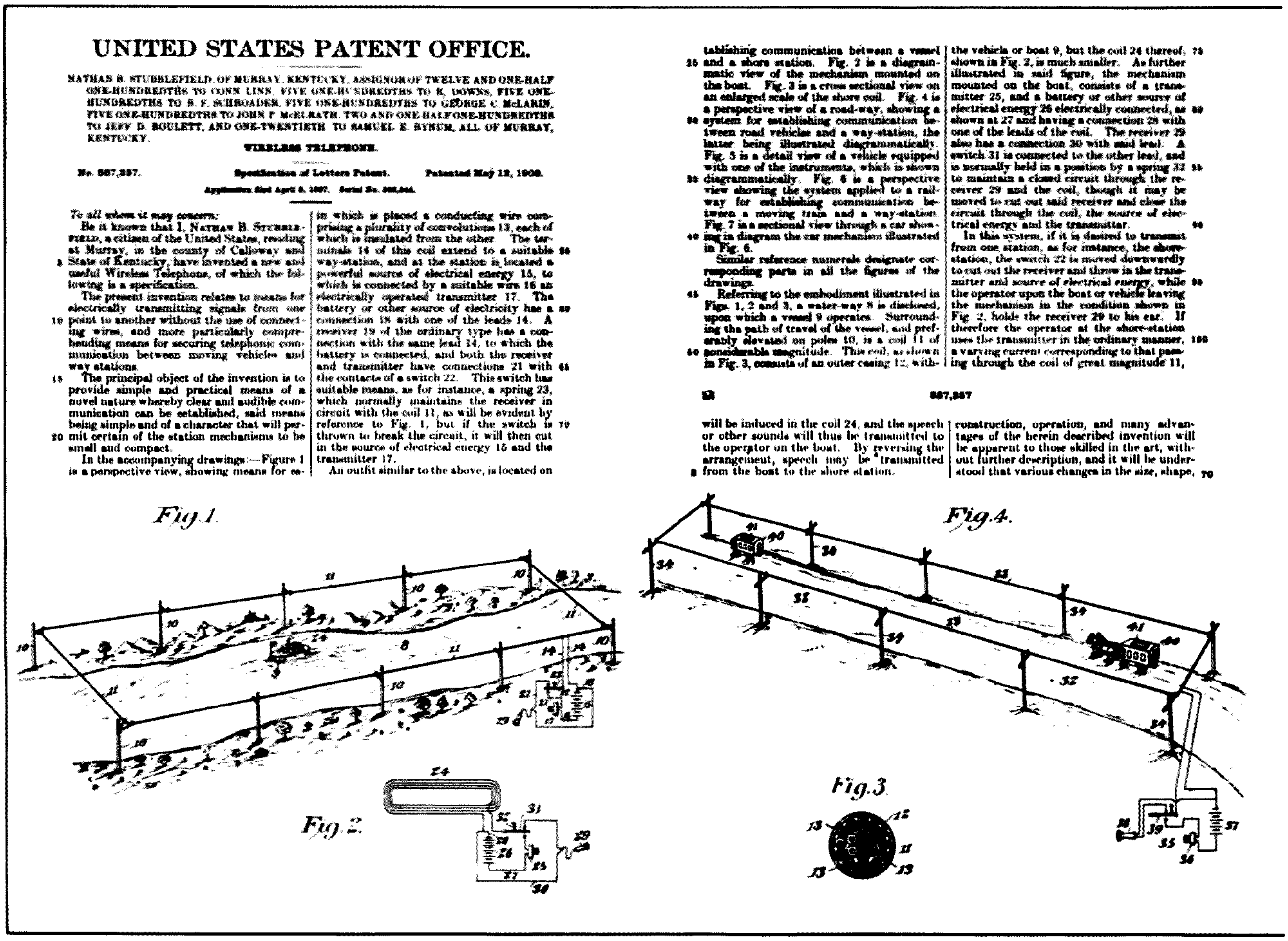
Photo D. Gravestone in Photo C located behind the Watson home, Route 8, about a mile north of Murray.

In addition, it appeared that much of what has been written about Stubblefield was based on the research of two prominent Murray citizens who are less than unbiased about the role of the farmer/inventor in radio's early days.

It was not an auspicious beginning.

Some things are certain, however. Few disagree that Stubblefield was born in 1860 in Murray, the son of Victoria and William Stubblefield. He was a loner and had few friends besides Duncan Holt, a boyhood chum.

As they grew up, they became fascinated by the work of Nikola Tesla and Heinrich Rudolf Hertz. They read all they could about the burgeoning interest in this new concept of electrical waves and com-



UNITED STATES PATENT OFFICE.

NATHAN B. STUBBLEFIELD, OF MURRAY, KENTUCKY, ASSIGNOR OF TWELVE AND ONE-HALF ONE-HUNDREDTHS TO CONN LINN, FIVE ONE-HUNDREDTHS TO R. DOWNS, FIVE ONE-HUNDREDTHS TO B. F. SCHROADER, FIVE ONE-HUNDREDTHS TO GEORGE C. McLARIN, FIVE ONE-HUNDREDTHS TO JOHN P. McELRATH, TWO AND ONE-HALF ONE-HUNDREDTHS TO JEFF D. ROULETT, AND ONE-TWENTIETH TO SAMUEL E. BYRUM, ALL OF MURRAY, KENTUCKY.

WIRELESS TELEPHONE.

No. 887,357. Specification of Letters Patent. Patented May 12, 1908.

Application filed April 5, 1907. Serial No. [illegible].

To all whom it may concern:

Be it known that I, NATHAN B. STUBBLEFIELD, a citizen of the United States, residing at Murray, in the county of Calloway and State of Kentucky, have invented a new and useful Wireless Telephone, of which the following is a specification.

The present invention relates to means for electrically transmitting signals from one point to another without the use of connecting wires, and more particularly comprehending means for securing telephonic communication between moving vehicles and way stations.

The principal object of the invention is to provide simple and practical means of a novel nature whereby clear and audible communication can be established, said means being simple and of a character that will permit certain of the station mechanisms to be small and compact.

In the accompanying drawings:—Figure 1 is a perspective view, showing means for establishing communication between a vessel and a shore station. Fig. 2 is a diagrammatic view of the mechanism mounted on the boat. Fig. 3 is a cross sectional view on an enlarged scale of the shore coil. Fig. 4 is a perspective view of a road-way, showing a system for establishing communication between road vehicles and a way-station, the latter being illustrated diagrammatically. Fig. 5 is a detail view of a vehicle equipped with one of the instruments, which is shown diagrammatically. Fig. 6 is a perspective view showing the system applied to a railway for establishing communication between a moving train and a way-station. Fig. 7 is a sectional view through a car showing in diagram the car mechanism illustrated in Fig. 6.

Similar reference numerals designate corresponding parts in all the figures of the drawings.

Referring to the embodiment illustrated in Figs. 1, 2 and 3, a water-way 8 is disclosed, upon which a vessel 9 operates. Surrounding the path of travel of the vessel, and preferably elevated on poles 10, is a coil 11 of considerable magnitude. This coil, as shown in Fig. 3, consists of an outer casing 12, within which is placed a conducting wire comprising a plurality of convolutions 13, each of which is insulated from the other. The terminals 14 of this coil extend to a suitable way-station, and at the station is located a powerful source of electrical energy 15, to which is connected by a suitable wire 16 an electrically operated transmitter 17. The battery or other source of electricity has a connection 18 with one of the leads 14. A receiver 19 of the ordinary type has a connection with the same lead 14, to which the battery is connected, and both the receiver and transmitter have connections 21 with the contacts of a switch 22. This switch has suitable means, as for instance, a spring 23, which normally maintains the receiver in circuit with the coil 11, as will be evident by reference to Fig. 1, but if the switch is thrown to break the circuit, it will then cut in the source of electrical energy 15 and the transmitter 17.

An outfit similar to the above, is located on the vehicle or boat 9, but the coil 24 thereof, shown in Fig. 2, is much smaller. As further illustrated in said figure, the mechanism mounted on the boat, consists of a transmitter 25, and a battery or other source of electrical energy 26 electrically connected, as shown at 27 and having a connection 28 with one of the leads of the coil. The receiver 29 also has a connection 30 with said lead. A switch 31 is connected to the other lead, and is normally held in a position by a spring 32 to maintain a closed circuit through the receiver 29 and the coil, though it may be moved to cut out said receiver and close the circuit through the coil, the source of electrical energy and the transmitter.

In this system, if it is desired to transmit from one station, as for instance, the shore-station, the switch 22 is moved downwardly to cut out the receiver and throw in the transmitter and source of electrical energy, while the operator upon the boat or vehicle leaving the mechanism in the condition shown in Fig. 2, holds the receiver 29 to his ear. If therefore the operator at the shore-station uses the transmitter in the ordinary manner, a varying current corresponding to that passing through the coil of great magnitude 11,

2 887,357

will be induced in the coil 24, and the speech or other sounds will thus be transmitted to the operator on the boat. By reversing the arrangement, speech may be transmitted from the boat to the shore station.

The construction, operation, and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape,

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

munication. They spent hours reading magazines, *Scientific American* being a favorite.

Stubblefield and his wife had several children, but only their son Bernard took a fancy to his father's tinkering, and he later became a trusted cohort.

Another man, Rainey T. Wells, who went on to found Murray State Teachers College, figured heavily in the inventor's life and was allegedly present when Stubblefield demonstrated his wireless invention in 1892. Before that, though, Stubblefield supposedly told Holt of his discovery in 1885. However, it was not until January 1, 1902, that he gave the first documented public demonstration of his device in Murray's town square.

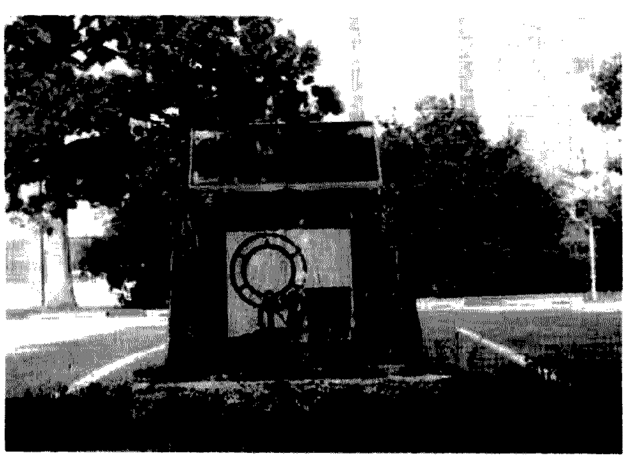


Photo E. Monument erected by L. J. Hortin and others to mark the home (since torn down) of Stubblefield. The massive stone was established at the edge of the Murray State University campus in the 1930s.

The instruments he and his son exhibited by the courthouse consisted of a transmitter and receiver—200 feet apart—and metal rods thrust into the ground connected by wire to both devices. Coils spread all over the walkway.

In an interview with a *St. Louis Post-Dispatch* reporter ten days after the demonstration, Stubblefield was quoted as saying: "I had been working on this ten or twelve years before I heard of Marconi's efforts (Marconi successfully sent radiotelegraphy in 1896, but not voice) or the efforts of others to solve the problem of transmission of messages through space without wires. I have solved the problem of telephoning without wires through the earth as Signor Marconi has of sending signals through space. But I can also telephone without wires through space as well as earth because my medium is everywhere."

He never said what that medium was.

Stubblefield demonstrated his wireless voice device on his farm to the reporter. Bernard stayed in the house while his father and the reporter walked to a cornfield about 500 yards away.

The reporter wrote: "The transmitting apparatus is concealed in a box. Two

The use of coils for both stations, each coil consisting of a plurality of convolutions has been found by experience to be of the utmost value, and furthermore experience has demonstrated that the employment of coils of different magnitudes is of great importance, for it has been found that while two small coils can be used to transmit but a short distance, if one large coil of the character set forth is employed, the other may be very small, and speech or sounds can be transmitted comparatively great distances from one to the other. These sounds are clearly audible.

The structure disclosed in Figs. 4 and 5 is of the same general character. A road-way 32 is disclosed surrounded by a coil 33 of great magnitude that is supported on suitable poles 34. The way-station 35 consists of a transmitter 36, a source of electrical energy 37 connected thereto, a receiver 38, and a switch 39, whereby the receiver or the transmitter and source of electrical energy can be thrown into circuit with the coil 33. The vehicles 40, which operate on the road-way, are provided with smaller coils 41 and instruments consisting of receivers 42, transmitters 43, sources of electrical energy 44 and switches 45 all arranged in the manner already described. In a system of this kind, it will be evident that the occupant of one vehicle may telephone to the home or way-station, and the message can be transmitted to another vehicle. Thus it will be evident that communication can be established between two moving vehicles or between a way-station and any vehicle desired which is within the range of the home- or way-station.

The system is also capable of use in connection with railways, and in Figs. 6 and 7, such a system is disclosed in connection therewith. A comparatively great coil 46 is supported on opposite sides of the railway 47 by poles 48 and a station 49 has a receiver 50 and a transmitter 51, a source of electrical energy 52 and a switch 53, the last mentioned being employed for throwing either the receiver or the transmitter and source of electrical energy into closed circuit with the coil 46. One or more cars of a railway train is equipped with an outfit consisting of a coil 54, a receiver 55, a transmitter 56, a source of electrical energy 57, and a switch 58 for throwing either the receiver or the transmitter and source of electrical energy into circuit with the coil 54. It will be evident that the operation of these two last described systems are substantially the same as that first set forth, and no extended description thereof is believed to be necessary.

From the foregoing, it is thought that the

887,357 — 3

proportion, and minor details of construction, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. In a system of the character described, the combination with a vehicle, of a comparatively small coil of conducting material mounted thereon, electrical transmitting and receiving mechanism including a source of electrical energy connected to the small coil and carried by the vehicle, a stationary aerial coil of much greater magnitude than the small coil having its opposite stretches or sides extending along the opposite sides of the path of travel of the vehicle and elevated above the same and above the vehicle coil, and electrical transmitting and receiving mechanism connected to the greater coil and including a source of heavy electrical current.

2. In a system of the character described, the combination with a vehicle, of a coil of conducting material mounted thereon, electrical transmitting mechanism, a source of electrical energy connected thereto, receiving mechanism, means for connecting either the transmitting mechanism and source of electrical energy or the receiving mechanism to the coil, a stationary coil of greater magnitude surrounding the path of travel of the vehicle and comprising a plurality of convolutions of conducting material, the different convolutions being insulated one from the other, means for supporting the coil in an elevated position, electrical transmitting mechanism, a source of great electrical energy connected to said transmitting mechanism, electrical receiving mechanism, and means for electrically connecting either the transmitting mechanism and source of electrical energy or the receiving mechanism to the said coil of greater magnitude.

3. Means for communicating between a plurality of stations which consists of an aerial electrical coil of great magnitude, means for supporting the said coil, a station electrically connected to the great coil and comprising transmitting and receiving mechanism that includes a source of heavy electrical energy, and a plurality of other separate stations simultaneously in coacting relation with the aerial coil, each of said latter stations comprising a coil of conducting material spaced from but in coacting relation with said great coil and below the same, and transmitting and receiving mechanism connected to said other coil and including a source of electrical energy.

4. Means for communicating between a plurality of stations which consists of an aerial coil of conducting material of great magnitude, transmitting and receiving mechanism connected to said aerial coil and including a source of heavy electrical energy, a plurality of vehicles movable between the opposite sides or stretches of the great coil, coils carried by said vehicles and disposed within the field of action of the aerial coil, and transmitting and receiving mechanism mounted on each vehicle and including a source of electrical energy.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

NATHAN B. STUBBLEFIELD.

Witnesses:

J. P. McElrath.

J. H. Coleman.

Fig. 6.

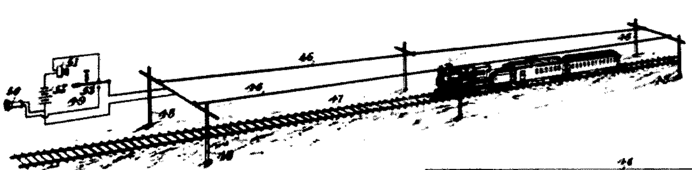


Fig. 5.

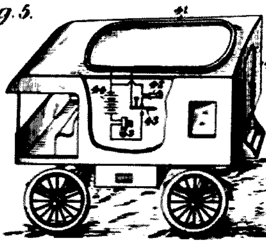
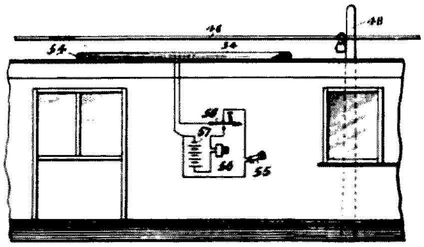


Fig. 7.



wires of the thickness of a lead pencil coil from its corners and disappear through the walls of the room and enter the ground outside. On top of the box is an ordinary telephone transmitter and a telephone switch. This is the machine through which the voice of the sender is passed into the ground to be transmitted by the Earth's electrical waves to the ear of the person who has an instrument capable of receiving and reproducing it.

"We went into the cornfield back of the house. After walking five hundred yards, we came to the experimental station the inventor has used for several months. It is a dry goods box fastened to the top of a stump. A roof to shed the rain has been placed on top of it; one side is hinged for a door, and the wires connected with the ground on both sides run into it and are attached to a pair of telephone receivers. The box was built as a shelter from the weather and as a protection to the receivers. I took a seat in the box and Mr. Stubblefield shouted 'hello' to the house. This was a signal to his son to begin sending messages. I placed the receiver to my ear and listened. Presently, there came with extraordinary distinctness several spasmodic buzzings and then a voice which said: 'Hello, can you hear me? Now I will count to ten. One-two-three-four-five-six-seven-eight-nine-ten. Did you hear that? Now I will whisper.'"

The demonstration continued with the reporter and Stubblefield walking about a mile from the house, the reporter placing the rods anywhere he wished and hearing Bernard talk as clearly as when they were 500 yards away.

The reporter quoted Stubblefield: "The earth, the air, the water, all the universe as we know it is permeated with the remarkable fluid which we call electricity, the most wonderful of God's gifts to the world and capable of the most inestimable benefits when it is mastered by man. For years I have been trying to make the bare earth do the work of the wires. I know now I have conquered it."

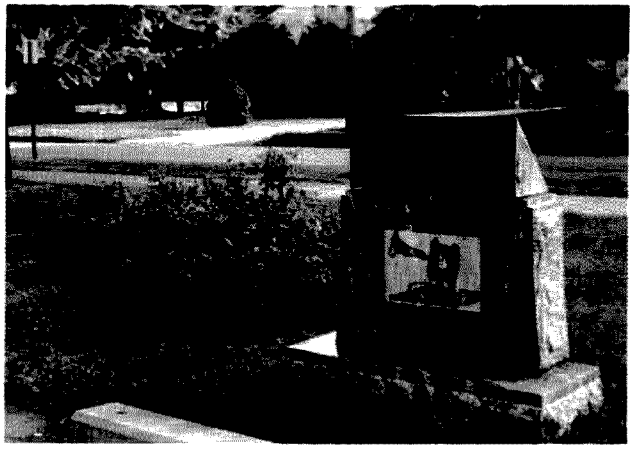


Photo F. The back of the monument in Photo E.

Photo G. This sign, erected by the state of Kentucky, marks Stubblefield's birthplace. Ironically, it is almost directly opposite the tower of radio station WNBS.

Stubblefield claimed his invention would work for any distance. He also said that eventually he would invent a tuning apparatus so that many conversations could go on at the same time without interference. And, he said it wasn't necessary to use the ground rods.

The father and son team demonstrated the wireless device in Philadelphia, New York, and Washington, D.C. Newspapers and magazines documented the events and Stubblefield's fame grew. The March 20, 1902, experiment was particularly unique in that Stubblefield transmitted from the ship *Bartholdi* on the Potomac River, and it was billed as the "First Marine Wireless Telephone Demonstration." He transmitted about ¼ of a mile.

During all his demonstrations, Stubblefield employed what he called "an earth battery." Although no one knows for sure what it was, Stubblefield claimed the cell, which he placed in the ground, converted the earth's natural current into electricity. That, in turn, transmitted his voice.

(Stubblefield received patent #600,457, March 8, 1898, for a "primary battery" consisting of a bare iron wire and insulated copper wire wound helically on an iron core. The patent claimed this construction increased the output of the couple, using water as an electrolyte. A couple is two dissimilar metals touching. He proposed placing the battery in moist earth, but it was never proven to be the one used in his voice transmission experiments, although it probably was.)

Interestingly enough, his Philadelphia experiments as well as his Washington showings were successful, but his New York trip was a bust. Some observers attribute the poor performance to the hard, dry bedrock in the area.

Around this time, Stubblefield became quite well known. *Scientific American* printed an article about his work, and a coterie of sharp financiers took notice. They saw his system as a moneymaker. A group of New York businessmen formed The Wireless Telephone Company of America to promote the still unpatented device. Several Murray men owned stock. But, for some reason, Stubblefield shied away from the operation after it got underway. It's rumored that he turned down a half million dollars for his invention.

He finally applied for a patent on April 5, 1907, and received it May 12, 1908. He also obtained foreign patents.

Then, for some unknown reason, Stubblefield retreated to his home, disillusioned, distant, and despondent.

Some say his invention was stolen. Others say he became angry at his backers' greed. Still others contend he went mad.

After a Washington trip in 1912, Stubblefield told his friends and associates to withdraw their investments, go away, and leave him alone. That same year his house burned to the ground.

Later, his wife and children left him and he built a cabin about six miles north of Murray. There he continued to tinker, and apocraphyl stories abounded about his strange experiments which supposedly involved drawing energy from the earth for lighting.

He died March 28, 1928, of natural causes, and two days later Horace Churchill, country coroner, and his son, Ronald, broke down the door to Stubblefield's cabin. He was dead on the floor.

In his report, Churchill wrote: ". . .he had been dead for some time. I wouldn't know, but he was pretty stiff and all. Rigor mortis has set in. That cat had licked out his entire eyeball sockets. That's what the cat was doing."

One question still remains amid all the conjecture, weird tales, and questionable articles. Did Nathan B. Stubblefield invent radio? Are the people of Murray correct; did hometown boy make good?

It all depends on how you look at it and who you ask.

L. J. Hortin, one-time chairman of the Murray State University journalism school, spent 50 years studying Stubblefield. He has written hundreds of articles about the man and his work and is responsible for raising most of the money for a monument at Murray State University honoring Stubblefield.

But, like Stubblefield, Hortin appears distant and bitter about the whole affair, and although he claims to possess documents, affidavits, and photos attesting to Stubblefield's inventions, he refuses to let anyone see them. "I've been giving it out free for years," Hortin said. "I'm tired of people making fun of him and getting their information wrong. I've decided to put it all together and write a book.

"Pardon my vehemence," he continued, "but I've been doing this for 50 years.

"I say he invented radio about 1890, but I don't think anyone really knows. When someone questions me, I say, 'Let's see what you have. Who do you think did it?' That usually quiets them down.

"Radio is a device that transmits and receives voice over considerable distance without connecting wires," Hortin said. "Stubblefield invented, manufactured, and demonstrated

"Be it resolved by the General Assembly of the Commonwealth of Kentucky: That the General Assembly of the Commonwealth of Kentucky hereby publicly recognizes Nathan B. Stubblefield, who was a native of the city of Murray, Calloway County, Ky., as the true inventor of the radio, and it is the sentiment of the General Assembly that said Nathan B. Stubblefield is entitled to the highest honor and respect at the hands of the people of this Commonwealth and of this nation for his outstanding service."

—Resolution by the Kentucky Legislature, 1944.

such a device and did so before anyone else on this planet. That's my claim." He described "considerable distance" as several miles.

James L. Johnson is another unabashed Stubblefield booster. In a 1961 speech, the former executive secretary of the Murray chamber of commerce told the annual convention of The Kentucky Broadcaster Association in Louisville: "'Hello Rainey... Hello Rainey.' These four words, highly insignificant in themselves, were the gateway that opened a fabulous industry in the late 19th and early 20th century. These were the first words ever broadcast by radio. These four words put you people in business."

Following the address, the association presented the chamber of commerce a plaque recognizing Nathan B. Stubblefield as the inventor of broadcast radio.

But Riley Kaye W4LMF holds a different view of the Stubblefield story.

"I think Stubblefield invented the induction telephone. He used loops above the ground. There appeared to be no carrier. He used audio frequencies, and that's where the challenge comes in," said the man who worked for 7 years as chief instructor at RCA and high-frequency development engineer for Western Electric in Chicago.

"There is no proof that he used radiation. There's no proof he used resonant circuits. That would be radio."

Kaye, 9DKN during sparkgap days, added: "Nobody can challenge that he didn't invent the wireless telephone and that he was the first to transmit voice without wires. He deserves a lot of credit and Murray can be proud of him."

Despite its limitations, Kaye believes that Stubblefield's system needs a closer look. "It's not a private system, but it is cheap. It has a range of about five miles and seems perfect for community civil defense and emergencies. That avenue has not been pursued."

(Note that in Stubblefield's patent the ground rods are missing. In his early work, he employed a conduction system of telephony using the earth, but he later switched to an induction system. Evidently, Stubblefield confused the two media, thinking his voice traveled through both of them in a similar fashion.)

Another local ham takes issue with the Stubblefield saga. William Call KJ4W is vice-president and trustee of the Murray State University Amateur Radio Club. "It may have been magnetic induction," he said. "But you won't find that opinion around here much because it offends people. They want to believe he invented radio. On what I've seen," the school's electrical engineer said, "I don't believe he invented radio, but one thing almost everyone agrees on is that Stubblefield was a genius."

That he was.

Assaults on his claims of inventing radio have drawn attention from Stubblefield's other brilliant inventions. In 1888, he patented the first mechanical telephone, and he linked Murray with the system. It worked well until Bell introduced his electrical telephone which was superior in voice quality and reliability. He also invented a new type of primary battery, previously mentioned, whose revolutionary design stepped up dry-cell technology many notches.

So, if Stubblefield didn't invent radio—and it appears from his patent that he really didn't—who did?

According to many experts, another relatively unknown inventor, Reginald Aubrey Fessenden, on December 11, 1906, gave the first public demonstration of voice transmission using Hertzian waves—radio as we know it.

Photo H. Built in 1948, radio station WNBS was the first broadcast station in Murray. Its call letters were chosen to honor Nathan B. Stubblefield.

The exhibition by the one-time chief chemist of Thomas Edison's lab took place at Brant Rock, Massachusetts. He reportedly told a journalist in 1915 that he had been toying with the invention for some time and perfected it in December, 1900. He gradually increased the transmission range until, in 1904, he could cover 25 miles. Then he offered it to the Navy for development.

Fessenden was born October 6, 1866, in East Bolton, Quebec, and died July 23, 1932, in Bermuda.

So, it appears that although Stubblefield didn't invent radio, he was indeed the first person to send wireless voice transmission and suggest that it be employed in a moving vehicle such as a boat or horseless carriage.

But he holds another title, too. He was the first to transmit wireless voice from a ship.

In a 1971 thesis paper for Florida State University titled "The Contribution of Nathan B. Stubblefield to the Invention of Wireless Voice Transmission," author T. Morgan wrote: "Nathan B. Stubblefield was not the father of radio broadcasting. Stubblefield was the first man to successfully transmit and receive the human voice without wires. Therefore, let him be called the father of wireless voice transmission, for this title is truly his."

Perhaps I should drive to East Bolton and see if the residents there agree. ■

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In Search of the Elusive SES

—track solar activity with this simple VLF receiver

With the continuing and growing interest in solar flare activity, including the predictions for Cycle 21, radio amateurs and experimenters alike are searching for methods to follow and record this fascinating phenomenon. The SES (Sudden Enhancement of Signal) receiver that I am going to describe in this article provides a simple answer.

Photo A. Finished package with the fine-tune control added.

When a solar flare occurs on the sun, there is a major emission of X-rays. This has the effect of increasing the electron density of the D layer, immediately enhancing the storm noise (or the transmitted signal) to levels about twice normal. The effect is very prominent in the LF and VLF ranges. This enhancement, though it has a rather rapid rise time as seen from the recordings in Fig. 1, has a slow decay time as the D layer reestablishes its normal condition which can take from 30 minutes up to an hour.

Heat generated by the sun in the daytime periods expands the gas in the D layer, lowering its efficiency for radio propagation

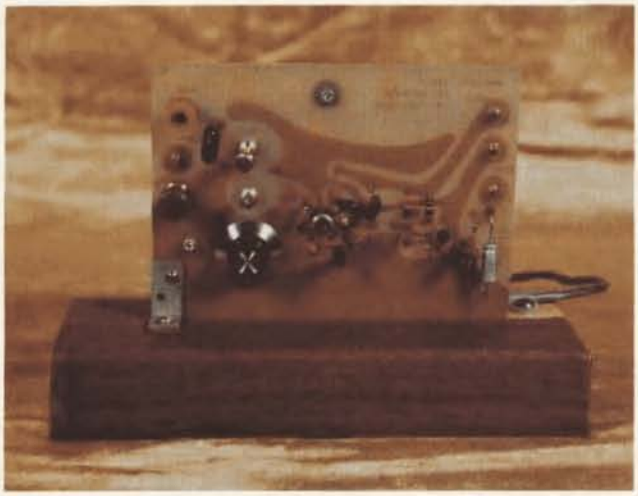

Photo B. Prototype receiver—front view.

Photo C. Prototype receiver—rear view, showing the shielding method used.

during the day. Similarly, the cooling of the layer allows the gas to contract, increasing its efficiency; this, of course, is the reason that AM radio stations are received at greater distances at night. There also are seasonal effects which occur as the Earth heats or cools, depending upon the angle of the sunlight as it strikes the Earth.

Receivers used to record these enhancements come in two categories. The first is an SEA receiver that is tuned to an unused frequency spectrum in the VLF range—hence the name, Sudden Enhancement of Atmospherics. The second type is tuned to a transmitted signal in the VLF range, and is the SES receiver—referred to above. SES receivers are easier to tune, and you do not have to be an expert to interpret the recording charts.

Building the SES Receiver

A proven circuit for building a tunable SES receiver is shown in Fig. 2. It is basically a high-gain amplifier which is tunable from 17.8 to 35 kHz. If you use the exact components shown on the schematic, the frequency range will be from 17.8 to 23 kHz. This circuitry is then followed by a detector and integrator and finally by a dc amplifier which brings the dc signal-related current up to a proper level to operate an analog meter or a recording device.

The recorder recommended is a model 288 Rustrak (0-100 uA) with a chart speed of 1" per hour, although I have used Esterline Angus 0-1-mA chart recorders successfully. The receiver has more than enough gain to peg a 0-1-mA meter.

All of the parts used in the construction of the receiver are standard, with the exception of the inductor coils. These inductor coils (Miller 6319) are high-Q types and are Litz-wire wound. They can be obtained from Bell Industries, J. W. Miller Division, 19070 Reyes Avenue, PO Box 5825, Compton CA 80224.

Wiring of the circuit is not critical; however, I suggest that a socket be used to mount the IC amplifier. A

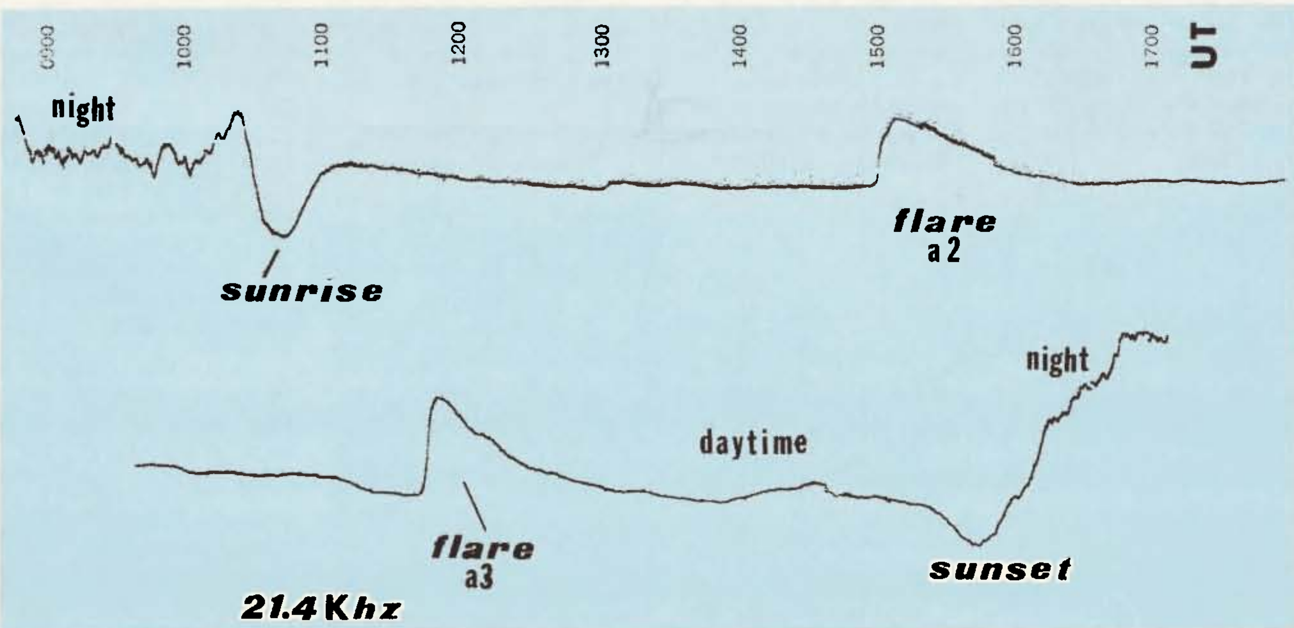

Fig. 1. Actual recordings showing characteristic fast rise/slow decay times.

Photo D. Shield removed to show coils, L1, L2, and gain pot.

substitution for the RCA CA3035 amplifier array is the more-readily-available Sylvania ECG-785. Both wideband amplifier arrays are made up of three individual ultrahigh-gain amplifiers. These amplifiers have low noise characteristics, can be operated either independently or in cascade, and have excellent high cascade voltage gain—129 dB at 40 kHz. The output transistor (RCA SK3019) can be replaced with either a Sylvania ECG-108 or a GE-214. Power supply requirements are 9.3 V dc for optimum operation, but any well-regulated 12-volt power supply can be used. The higher the voltage, the "choppier" the trace will become on the recording.

Initial Tuning Procedure

Run the cores of L1 and L2 completely in. Proceed to turn the gain control (R1) ¼ turn clockwise. Connect the antenna (preferably an 18-foot vertical or an 8-foot CB whip) to the receiver input jack. Ground the receiver using a good *earth* ground. Connect an oscilloscope (using the vertical input) to the test-point jack on the receiver. Turn out L1 one full turn. A large sine wave will appear on the screen, showing a prominent "hump."

If you have used the components specified in the schematic, this will be a signal coming from 17.8 kHz (NAA, Coutler, Maine). The format of this transmitted signal is such that it cannot be used in solar flare studies, so continue to turn the core of L1 out. The 17.8-kHz signal should drop out and a small hump will appear. This will be 18.6 kHz—NAA's 1-megawatt station. If the signal has good strength, by all means record it. If the signal is weak, as in my case, continue with the turning by opening the core of L1 until it's almost fully open or until a large signal reappears on the screen.

This signal will be 21.4 kHz (NSS) radiating a 200-kW signal. This station is an excellent choice for flare propagation recording for a number of reasons. First, it is easy to access (you cannot mistake the signal) and tuning is straightforward. Second, my records, along with the records at the AAVSO (American Association of Variable Star Observers) show that a lot of small flares are recorded at this frequency while they are often completely missed at other low frequencies.

If an oscilloscope is not available for tuning, the receiver can be tuned with a 0-200 uA meter placed across the receiver's recorder output terminals. When coil L1 is turned, a prominent peak will indicate that you have tuned the signal.

Final Tuning Procedure

Disconnect the oscilloscope or tuning meter and place a recorder at the designated terminals. Turn up gain control R1 to give you a mid-scale reading of either 50 uA or close to 1 mA if you are using a 0-1-mA recorder. By turning L1 in and out a few threads, peak the signal. Fine-tune the signal with 5-6 turns of L2. In some cases, it will show a prominent increase; in others, it will not. (Since all coils are not the same, the tuning of L2 may vary.) To test for oscillation, disconnect the antenna; the signal on the recorder should drop to zero or almost to zero. When the ground is disconnected, the signal definitely should drop to zero.

Other Hints and Correlation Ideas

The receiver itself can be housed in any standard metal or wood enclosure, but be sure to make use of adequate shielding around the inductor coils to ensure proper mixing. I use small, lined aluminum cans attached to brackets which are mounted to the circuit board. These make excellent shields.

Good correlation on an official basis for flare recording and verification may be obtained by sending for a weekly solar data bulletin (free) printed by the government. Write to the Space Environment Services Center, Space Environment Laboratory ERL, NOAA, Boulder CO 80302. Ask for the preliminary report and forecast of solar geophysical data.

Circuit boards for building the receiver are available from me for $8.00 each, plus postage.

For those further interested in solar flares and flare recording, my *Handbook of Solar Flare Monitoring and Propagation Forecasting* is available from Tab Books. ■

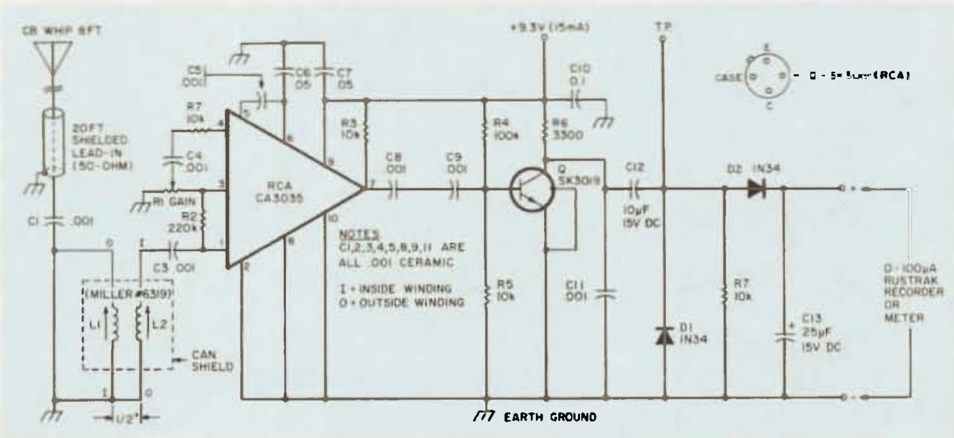

Fig. 2. Circuit for a tunable SES receiver.

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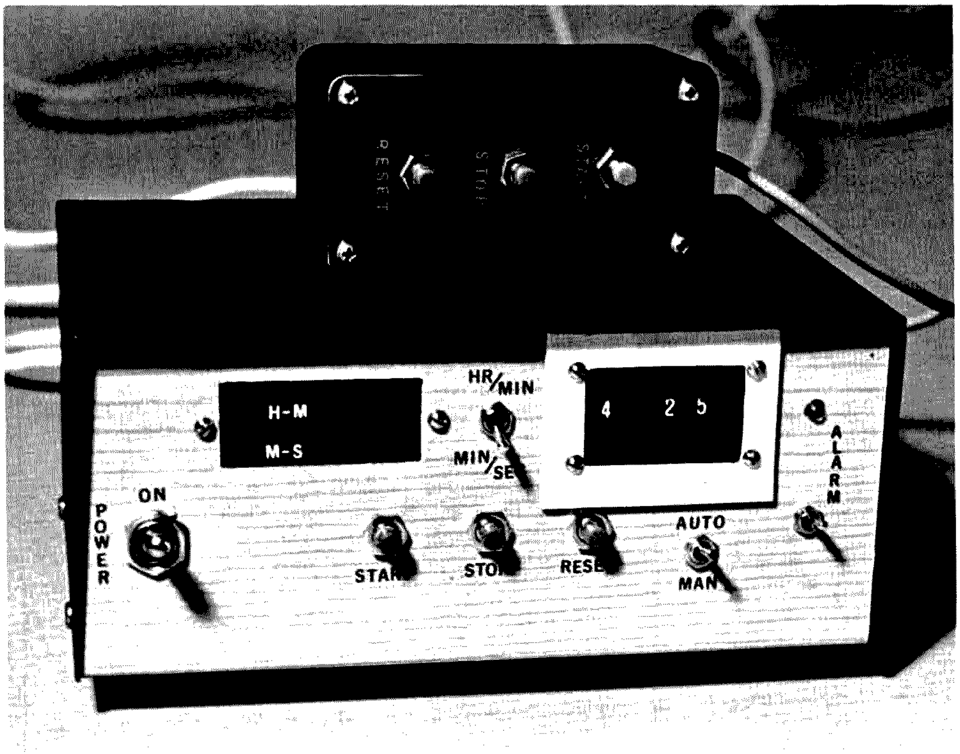
An Even Better IC Timer

—better than what?

Photos by Joe Woelfel



This is the front of the timer. Three 7-segment LEDs are behind a red plastic filter mounted in the upper left section. One digit is to the left of the letters; two are on the right. Discrete LEDs behind the H-M and M-S indicate whether the timer is in the hours/minutes or minutes/seconds mode. They are controlled by the toggle in the upper center. Thumbwheel switches are in the upper right section. The white frame is a piece of plastic covering a mistake made when cutting the hole. Lying on top of the timer is the remote switch box connected by a 4-wire cable. Woodgrain contact vinyl was used to cover the bare aluminum of the Radio Shack cabinet. Labels are dry transfer letters.

This project is a good example of the use of elaborate means to accomplish a simple task. Having become hopelessly hooked on the fun and logic of TTL devices, I was intrigued by an article by Kenneth Williams WB3ELV, in *73*, September, 1978. He had designed a circuit board for a 10-minute ID timer described by Ken Henry K3VTZ in a May, 1977, *73* article. His timer used a single 7-segment readout and cycled through 10-minute intervals.

After reading most of the series of *73* articles on how to use ICs, by Alexander McLean WA2SUT, I decided it would be more fun to have a timer which indicated minutes *and* seconds. I had a 10-minute timer working on the breadboard when I found another *73* article, "Build a Unique Timer," by Marc Leavey WA3AJR (August, 1977). His timer, built for darkroom use, will time to either 99 seconds or 99 minutes and used a 555 as the timebase. That article exposed me to the 7485 comparator chip and

thumbwheel switches. My timer grew out of all these, along with some basic design concepts from *The TTL Cookbook*.

My timer will do everything these will do and more. It will run to any user-selected time up to 9 minutes, 59 seconds by seconds or it will run from 1 minute to 9 hours, 59 minutes by minutes. At the end of the selected interval, an alarm may be sounded and a 115-V ac appliance may be turned on or turned off. The timing sequence may be interrupted by a manual reset. The timer may also be used as a stopwatch or an elapsed-time recorder. It may be stopped and restarted with or without resetting to zero.

The block diagram, Fig. 1, shows the general operation of the timer. A wave-shaper converts 60-Hz sine-wave current from the transformer secondary into the square wave required by TTL. A gate, controlled by a start/stop flip-flop, routes these pulses to the divider chain which divides by 60 twice to produce one pulse per second and one pulse per minute. These, as selected by the mode switch, go to the counter/driver/display section which shows minutes and seconds or hours and minutes. The output of the counters is compared with the settings of external thumbwheel switches. When these match, an alarm sounds and all dividers and counters are reset to zero.

The wave-shaper consists of two resistors, a diode, and a Schmitt trigger circuit using two inverters on U1. I have seen circuits which used only a diode to clip the sine-wave output, but I did not get dependable triggering until I included the trigger. Most TTL devices require negative-going pulses and tend to get confused unless they see very fast high-to-low switching. The circuit shown does not produce a 50% duty cycle square wave, but the negative-going pulses follow each other at a 60-Hz rate. Switching time is very short—on the order of a few nanoseconds.

The shaper output goes to the divider chain through a gate on U2 controlled by the start/stop flip-flops. U3 and U4 divide by 6 and 10 and produce one pulse per

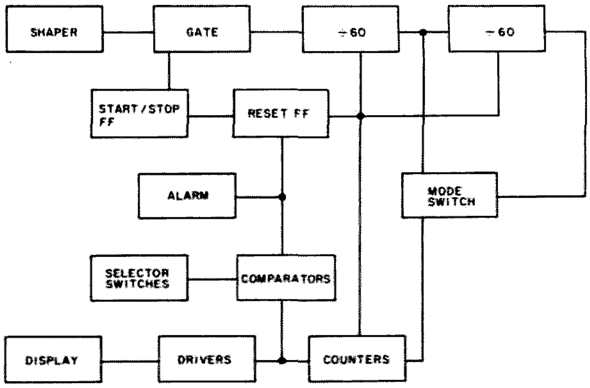


Fig. 1. Block diagram.

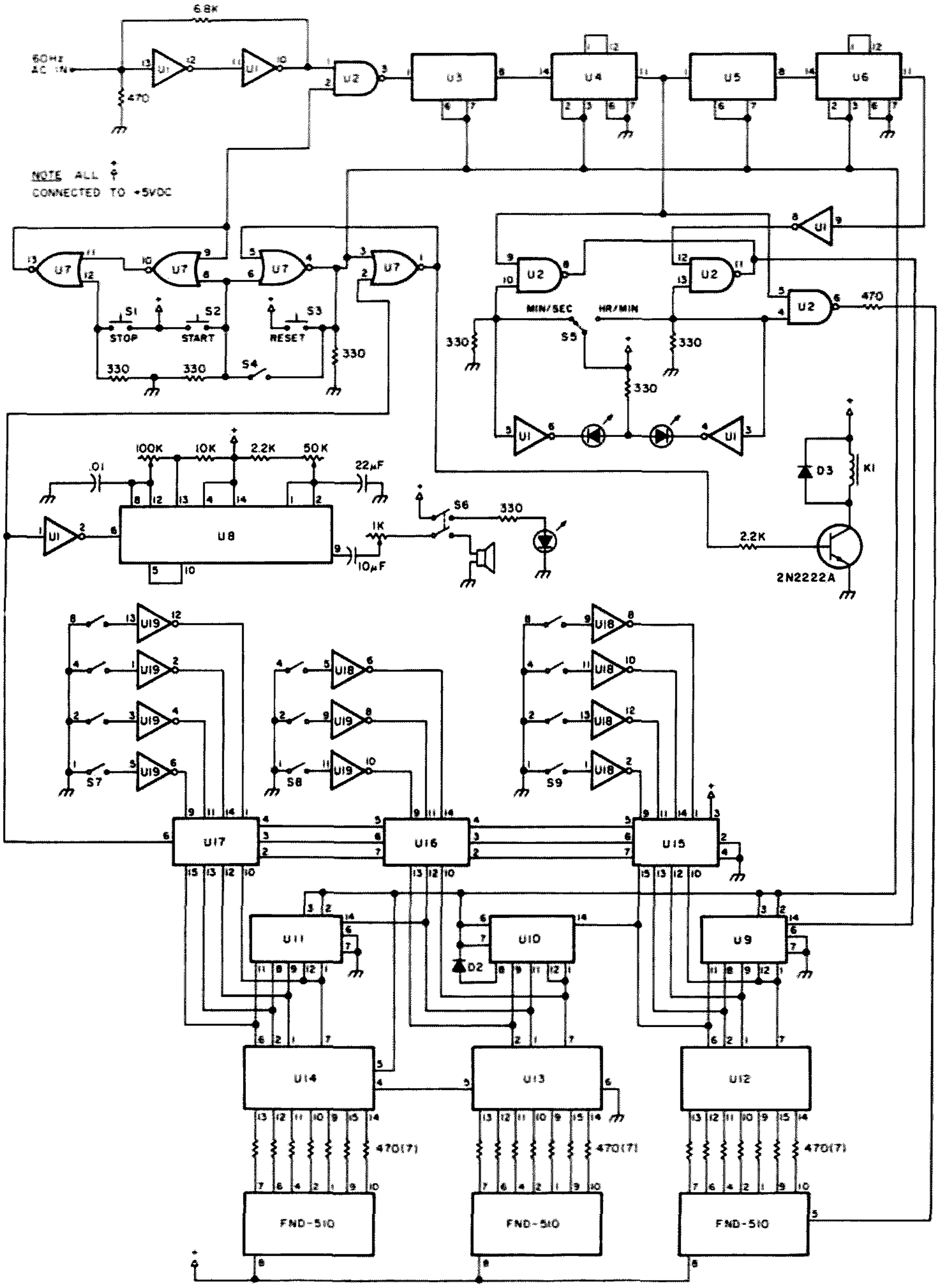
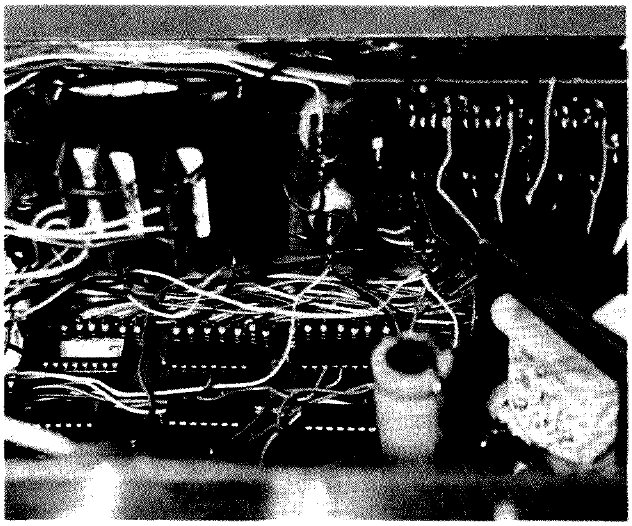
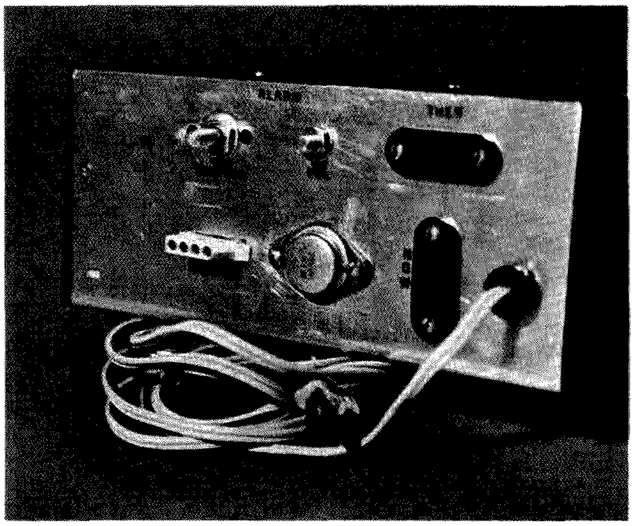


Fig. 2. Schematic.



Interior view showing the inside of the front panel and part of the main circuit board. Displays are upper right; thumbwheel switches are at the left. The 7447 display drivers and segment current-limiting resistors are in the lower center. Below them are the 7490 and 7492 decoders. The unorthodox wire connections to two of the drivers were added to correct errors on the circuit board. Because of omitted foil connections, wires were forced into the sockets beside IC pins.



Rear view showing placement of tone duration and volume pots, voltage regulator, and external connections. The four-hole socket at the left is for the remote switch box. At the right are two 115 V ac sockets, "THEN" is hot at the end of the pre-set timing period. "NOW" is hot during the timing period.

second. This is further divided by 6 and 10 by U5 and U6 to produce one pulse per minute.

The one-per-second or one-per-minute pulses, as selected by the mode switch, S5, are fed to the divider chain consisting of U9, U10, and U11. Each of these feeds a 7447 driver and a 7-segment LED readout. The outputs of U9, U10, and U11 are compared with the settings of three BCD thumbwheel switches by U15, U16, and U17. When those outputs match, pin 6 of U17 goes high, resets all counters to zero, sets off an alarm, and trips an SPDT relay which switches one 115-V ac outlet on and another off.

U7 is wired to form two interconnected R-S flip-flops. One is used to start and stop the timer by operating a gate on U2 which controls the 60-Hz pulse to the divider chain. This permits stopping and restarting the timer without resetting the counters to zero. Interrupting the count at this point introduces a minimum of error. The other flip-flop is used to control the reset line to all dividers and counters. When pin 6 of U17 goes high, pins 3 and 4 of U7 and the reset line go high. This stops all counting and resets the dividers and counters to zero. The reset line stays high until the start button is pushed, which drives the reset line low and permits the counters and dividers to operate. Closing the start switch also sets the reset flip-flop so that it is ready to accept a new pulse from U17. The reset line also can be driven high manually by S3.

U10, a 7492, needed some special treatment. To show tens of seconds (or minutes), the counter has to count to 5 and reset to zero on the sixth count. On the sixth count, a negative-going pulse must be provided to the input of U11, the minutes (or hours) counter. Pin 9 of the 7492 goes high on the fourth count and low on the sixth count. U11 ignores the positive-going pulse and is triggered by the negative-going pulse. However, if left to proceed through its normal count cycle, the pin 9 output would remain low for 10 more counts, triggering U11 only every second minute (or hour).

There is a solution, though. Pin 8 goes high on the sixth count, so that output can be used to reset the counter to zero, and U11 is triggered every sixth count. Connecting pin 8 of U10 directly to its reset pins, 6 and 7, interfered with the operation of the system-reset from U2. A diode between pins 7 and 8, blocking the system-reset pulse from U2, solved the problem.

The 7447 BCD drivers provide leading-zero blanking. When pin 5 of the most significant digit is grounded and pin 4 is connected to less significant digits, the readouts will not display meaningless zeros. I connected pin 5 of U14 to the reset line instead of to ground; thus, leading zeros are blanked only when the timer is counting. This gives a visual indication of the state of the timer.

I also wanted visual indication of whether the timer was in the hours/minutes or minutes/seconds mode. The obvious solution was to use discrete LEDs as indicators. Also, in the hours/minutes mode, the readout changes only once per minute. To provide assurance that something was really happening, I made one of the readout decimal points blink at a 1-Hz rate. Switching all those functions would be simple with a 3-pole, 2-position switch. However, switches are expensive; ICs are cheap. With the use of gates on U2 and inverters on U1, the hours/minutes and minutes/seconds timing pulses, the LED indicators, and a pulsing decimal point for hours/minutes are all switched with an SPDT toggle, S5.

When S5 is in the minutes/seconds position, pin 10 of U2 is high, allowing the 1-Hz pulses to reach the counter chain. Also, pin 5 of U1 is high and pin 6 is low, providing a ground for the minutes/seconds indicator LED. In the hours/minutes position of S5, pin 13 of U2 is high and one pulse reaches the counter each minute; pin 4 of U1 is low, providing a ground for the

indicator, and pin 4 of U2 is high, passing one pulse per second to the decimal point of the units readout.

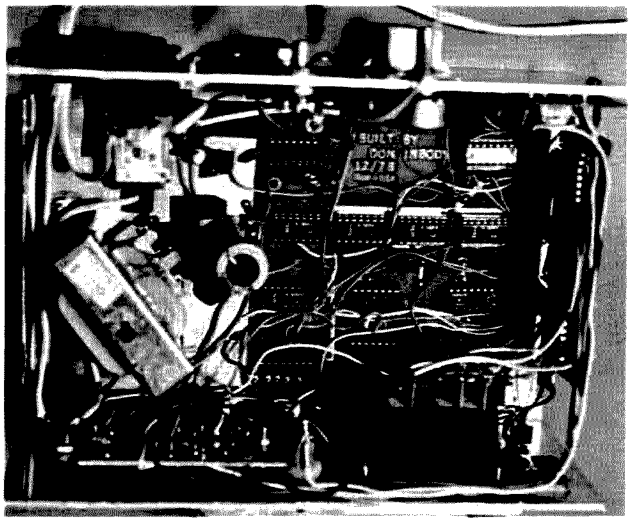
All this switching caused a small problem. I discovered that in the hours/minutes mode, the timer indicated 1 minute after 48 seconds had elapsed. Just a little examination of the 7490 logic table revealed the reason. Pin 11 of a 7490 is low for 8 counts, high for 2 counts, then goes low. That negative-going pulse triggers other devices. However, I had routed the pulses through a 7400 gate and inverted everything. Thus, the positive-going pulse at the eighth count of U6 was seen at the input of U9 as a negative-going pulse. Of course, each succeeding "minute" was 60 seconds long. The problem was corrected by running the minutes output from U6 through an inverter on U1.

The same inaccuracy exists with the 1-Hz output from U4. The first "second" is only .8 second long. I decided to live with that error, because no more inverters were available without adding another IC. By now I realized that the whole problem (and some others) could have been avoided by using a 7408 for U2 instead of a 7400. I did not have a 7408, and my circuit board was already laid out. Oh, well. Next time!

S4, an SPST toggle, was added to increase the versatility of the timer. When it is closed, the reset and start push-buttons are shorted together. Pressing either switch resets everything to zero and immediately starts a new timing sequence. The alarm still sounds at the end of the selected interval, but it is not possible to stop and restart the count without returning to zero. This mode also effectively disables the 115-V ac switching function as the stop-reset-start sequence is so fast that the relay does not trip. I called the closed position of S4 "auto" and the open position "manual." The strange location of the switch happened because this feature was not installed until the project was complete. With a little forethought, the switch could have been located in a better place.

Two 115-V ac sockets are provided for the operation of external appliances such as lights, radio, TV, etc. An SPDT relay with a 6-V coil switches the outlets on or off. One is on and one is off during the timing sequence. This is reversed at the end of the selected interval. Pin 1 of U7 is high during the timing period, so that output was used to make a 2N2222A transistor switch 5 V dc to the relay. A 1N914 diode across the relay coil reduces voltage spikes which occur when the coil is switched out.

The alarm circuit is built around a 556 timer. This is a dual 555 with one part serving as an oscillator to produce a tone and the other as a timer to set the duration of the tone. Pin 6 must be low to trigger the multivibrator, so the high output from pin 6 of U17 is inverted through U1. The pitch of the alarm tone may be adjusted with a 100k pot mounted on the circuit board. The duration of the alarm tone may be varied from a fraction of a second to several seconds with a 50k pot mounted on the rear of the cabinet. I placed a 2.2k resistor in series with the pot so that there would be some tone when the pot was at minimum resistance. The volume of the alarm tone may be adjusted with a 1k pot on the rear of the cabinet. The alarm can be completely disabled with a toggle switch mounted on the front of the cabinet. I included an LED to indicate when the alarm is enabled. If the indicator were omitted, an SPST switch could



Interior view of the timer. The power supply and ac switching relay are on the left. Displays are at lower left; thumbwheel switches are at lower right. The 7485 comparators and 7405 inverters are on a small circuit board mounted vertically at the right. The unorthodox wires on the ICs in the upper right and lower left were used to correct circuit board mistakes. Some foil connections were omitted, so wires were forced into the sockets beside the IC pins.

be used.

The switch input to the 7485 comparators requires a BCD complement. I have read that complement mode switches are available, but I could locate only straight BCD switches. A couple of 7405 hex inverters were used to generate the complements of the selected numbers.

The power supply as shown in Fig. 3 is conventional. A 12.6-V, 1-A transformer was used because it was on hand. Anything that will produce at least 7.5 V at .5 A should work. I used a 7805 regulator and mounted it on the rear of the cabinet. Any +5-V regulator capable of handling .5 A could be used. A 10-uF tantalum capacitor from the output of the 7805 to ground is necessary to prevent oscillation and should be mounted as close to the output terminal as possible. De-spiking is provided by several .01-uF disc capacitors. These are not shown on the schematic, but were placed at various locations where the +5-V dc lines were near ground buses. Good TTL design calls for one de-spiking capacitor for every 3 ICs, and one at every place the supply line enters a circuit board.

To make the timer more useful for timing games, for use as a stopwatch, and to generally improve portabil-

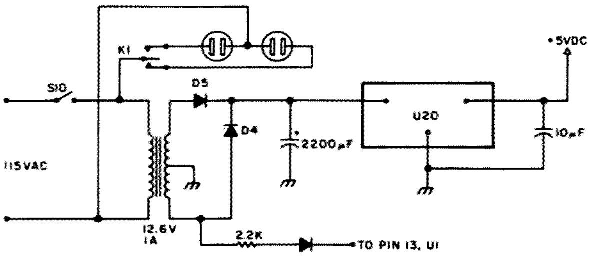
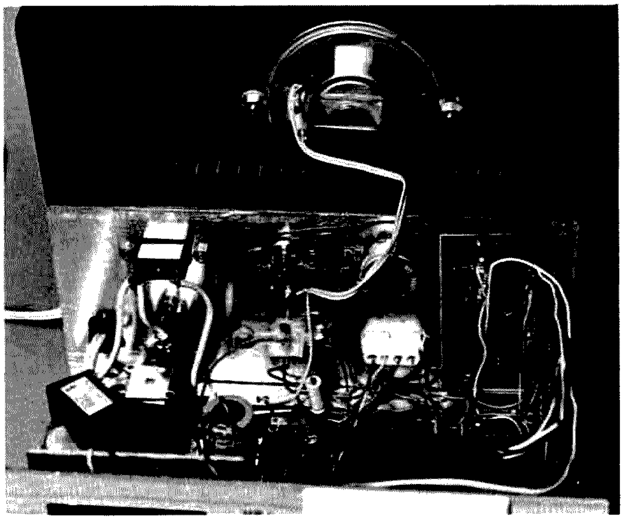


Fig. 3. Power supply.



Interior view of the timer showing the speaker mounted on the top of the cabinet. The power supply components and 115 V ac connections are shown on the left side. The small board at the right was added after the project had been designed and the main circuit board etched. With better planning, the 2 ICs could have been mounted on the main board.

Parts List

Diodes
- 2 1N914 or 1N4148
- 3 1N4001

Capacitors
- 6 .01-uF ceramic disc
- 1 10-uF tantalum
- 1 10-uF 16-V electrolytic
- 1 22-uF 16-V electrolytic
- 1 2200-uF 16-V electrolytic

Integrated Circuits
- 1 U1—SN7404
- 1 U2—SN7400
- 3 U3,U5,U10—SN7492
- 4 U4,U6,U9,U11—SN7490
- 1 U7—SN7402
- 1 U8—NE556
- 3 U12,U13,U14—SN7447
- 3 U15,U16,U17—SN7485
- 2 U18,U19—SN7405
- 1 U20—7805 regulator

LEDs
- 3 .2" discrete LEDs
- 3 FND-510 displays

Resistors (all ¼ Watt)
- 7 330 Ohm
- 23 470 Ohm
- 3 2.2k Ohm
- 1 6.8k Ohm
- 1 10k Ohm
- 1 1k linear pot
- 1 50k linear pot
- 1 100k PC-board pot

Sockets
- 2 ac sockets (Radio Shack 270-642)
- 13 14-pin IC sockets
- 6 16-pin IC sockets

Switches
- 3 NO push-buttons (S1,S2,S3)
- 1 SPST miniature toggle (S4)
- 1 SPDT miniature toggle (S5)
- 1 DPST miniature toggle (S6)
- 1 SPST standard toggle (S10)
- 3 *BCD thumbwheel switches (S7,S8,S9)

Other
- Cabinet (Radio Shack 270-269)
- Relay—SPDT, 6-V coil (Calectro D1-066)
- Speaker—8-Ohm, 2-inch
- Transformer—12.6-V c-t, 1 A
- Transistor—2N2222A

*Thumbwheel switches are available from Jameco. This installation required:
3 SR21 BCD switches
1 SRBB blank body
1 pr. SREP end plates

ity; I installed 3 push-button switches in a small box and connected them in parallel with the front-mounted start, stop, and reset buttons. I used a 4-pin socket on the cabinet back and a piece of 4-wire cable from the junk box.

I used FND-510s for the readouts. They are large (.5") and can be bought for $1.00 or less. The 510 is a common-anode device. Almost any 7-segment LED could be used. Common-cathode devices would require 7446 drivers and ground connections instead of +5 V dc.

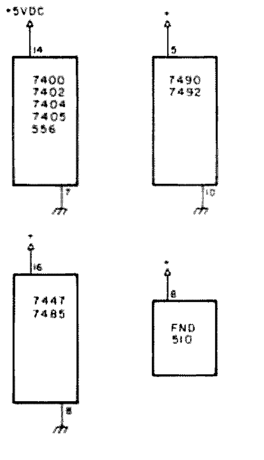


Fig. 4. Supply connections.

All parts were readily available at local Radio Shack stores and from firms advertising in *73*. There is considerable variation of prices, so it pays to do some comparison shopping.

I used circuit board construction. Perfboard or wire-wrap probably would have worked, but I wanted the neater appearance of circuit boards. I ended up with 4 boards. The FND-510s, the hours/minutes, and the minutes/seconds LEDs were on one. Because of the many interconnections with other ICs, it seemed simpler to mount the 7485s and 7405s on a separate board. After the main board was etched, I made a design change which required the addition of the 7404 hex inverter and different connections to the 7400 NAND gate. A separate small board was made for those two ICs. They could have been included on the main board with proper planning. The 7805 regulator, alarm volume control, alarm duration pot, 115-V ac sockets, and the remote-control socket were all mounted on the rear of the cabinet. All other components were mounted on the main circuit board except the front-mounted switches. There is nothing especially critical about parts placement, although a little care and planning are needed to reduce the need for jumpers.

Supply connections are not shown on the schematic, Fig. 2. Ground and +5-V dc connections must be provided to all ICs, as shown in Fig. 4.

This project has been a lot of fun. In it, as my first attempt to design a project, or at least to make major modifications to others' projects, I have learned a great deal about TTL. *And*, the completed timer has even proven useful! I have

actually used it as an ID reminder when rag chewing on 15 meters. My family enjoys a variety of games which have time limits varying from a few seconds to several minutes. The timer works well for them. One son is supposed to practice on the organ for 30 minutes. Sometimes he has to interrupt that practice for more important business such as petting the dog, going to the bathroom, etc. Now the rule is that he has to set the timer for 30 minutes, stop it whenever one of those diversions occurs, restart it when returning to the organ, and continue until 30 minutes of actual practice have been completed.

If you build this timer, you will no doubt want to make changes. Some variations have already occurred to me. I have already mentioned the use of a 7408 for U2. The timer limit could easily be extended to 99 minutes or 99 hours. The counter/driver/comparator chain could easily be expanded by adding another 7490, 7485, 7447, readout, and thumbwheel switch. The timer could be made to display tenths of seconds by feeding the counters from the output of U3. No doubt there are also more efficient or effective ways to accomplish some of the same functions. I will be interested in hearing about your results.

Incidentally, etched and drilled circuit boards and parts kits are *not* available. You are on your own! You will probably want to make modifications to suit your own needs. Anyway, getting there is at least half the fun.

My thanks to my colleague, Joe Woelfel, for the photography, and to those mentioned in the opening paragraphs who got me into this. ■

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Direct Printing FAX

—part II: constructing the facsimile recorder

In part II of this three-part article, I will cover construction of the facsimile recorder. Construction is probably the most critical part of the project, as considerable mechanical tinkering is involved and the various parts must function smoothly in relation to one another if quality results are to be obtained.

Recorder Mechanics

The easiest approach is to use the FX-2E minikit available from METSAT Products, Box 142, Mason MI 48854. This kit contains drilled and plated circuit boards for the electronics circuits and a complete set of parts, most fully assembled, for the fax mechanics. The mechanical assembly, illustrated in Fig. 1, is made up of a series of parts machined out of brass, aluminum, and stainless steel and it is built like a battleship. It is quite heavy and massive and provides the rigidity and precision required for a smoothly operating system. The parts are drilled and tapped to permit assembly and disassembly with machine screws, and the kit includes all of the mechanics components including the motors. About 15 minutes of additional assembly work is required to get the assembly ready for operation. The cost for this package is $500 plus shipping. This is more than you will pay for the home-built alternative but does eliminate virtually all of the work associated with the mechanical part of the project, and you also get circuit boards for the electronics.

The second approach is to build the mechanics yourself. To this end, I have documented a modified (and improved) version of the fax mechanics described in the first edition of the *Weather Satellite Handbook*. This assembly will do an excellent job, but you will have to build it and do considerable fine-tuning to get it operating properly. Once it is set up, it should require very little ongoing maintenance.

The Drum. The drum (Fig. 2) is fabricated from a plastic rolling pin—a "Pastry Pin" manufactured by the Housewares Division of the Foley Manufacturing Company of Minneapolis. This item is sold in housewares departments and discount stores across the country and costs between $1.60 and $2.00 depending upon the source. The drum is just over 2 inches (5 cm) in diameter and is perfect for this application. Other materials may be used for the drum, but you should stick close to this figure for the diameter to avoid distortion of the image aspect ratio.

The plastic handles of the rolling pin are twisted off and the shaft removed. A fine saw is used to cut the drum down to a length of 8 inches. True the cut end by using a fine file or sandpaper, and insert the end piece removed from the short length that was cut from the drum. The steel shaft should be cut down to 11.25 inches (save the piece you cut off as we will use it for the stylus). Deburr the ends with a fine file, and use steel wool or emery cloth to remove any corrosion from the steel shaft. Use a cyanoacrylate adhesive (Super Glue™, Eastman 910™, or other brands) to cement the shaft into place as indicated in Fig. 2.

Now comes the part which is harder to describe than it is to do. The paper we will use is a front-grounding paper. This means that the ground return must be provided from the paper surface. This is accomplished via an aluminum foil strip attached to the drum surface and connected to the drum shaft for grounding. Drill a #2 pilot hole at the right end of the drum and place the small end of the angled piece of foil over this hole. Use a small sheet-metal screw to attach a small solder lug so that it is in contact with the foil strip. The 7-inch length of foil is folded in half lengthwise along the dotted line and laid along the precise center line of the drum so that the right end of the strip is in contact with the piece of foil already in place. A long piece of transparent tape is then used to attach the *lower* side of the folded tape to the drum surface. The upper folded side must be free so that the paper can be inserted under it when it is fastened to the drum. The transparent tape should extend all the way to the back of the fold so that the entire lower half of the foil strip is covered, and should be wide enough to extend past the foil on three sides as indicated in the

figure. Additional tape then can be used to cover the exposed parts of the angled piece of foil so that it will not pull loose.

Next, break two brass inserts out of standard plastic panel knobs. Set one of these aside for stylus construction and slide the other over the right end of the drum shaft, using its set screw to secure it up against the right end of the drum. Prior to this step, however, you should solder a short length of hookup wire to the outside of the brass insert. When the insert is locked in place, cut and strip the wire and solder it to the small solder lug mounted previously. Do this operation quickly to avoid melting the plastic of the drum. A small magnet should be cemented to the drum as indicated in the figure. This completes the drum assembly. It should be set aside carefully to avoid spoiling your handiwork.

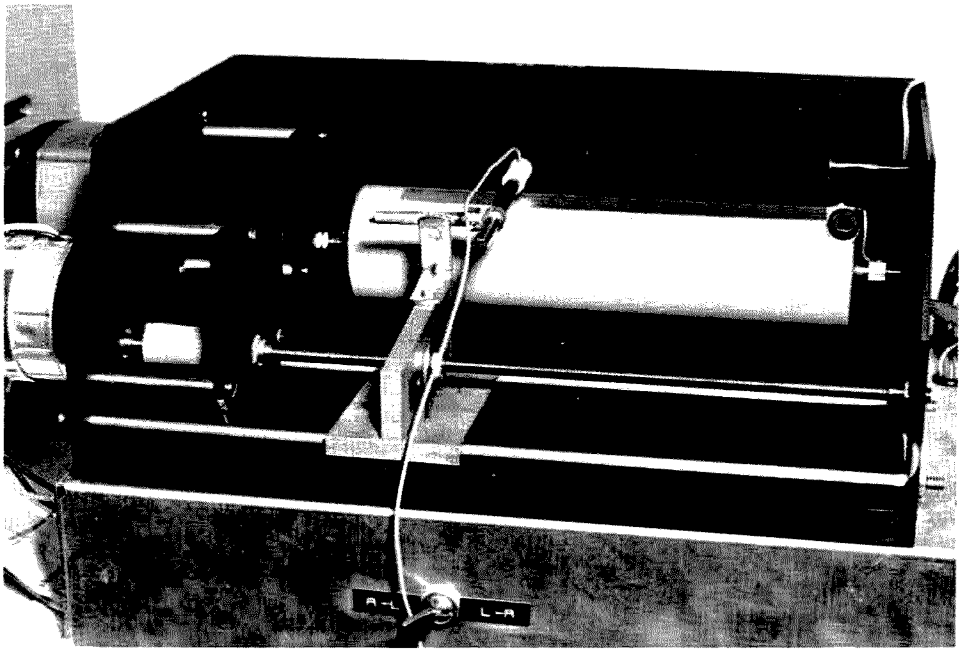


Fig. 1. A photograph showing the METSAT version of the facsimile mechanics. The home-built version described here operates on the same principles, but some features have been changed to facilitate home construction. In the METSAT version, the base and backplate are 1/2" aluminum with 1/8" aluminum side plates. The motors are to the left and the stylus carriage and the stylus itself are visible. In the illustrated version, the machined brass carriage base plate rides on two brass rails. The drum shows the foil grounding strip, magnet, and grounding wire and shaft collar. The magnetic reed switch that helps control WEFAX phasing is shown on the right end plate.

Motors. The drum and traverse motors which are recommended are manufactured by the Hurst Manufacturing Company of Princeton IN. Other synchronous motors of identical speed and similar power rating or torque may be substituted. Motors of other speeds might also be usable if suitable gearing is provided to produce the proper speed at the output shaft of the gearing assembly.

The drum motor is a 240-rpm type-GA motor, rated at 10 W, with 600-inch-oz. torque at 1 rpm. This speed is not a normally stocked option, but can be obtained on special order with a lead time of 4-6 weeks. The traverse motor selection is based on the class of service for which the recorder is intended. For GOES WEFAX, you should obtain a 40-rpm type-CA motor. This selection also will work well for METEOR display. TIROS N display will require a 20-rpm type-CA motor. Both the 40- and 20-rpm motors are available as stock items. It should be noted that all of the motor speed ratings given are referenced to 60-Hz ac drive. In 50-Hz countries, you should obtain motors designed to operate from 50-Hz mains. Do not do this for the drum motor as the sync system is designed to provide 60-Hz drive, and if you use a 240-rpm motor designed for 50 Hz, the drum will be too fast. The motor wiring should be followed carefully, or the motors may not turn in the proper direction—something that will lead to some rather unusual pictures.

Mechanics Assembly. Fig. 3 shows some general views of the relationship of parts for the home-built version of the fax mechanics. Precise measurements are

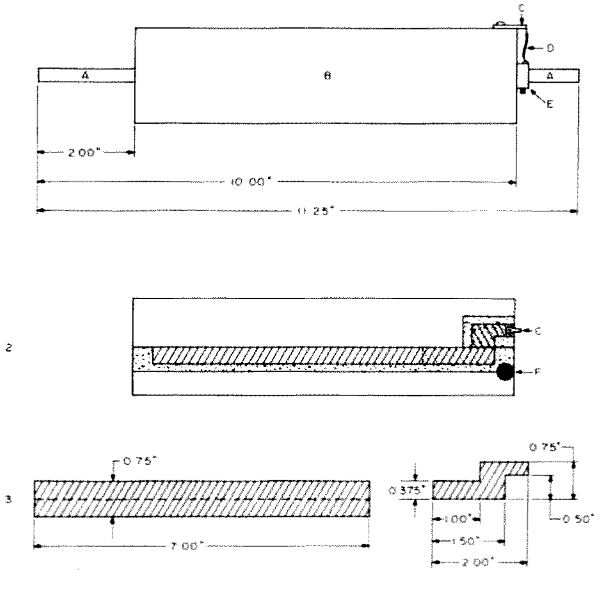


Fig. 2. (1) General drum configuration. (A) 1/4" steel shaft. (B) Drum. (C) Small solder lug. (D) Piece of insulated hookup wire soldered to C and E. (E) Brass insert from a 1/4" control knob secured to the drum shaft with its set-screw. (2) Layout of aluminum foil strips (crosshatched) and transparent tape (stippled) on the drum. (F) is the small magnet attached to the drum surface with double-sided adhesive foam tape. (3) Dimensions of aluminum foil strips (see text for assembly).

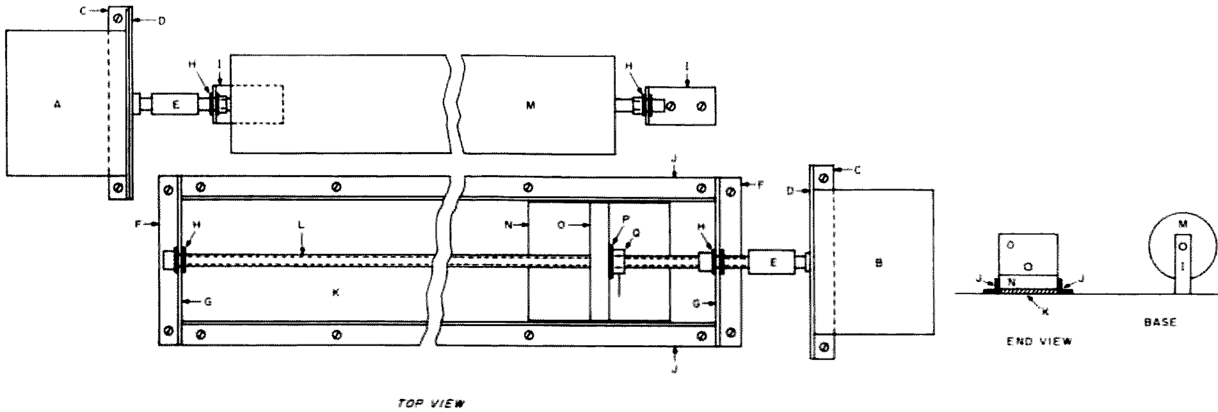


Fig. 3. The facsimile recorder mechanical assembly. A—Drum motor; B—traverse motor; C—motor mounting plate angle bracket; D—motor mounting plate; E—rubber-tubing shaft coupling; F—drive-rod support plate angle bracket; G—drive-rod support plate; H—3/8" panel bushing; I—drum support bracket; J—carriage track bracket; K—glass-plate track surface; L—1/4-20 threaded drive rod; M—drum assembly; N—stylus-carriage base; O—stylus support; P—carriage-drive washer, and Q—1/4-20 carriage-drive nut.

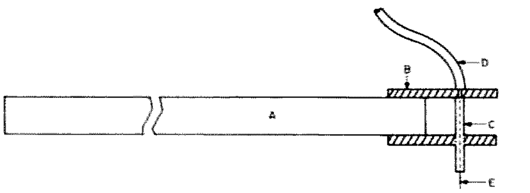


Fig. 4. Stylus holder details. (A) 3-1/4" piece of 1/4" steel rod stock (left over after the drum shaft has been cut to size). (B) 3/4" piece of 3/8" o.d. plastic tube stock. (C) 1/2" piece of 1/16" tube stock (stylus holder). (D) length of hookup wire soldered to one end of (C). (E) Wire stylus inserted into (C).

of little use since the details of layout will depend upon the locally available materials. I will, however, provide some general notes, trusting in your ability to improvise.

The base of the unit is best made with a piece of 3/4" plywood. The surface should be covered with formica, masonite, or some other smooth material. The recorder will produce some fine black ash that accumulates after a time and needs to be wiped off the surface. This is quite difficult if the natural rough wood porous surface is retained. The recorder mechanics utilize standard 3/8" panel bushings for 1/4" control shafts as bearings for the drum and drive rod. The drum is supported by two such bushings mounted at the top of the upright section of two standard steel or brass right-angle brackets available from local hardware stores. The brackets should have the standard screw holes enlarged to 3/8" to accommodate the bushings.

Mount the right bracket to the base with wood screws and orient the left bracket so that the drum will turn freely when the bracket is screwed in place. Occasionally, these brackets are not completely true so that some bending with a pair of heavy pliers may be required after mounting to true up the bushings so that the drum will turn freely. The drum motor is mounted to a plate of G-10 fiberglass board stock, 1/8" aluminum sheet stock, or other rigid material. This mounting plate is secured to the base with a piece of 1/2" aluminum angle stock cut to the width of the motor mounting plate. The hole for the motor shaft bushing is drilled so that the motor shaft will line up precisely with the drum shaft when the plate/bracket assembly is screwed to the plywood base.

Once the shaft bushing hole has been drilled correctly, you can mark and drill the holes for the motor mounting lugs. Final positioning and securing of the mounting plate to the base is done while checking the alignment of the motor and drum shafts. The motor and drum are coupled with a piece of thick-walled tubing of the type used for vacuum lines in laboratories or automobile engines.

The stylus carriage is assembled from hardwood. The base piece should be about 3 inches square, and the vertical upright should be cut so that it is at or slightly above the centerline of the drum. A long piece of aluminum angle bracket is laid out parallel to and about an inch out from the drum face to define one edge of the carriage track. The positioning of the other edge is based on the width of your carriage base piece. The second rail should be positioned to provide a smooth sliding fit for the carriage base piece. It should be tight enough to eliminate any shifting of the base but no so tight that it binds. Once the second track rail has been mounted, you should measure the track width (between the rails) and have a piece of window glass cut to fit between the rails. It should be epoxied in place.

The next job is to prepare the support plates for the 1/4-20 threaded drive rod. The rod must run down the center of the track at a height that will place it about 1/2" above the top surface of the carriage base. The rod is supported by two 3/8" bushings in small plates of G-10 board stock or metal secured to the base with strips of aluminum angle stock. Drill the plates so that the 3/8" holes are at exactly the same height. Install the bushings and secure the plates to the base so that the rod runs down the center of the track.

The traverse motor mounting arrangements are essentially identical to those of the drum motor, with alignment and mounting adjusted to keep the traverse drive shaft in alignment with the threaded

drive rod.

A 3/8″ hole should be drilled in the vertical member of the carriage assembly so that the carriage can be moved along the length of the track without coming in contact with the drive rod. Remove the carriage and paint it with several coats of epoxy paint or other oil-resistant finish. While the carriage is drying, take a 1/4-20 nut and drill a small hole part way through one of the flat faces on the edge of the nut. Solder a 3/4″ wire brad or nail into this hole.

A small quantity of talcum powder should be sprinkled onto the track to serve as a dry lubricant. Place the carriage at the center of the track and thread the drive rod through the left support bushing, continuing to extend the rod until the right end protrudes through the hole drilled in the vertical carriage member. Slide the 1/2″ flat washer over the exposed end of the drive rod and thread the prepared nut over the end of the rod. Run the nut down the rod (to the left) while extending the rod until it passes through the support bushing on the right end of the track. Couple the right end of the threaded drive rod to the traverse motor shaft using another piece of thick-walled rubber tubing.

Rotate the drive nut until the brad is horizontal, and move the carriage up against the drive nut/washer assembly. Note that if the drive rod is rotated in either direction, the nut will rotate until the brad comes into contact with the carriage base. At this point the nut can no longer rotate and must move along the shaft. If the shaft is rotated in a counterclockwise direction (viewed from the front of the traverse motor), the nut will move away from the carriage and toward the motor. This is

Pin	Function
1	Ground
2	Phase sensor reed switch (S203)
3	Stylus
4	M2 black lead (both)
5	M1 white lead
6	M1 black lead
7	M2 red lead
8	M2 white lead

Table 1.

what will occur when you are resetting the recorder. If the shaft is rotated in a clockwise direction, the nut will move away from the motor, pushing the carriage ahead of it. Misalignment or wobble in the shaft will cause the nut to slide around in contact with the washer but will not result in axial movements of the carriage; the only motion transferred to the carriage is a smooth push down the length of the carriage track. This particular drive system is much superior to systems where the nut is directly attached to the carriage assembly.

The final step in the assembly of the main mechanics package is to fabricate a small aluminum bracket that will attach to the right drum-mounting bracket and hold the magnetic reed switch above the right end of the drum. Wire leads should be soldered to the switch terminals and a covering of electrical tape placed over the entire switch assembly. The aluminum support bracket and the attachment of the switch assembly to this bracket should be adjusted so that the small magnet on the drum will close the switch once during each drum revolution. This can be checked with an ohmmeter connected to the switch leads. Although aluminum is specified for the switch mounting assembly, almost any non-ferrous metal can be used. Steel should be avoided as it will gradually become magnetized in the field of the drum magnet, exerting a pull on the switch elements that will gradually make the switch less sensitive.

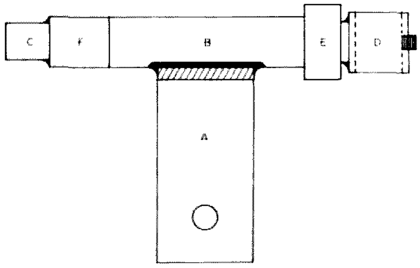


Fig. 5. Stylus support details. (A) 1″ brass angle bracket. (B) 1″ piece of 1/4″ (o.d.) brass tubing soldered to the top of the vertical leg of the angle bracket. (C) 1-3/4″ piece of 3/16″ (o.d.) brass tube soldered at one end to the side of the brass insert from a 1/4″ control knob (D). (E) 3/16″ (i.d.) wheel collar. (F) 5/16″ piece of 1/4″ (o.d.) brass tube stock soldered to (C) so that the latter extends beyond (F) on the right side.

Stylus Assembly. The details of the stylus assembly are shown in Figs. 4 and 5. The stylus holder is made up from the scrap piece of 1/4″ steel rod cut from the drum shaft. To insulate the stylus from the support arm, a small piece of plastic tubing is cemented to the end of the steel rod, using cyanoacrylate glue. A small

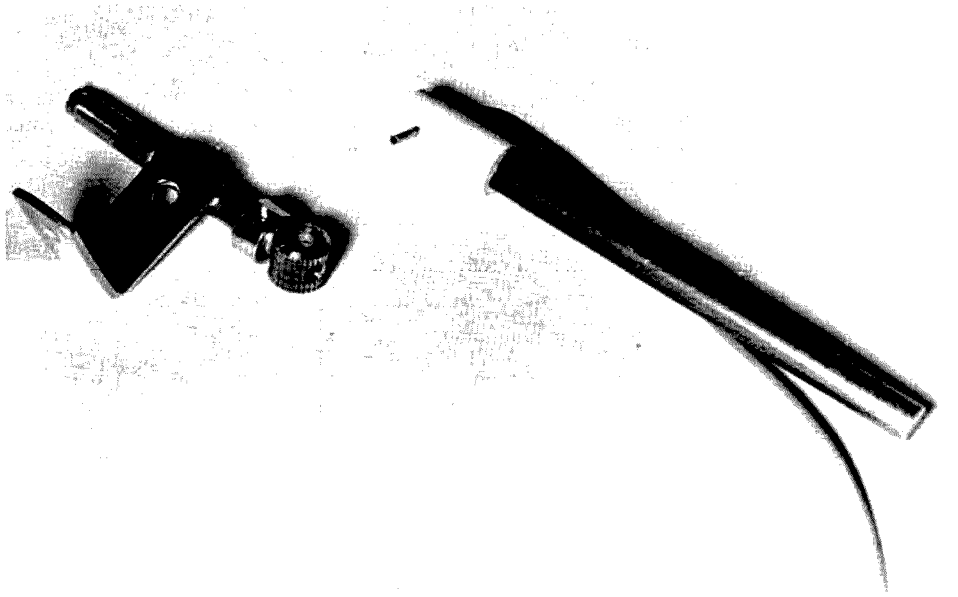


Fig. 6. Stylus pivot and stylus arm assemblies. The stylus support bracket and pivot assembly are shown to the left, while the stylus arm is on the right.

piece of 1/16" brass tubing (this and other sizes of brass tubing are available in your local hobby shop) serves to hold the small, steel stylus wire. A piece of lightweight hookup wire is soldered to one end of the brass tube which then is mounted in a hole drilled in the plastic end piece and secured with cyanoacrylate cement.

For the stylus wire, you will need one of the small wire brushes designed to operate in an electric drill. (We will get to that during final checkout.) The stylus arm is supported by a brass pivot/bearing assembly formed of small pieces of brass tubing. The bearing assembly is soldered to a small brass angle bracket screwed to the vertical support of the carriage assembly. The precise size of the various pieces of tubing used for the bearing assembly is unimportant as long as the pieces nest smoothly.

The second brass knob insert, which you had set aside earlier, is soldered to the long piece of tubing (C) which serves as the axle of the support structure for the stylus arm. The bearing for the support of this axle (B) is soldered at the top of the vertical extension of the brass angle bracket. An aluminum "wheel collar," available from the same hobby shop where you get the tubing, serves as a stop at the brass insert end of the shaft, while a small piece of tubing (F) is slipped over the shaft and soldered at the *outside* end to provide the second stop. The tubing pieces should be deburred and the ends filed true prior to assembly. When completed, the inserted knob should rotate very freely but with no excess play in any other axis. Fig. 6 shows the assembled stylus parts to give you some idea how they look when assembled.

The stylus pivot assembly is mounted to the carriage upright using wood screws. It should be oriented with the bearing tube facing the drum. The free end of the stylus arm is inserted in the brass knob insert, and the support arm is oriented so that the protruding brass tube is facing directly down at the top center of the drum. The set screw of the insert then can be tightened to secure the stylus arm. The small brass tube used to hold the wire stylus should now be resting in contact with the top of the drum along the centerline. The weight of the stylus arm will supply the needed stylus pressure. You should be able to lift the stylus arm, folding it back away from the drum, and there should be no binding in the pivot assembly.

The connection between the control electronics and the mechanics assembly is via an 8-conductor cable. The cable is anchored to the base of the mechanics assembly and is equipped with an 8-conductor plug (P3) that mates with an 8-conductor socket on the rear apron of the electronics cabinet. The P2 and P3 pin assignments, as indicated in the schematics, are shown in Table 1.

Heat-shrink tubing, tape, or other insulating steps should be taken for all connections (including the M1 starting capacitor, C301) to eliminate the possibility of shorting leads or creating a shock hazard.

If you've managed to get the electronics constructed and working already, completing this mechanical phase should keep you busy until part III of this article arrives. In part III, we'll put the whole system together, test and calibrate it, and (hopefully) enjoy the results. ■

A 600-MHz Universal Counter

—you'll freq out over this one

E. E. Buffington W4VGZ
2736 Woodbury Drive
Burlington NC 27215

This is truly a one-chip counter. The Intersil ICM7216 BIPI counter chip does it all. It is a frequency counter, period counter, frequency ratio counter, time interval counter, or a totalizing counter. It uses a 1- or 10-MHz timebase and has facilities for an external timebase input. For period and time interval, the 10-MHz timebase gives 0.1-microsecond resolution. In the frequency mode, the user can select accumulation times of 0.01, 0.1, 1, and 10 seconds. With a 10-second accumulation time, the frequency can be displayed to a resolution of 0.1 Hz in the least significant digit. There is 0.2 seconds between measurements in all ranges.

This universal counter chip has a high-frequency oscillator, a decade timebase divider, 8-decade data counter with latches, a 7-segment decoder, digit multiplexers, and 8-segment and 8-digit drivers which can directly drive large LED displays. The counter has a maximum input of 10 megahertz and, with the prescaler, this is extended to over 600 megahertz.

Intersil has an excellent 16-page data brochure describing this and other counters in a series. I have quoted from this brochure in many instances in this article. The A, C, and D versions of this counter have other characteristics and require a different circuit board layout, so beware.

	Function	**Digit**
Function Input Pin 3	Frequency	D_0
	Period	D_7
	Frequency Ratio	D_1
	Time Interval	D_4
	Unit Counter	D_3
	Oscillator Frequency	D_2
Range Input Pin 14	0.01 s/1 cycle	D_0
	0.1 s/10 cycles	D_1
	1 s/100 cycles	D_2
	10 s/1k cycles	D_3
Control Input Pin 1	Blank Display	D_3 and Hold
	Display Test	D_7
	1 MHz Select	D_1
	External Oscillator Enable	D_0

Table 1.

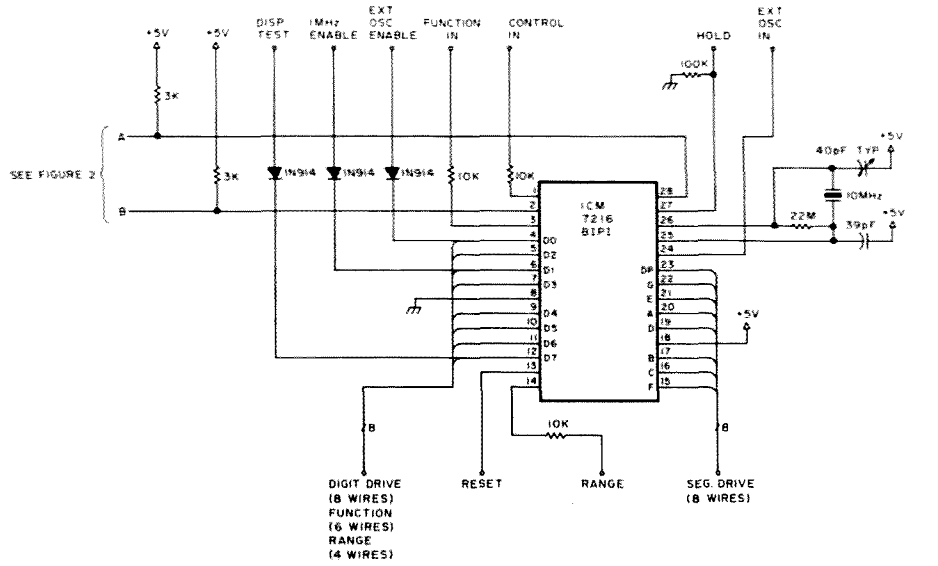


Fig. 1. Counter section part of main board.

Signal Conditioning

Front-end design is a

thorny problem since not enough gain means that there are many instances where a measurement cannot be made. Too much gain and you will be counting 60 Hertz, 120 Hertz, the local radio station, and whatever trash is there. I think the front end given here is a good compromise, with 50- to 100-millivolt rms sensitivity. The low frequency end has coverage to less than 5 Hz.

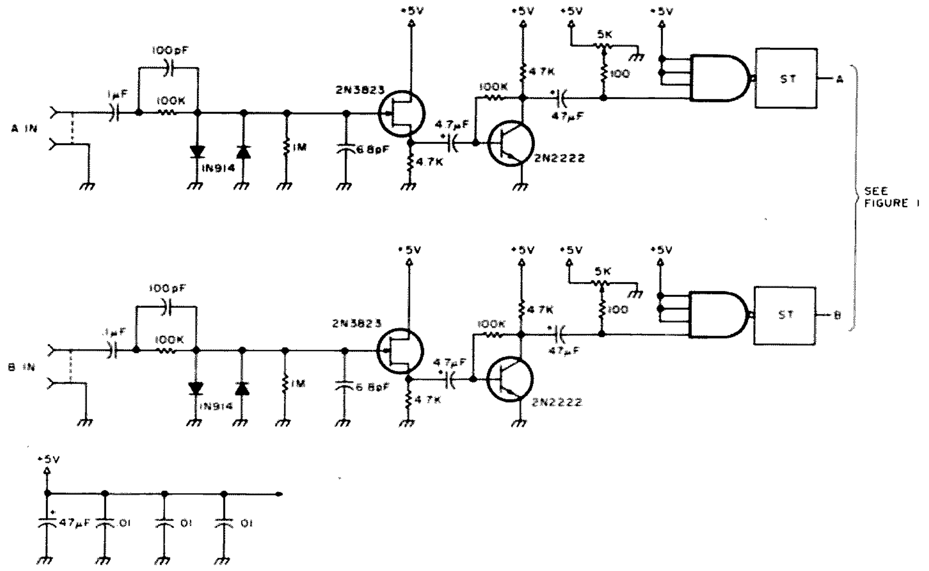


Fig. 2. Signal conditioner part of main board.

Multiplexed Inputs

The function, range, control, and external decimal point inputs are time-multiplexed to select the input function desired. This is achieved by connecting the appropriate digit driver output to the inputs. The input function, range, and control inputs must be stable during the last half of each digit output (typically 125 µs). The multiplex inputs are active low for the common cathode ICM7216B.

Table 1 shows the functions selected by each digit for the multiplexed inputs. You will note that some possible functions are not implemented in my circuit board.

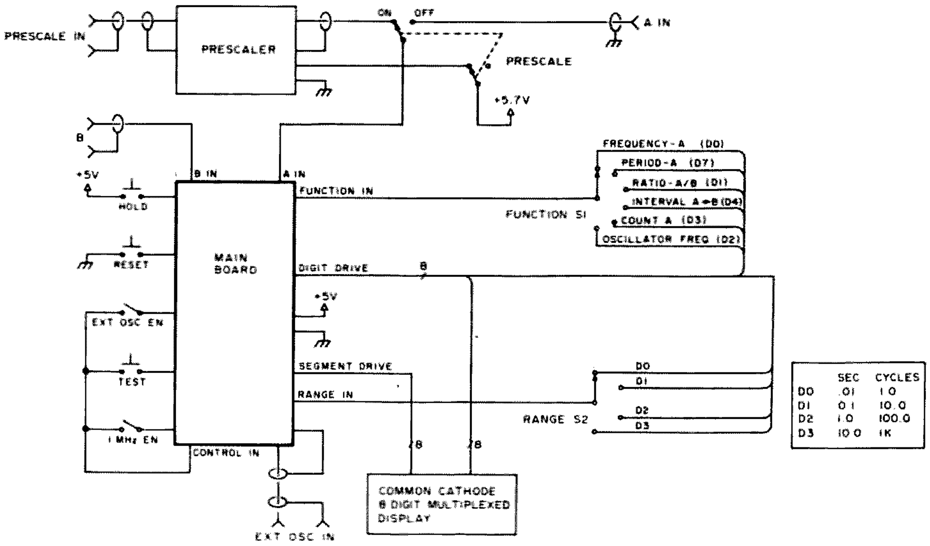


Fig. 3. External connections.

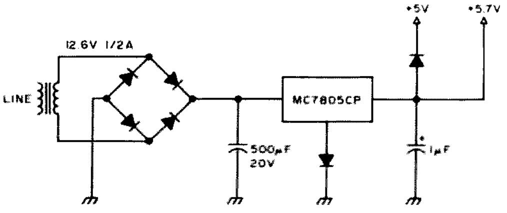
Control Input Functions

Display Test—All segments are enabled continuously, giving a display of all 8s with decimal points. The display will be blanked if Display Off is selected at the same time.

Display Off—To enable the Display Off mode, it is necessary to input D3 to the control input and have the HOLD input at V+. The chip will remain in the Display Off mode until HOLD is switched back to V−. While in the Display Off mode, the segment and digit driver outputs are open. During Display Off, the oscillator continues to run with a typical supply current of 1.5 mA with 10-MHz crystal and no measurements are made. In addition, inputs to the multiplexed inputs will have no effect. A new measurement is initiated when the HOLD input is switched to V−. The Display Off feature is not implemented in my circuit board layout.

1-MHz Select—The 1-MHz select mode allows use of a 1-MHz crystal with the same digit multiplex rate and time between measurements as with a 10-MHz crystal. The decimal point is also shifted one digit to the right in period and time interval, since the least significant digit will be in microsecond increments rather than 0.1-µs increments.

External Oscillator Enable—In this mode, the external oscillator input is used instead of the on-chip oscillator for timebase input and main counter input in period and time interval modes. The on-chip oscillator will



ALL DIODES IN4001 OR EQUIVALENT

Fig. 4. Power supply.

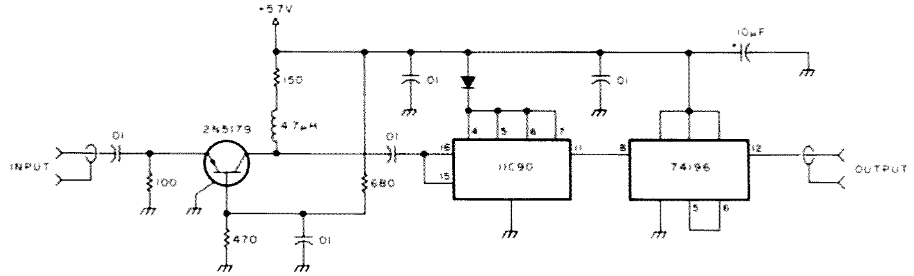


Fig. 5. Prescaler. This divide-by-one-hundred prescaler has a grounded-base input stage and gives good performance to over 450 MHz.

continue to function when the external oscillator is selected. The external oscillator input frequency must be greater than 100 kHz or the chip will reset itself to enable the on-chip oscillator.

Hold Input—When the hold input is at V+, any measurement in progress is stopped, the main counter is reset, and the chip is held ready to initiate a new measurement. The latches which hold the main counter data are not updated, so the last complete measurement is displayed. When hold is changed to V−, a new measurement is initiated.

Reset Input—The reset input is the same as a hold input, except that the latches for the main counter are enabled, resulting in an output of all zeros.

Range Input—The range input selects whether the measurement is made for 1, 10, 100, or 1000 counts of the reference counter. In all functional modes except unit counter, a change in the range input will stop the measurement in progress without updating the display and then initiate a new measurement. This prevents an erroneous first reading after the range input is changed.

Display Considerations

The display is multiplexed at a 500-Hz rate with a digit time of 244 μs. An interdigit blanking time of 6 μs is used to prevent ghosting between digits. The decimal point and leading zero blanking have been implemented for right-hand decimal point displays. Any zeros following the decimal point will not be blanked. Also, the leading zero blanking will be disabled when the main counter overflows.

The ICM7216B is designed to drive common cathode displays at peak current of 15 mA/segment using displays with $V_f = 1.8$ V at 15 mA. Resistors can be added in series with the segment drivers to limit the display current in very efficient displays if required.

To get additional brightness out of the displays, V+ may be increased up to 6.0 V. However, care should be taken to see that maximum power and current ratings are not exceeded.

The display consists of 8 digits of multiplexed, common-cathode LEDs. A circuit board for the popular MAN 74 is given. Calculator displays are available at super savings—8 or 9 digits on a circuit board for a dollar. You can't beat that!.

Crystal Characteristics

The circuit board has facilities for HC-33 or HC-18 crystal holders. The oscillator is implemented as a

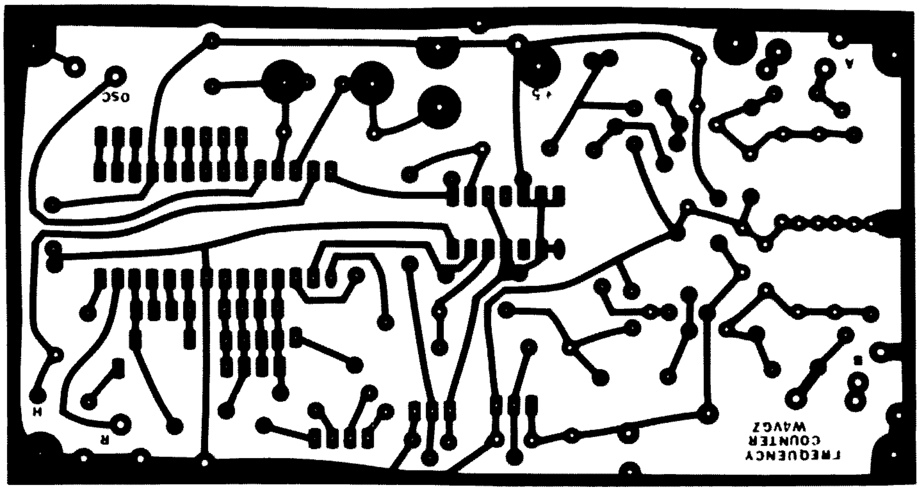


Fig. 6(a). Main counter board.

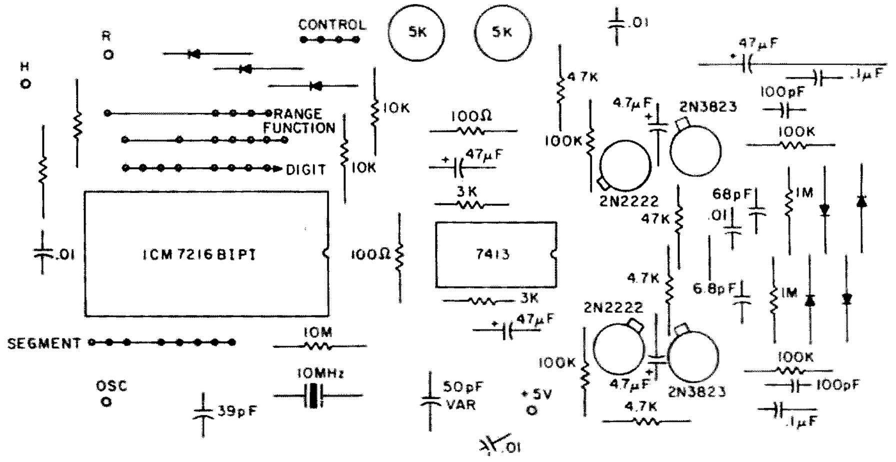


Fig. 6(b). Component layout, main counter board.

high-gain complementary MOS inverter. An external 10- or 22-megohm resistor is used for biasing. The oscillator is designed to work with a parallel resonance, 10-megahertz crystal calibrated with 22 pF and having a series resistance of less than 35 Ohms. You should not try to save money here since the accuracy of your counter is directly dependent upon the accuracy of this oscillator. You should specify: A-T cut, optimum angle, and commercial quality and accuracy.

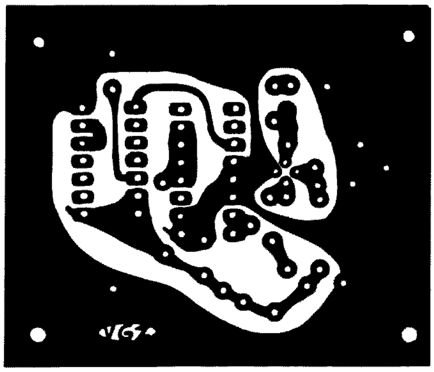


Fig. 7(a). Prescaler board.

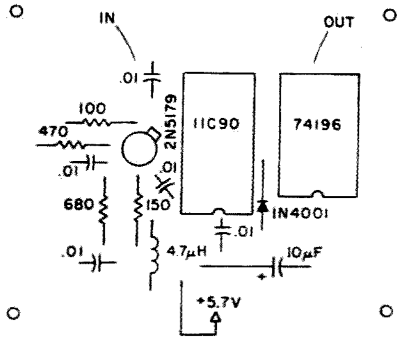


Fig. 7(b). Component layout.

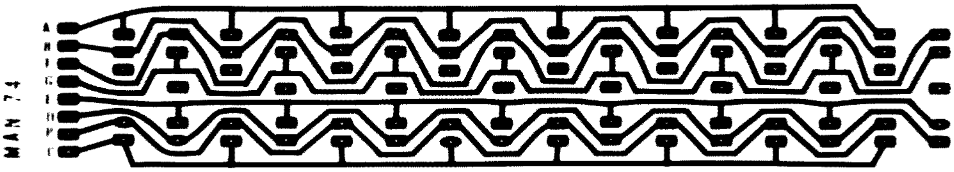


Fig. 8. Display board.

Prescaler

The prescaler uses a grounded-base amplifier driving an 11C90 600-MHz divide-by-ten followed by a 74196 divide-by-ten, resulting in a divide-by-100 circuit. The grounded-base amplifier yields a sensitivity of 20- to 50-millivolts rms and will respond to a 1-Watt handie-talkie several yards away with a quarter-wave antenna connected to the prescale input jack. Slightly better frequency response from the 74196 was obtained by using 5.7 volts. The voltage is reduced to 5 V for the 11C90 by the silicon diode. The prescaler draws about 200 mA from the 5.7-volt supply.

Power Supply

As the total current is only 300 mA or so, the simple power supply shown will be OK. Turning off the prescaler results in a savings of 200 mA, so battery power is a reasonable option by using a 9-volt transistor radio battery for portable use.

Construction

This is where the satisfaction of home-brew electronics really comes forth. Your workmanship will be there for all to see, so a few dollars spent for a good-looking box will buy much as far as satisfaction goes. You may not want to implement all six functions or all four ranges; this would simplify the front panel. The use of rainbow or ribbon wire will simplify the segment, digit, function, and range wiring.

Conclusion

Two of these counters were constructed, and good results were obtained with both. This is a fun project with little chance for problems. Circuit boards can be obtained from O. C. Stafford, 427 S. Benbow Road, Greensboro NC 27401. Write Ozzie at that address for a price list of both circuit boards and any other parts you're having trouble finding.

I will gladly correspond if you will send an SASE with your questions. I hate to be this way, but: no SASE, no reply! ■

Parts List

Main Board	
Resistors	Qty.
100 Ω, ¼ W	2
3k Ω, ¼ W	2
4.7k Ω, ¼ W	4
10k Ω, ¼ W	3
100k Ω, ¼ W	5
1 megohm, ¼ W	2
10 megohm, ¼ W	1
5k (TO-5) pot	2
Capacitors	
6.8-pF disc	2
39-pF disc NPO	1
100-pF disc	2
.01-µF disc	4
0.1-µF disc or tantalum	2
4.7-µF tantalum	2
47-µF tantalum	2
47-µF axial tantalum	1
50-pF variable	1
Semiconductors	
1N914	7
2N2222	2
2N3823	2
SN7413	1
ICM7216 BIPI	1
10-MHz crystal	(see text)

Prescaler	
Resistors	Qty.
100 Ω, ¼ W	1
150 Ω, ¼ W	1
470 Ω, ¼ W	1
680 Ω, ¼ W	1
Capacitors	
.01-µF disc	5
10-µF tantalum	1
Other Parts	
1N4001	1
2N5179	1
11C90DC	1
SN74196	1
4.7-µH coil	1
Counter	
Common-cathode display	(see text)
Function switch	1P6T
Range switch	1P4T
Prescale switch	2P2T
Hold switch	1P-NO
Reset switch	1P-NO
1 MHz En. switch	1P1T
Ext. osc. en. switch	1P1T
Display test switch	1P-NO
Coax jack (BNC)	4 each
Power supply	(see text)

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Top-Banding the DX-60B

—part II: a companion vfo

Part I of WB1ASL's 160-meter conversion for the DX-60B appeared on page 44 of the July 1980 issue of 73.

I recently converted the Heathkit® DX-60B to 160 meters. The transmitter works fine on that band, with one drawback: It is crystal controlled. This fact adds inconvenience to the operation even though there are four crystal positions provided. The ability to move at will around your allocated portion of the band not only eases operation, but also cuts down on operator frustration caused by unanswered responses to CQ calls. With many operators using transceivers nowadays, they do not bother to tune after a call, but expect a response only on their own frequency. After many such unanswered calls, I decided to add a vfo to my newly-converted rig.

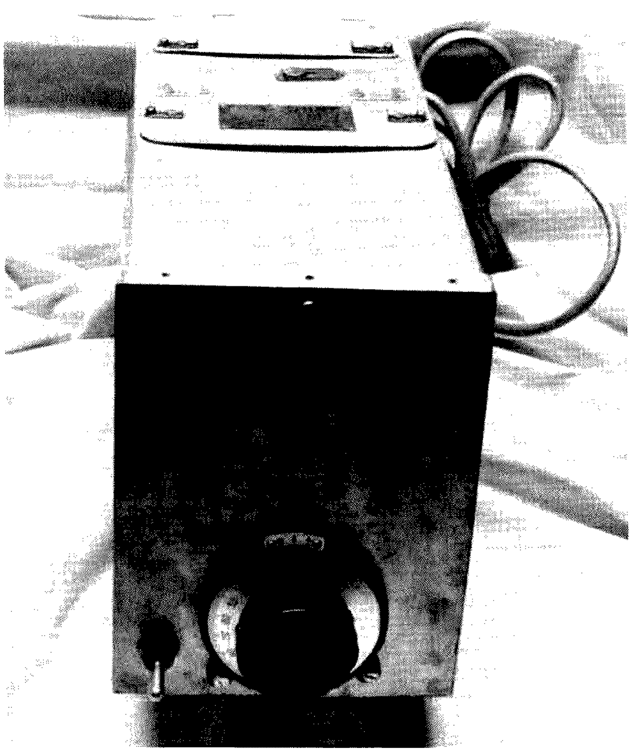

Photo A. Front view of the vfo showing use of the ARC-5 cabinet. The front is covered by a copperclad plate for appearance's sake and for dial mounting.

The DX-60B transmitter was originally designed to be used with the Heathkit HG-10B vfo on 80-10 meters. In fact, the unit comes with a vfo accessory power socket provided on the back, as well as a vfo input and a vfo position on the crystal switch. The accessory socket has pins for ground, 6.3 volts ac, 300 volts, keying bias, and a 110-volt ac line for powering a relay for antenna change-over.

With these facts in mind, I decided to use the existing provisions and design a vfo similar to the HG-10B to be used with the DX-60B on 160 meters. This vfo would be compatible with the power and switching circuits provided.

Because the HG-10B is a vacuum tube vfo, it seemed only reasonable to use vacuum tubes in the new design. The tubes I selected are, however, very easy to obtain even in this age of solid state.

The circuit is straightforward and operates on the fundamental frequency of 1.8-2 MHz. The 6AU6 tube operates as a Hartley oscillator on this fundamental frequency. Grid-block keying is used, with the keying bias provided from the accessory socket of the DX-60B. The bias, which is applied to the grid of the 6AU6 through the NE-2 neon lamp and R2, is sufficient to cut off the oscillator during standby. When this bias is removed through keying the transmitter, the oscillator resumes oscillation.

The 6C4 tube acts as a buffer. This tube, by the way, can be replaced by one-half of a 12AU7 or 12AT7 or even by a 6J6 if the 6C4 cannot be found. The circuit helps to main-

tain the stability of the oscillator by establishing a fixed load for the oscillator output.

Of course, the 0A2 tube is a voltage regulator to ensure that the voltage to the vfo remains at 150 volts.

As can be seen from the photographs, I made use of a surplus ARC-5 transmitter. I used the chassis, cabinet, and the coil form from the oscillator section. The coil form was used for L1 in the new vfo. All frequency range models of the ARC-5 use the same coil forms, so any ARC-5 unit will have the needed form.

This coil form is made of ceramic, which is a very good material for the winding of oscillator coils. Another coil form and chassis can, of course, be substituted if you do not have a surplus ARC-5 transmitter lying around the house. (They're getting rarer all the time, but are still available from some surplus outlets—although at a cost much too prohibitive for an oscillator coil and a cabinet.)

Be very selective about the coil form material to ensure stability in the transmitter. Ceramic is best, but whatever material you use for the form, make sure the wire is wound tightly over the form and cemented in place with Q-Dope. Avoid toroid cores! They are very susceptible to frequency drift, especially in vacuum tube environments where there can be a high degree of change in the ambient temperature. Also avoid slug-adjustable core forms. If you must change the diameter of the coil, experiment with the number of turns until you get the right resonant frequency range. You also can resort to a coil chart or coil design formula, but in all cases keep the coil Q quite high.

As for the chassis, you can see from the photographs that there is plenty of extra space in the ARC-5, so a different chassis and cabinet could actually reduce the size considerably.

Mechanical stability in construction as well as heat shielding are, of course, of paramount importance as they are in all oscillator construction. By mounting the coil below the chassis, it is shielded from drafts and variations in temperature after initial warm-up.

A sturdy bracket was fabricated for the mounting of capacitor C3. This helps ensure that an accidental jarring of the cabinet will not change the frequency of the oscillator. Also, keep component leads as short as possible for the same reason and to cut down on lead inductance.

All frequency-determining capacitors should be either silver mica or polyester types for stability.

The inclusion of the 0A2 regulator keeps the voltage to the oscillator rock steady, which is needed for stability purposes.

By following these good construction practices, I can, after initial warm-up, zero-beat the vfo to a stable receiver and come back an hour later and still be on zero beat. The amount of drift is infinitesimal.

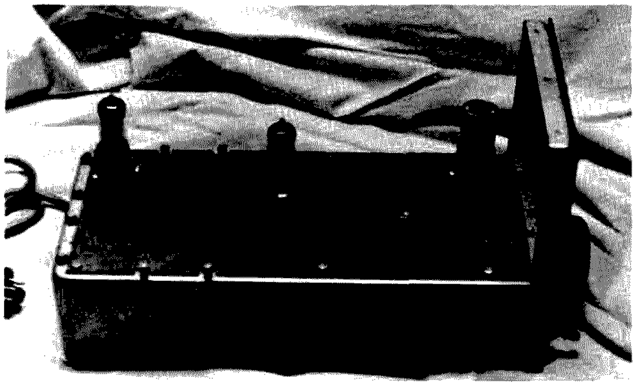

Photo B. Top view of the vfo. The copperclad board is used to cover holes in the chassis and to mount vfo parts. The 6AU6 tube is in the front, the 6C4 is in the center, and the 0A2 is in the rear.

After constructing the vfo, tune-up and testing are simple matters. First, check all your wiring to make sure it is correct. Especially check to see that the power connections are wired to the power plug correctly. If you are like most of us, you probably haven't used octal sockets in years and the numbering of the pins might not be fresh in your mind. Check, and check again. Tubes are expensive, and they don't like to have 110 or 300 volts on their filaments.

One preliminary adjustment can be made before the vfo is connected to the DX-60B. If a grid-dip oscillator is available, the vfo tuned circuit can be dipped to the 160-meter band. Do this by setting the main vfo tuning capacitor, C3, to the center of its range. Set the grid-dip oscillator to 1.9 MHz. With the grid-dip oscillator coil coupled to L1, tune trimmer capacitor C2 for a dip on the meter. Now the oscillator is tuned for approximately the center of the 160-meter band. (If you do not have a grid-dip oscillator, an alternative method follows.)

After all is checked out,

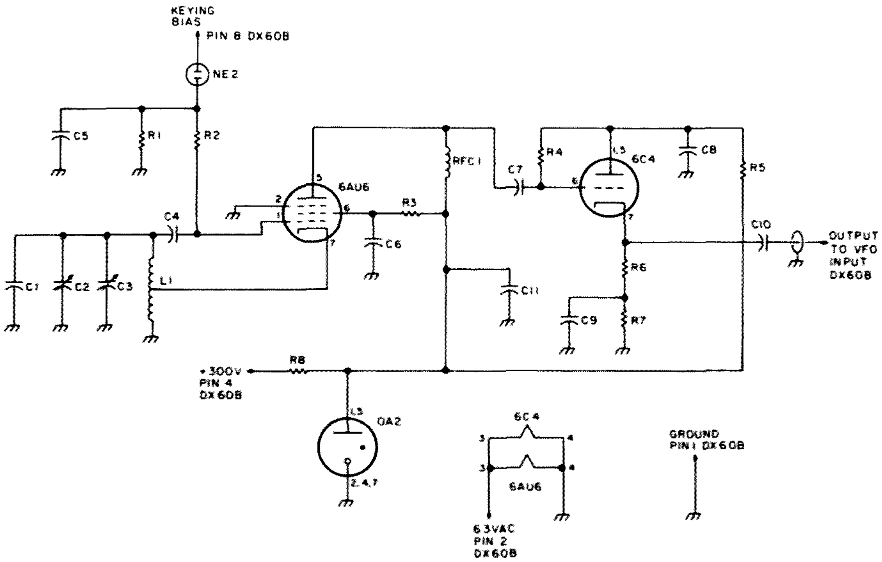

Fig. 1. Vfo schematic.

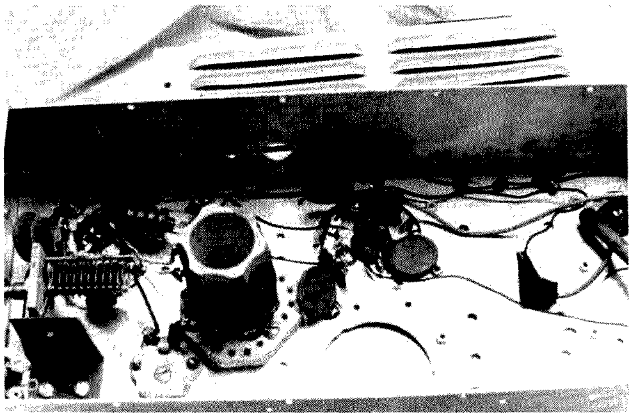

Photo C. Bottom view of the vfo, showing coil L1 at the left center and C3 mounted on the bracket at the left. As can be seen, there is an excess of space.

plug the vfo power cord into the DX-60B power-accessory socket and the rf output from the vfo into the vfo input socket on the back.

Turn the Function switch to "Standby," check to see that the tubes in the vfo are lighting, and let the unit warm up for at least one-half hour.

Set the controls on the front of the DX-60B as follows: Drive Level to 0, Xtal to vfo, Drive Tune to 1, and Band to 80 (which is now the 160-meter position).

The next step will need the services of a good, accurate communications receiver which covers the 160-meter band. Set the receiver, after warm-up, to the center of the 160-meter band. Run a wire from the receiver's antenna terminal to a point near the vfo to ensure the receiver will pick up the signal from the vfo.

Now, turn the Function switch to the "Tune" position. Tune the vfo main tuning capacitor, C3, through its range while listening for the signal in the receiver.

If the signal is not heard and the receiver is a general coverage receiver, leave the vfo capacitor set to the center of its range and tune the receiver both above and below the 160-meter band until the signal is found. If the signal is higher than the band, capacitor C2 will have to be adjusted to add more capacitance to the circuit to bring the oscillator within the band. If the signal is below the band, C2 will have to be adjusted to decrease the capacitance.

If the signal is not heard and the receiver only covers the 160-meter band, set capacitor C3 to the center of its range and the receiver to 1.9 MHz. Adjust capacitor C2 until the signal is heard. If it is still not heard, keep alternating capacitor adjustments on C2 and C3 until it is heard.

If the signal cannot be found at all, either the oscillator is not oscillating or its frequency range is completely out of the range of the receiver. Check all components and voltages. If an absorption wavemeter is available, use it to determine if the oscillator is oscillating. Once it is determined that the oscillator is functioning outside the desired frequency range, a few minor changes will have to be made to the oscillator to bring it into line. This will entail either increasing the amount of capacitance in the tuned circuit by adding a small silver mica capacitor across C1 to lower the frequency, or by removing turns from coil L1 to raise the frequency. This situation should occur only if L1 was redesigned incorrectly because of the use of a different coil form.

After the signal is found, one way or another, listen to the signal for purity of tone (no hum or hash). Turn the vfo off and on by turning the Function switch to "Standby" and then to "Tune" again several times to make sure oscillation begins immediately. After these observations, check for drift by zero-beating the signal on the receiver (with the receiver vfo turned on) and letting the oscillator sit for awhile to see how far it drifts from zero beat. A better alternative method to check drift would be to use a frequency counter. If excessive drift occurs, a bad capacitor or L1 may be the cause. Check voltage stability and drafts also.

If all checks out all right, you may then proceed to the next step, that of calibration. Set the main tuning capacitor, C3, to maximum capacitance. Tune the receiver to the bottom of the 160-meter band. Using trimmer capacitor C2 only, zero-beat the oscillator to the receiver. Mark the dial. Now, by tuning the receiver up the band to set intervals and adjusting the main vfo tuning capacitor, C3, to zero beat and then marking the dial, the vfo can be calibrated.

After calibration, final testing is at hand. With the antenna output of the DX-60B fed into a dummy load, set the vfo to an allocated part of the band. Proceed to tune up the DX-60B. If you do not get enough grid drive, check the buffer stage in the vfo.

If all is operating correctly, you should have no trouble tuning up the DX-60B. It should tune exactly as it did when it was crystal-controlled.

To zero-beat a signal or to locate your frequency, simply turn the Function switch to "Tune" with the Drive Level control turned down and use the vfo main tuning capacitor to zero-beat the signal.

With the use of the vfo, your number of QSOs should increase dramatically. No longer will the other guy have to look for you. You'll be right there on frequency with your DX-60B.

This completes the second phase of my conversion of the DX-60B to 160 meters. It has been great fun doing the conversion and operating on the "top band." I hope these two pieces will give many an opportunity to operate on this interesting segment of the amateur spectrum.■

Parts List

C1—270-pF polystyrene or silver mica
C2—3-30-pF mica trimmer
C3—30-pF air variable (Hammarlund HF-30)
C4—100-pF polystyrene or silver mica
C5, C6, C8, C9, C11—.02-uF disc ceramic
C7—.001 uF
C10—150 pF
L1—35 turns #18 AWG enamel on a 1-3/8" ceramic form (see text)
R1—47k, ½ W
R2, R4—150k, ½ W
R3—33k, ½ W
R5—1000, ½ W
R6—2700, ½ W
R7—10k, ½ W
R8—5.6k, 7 Watt
RFC1—2.5-mH rf choke
NE-2—Neon lamp

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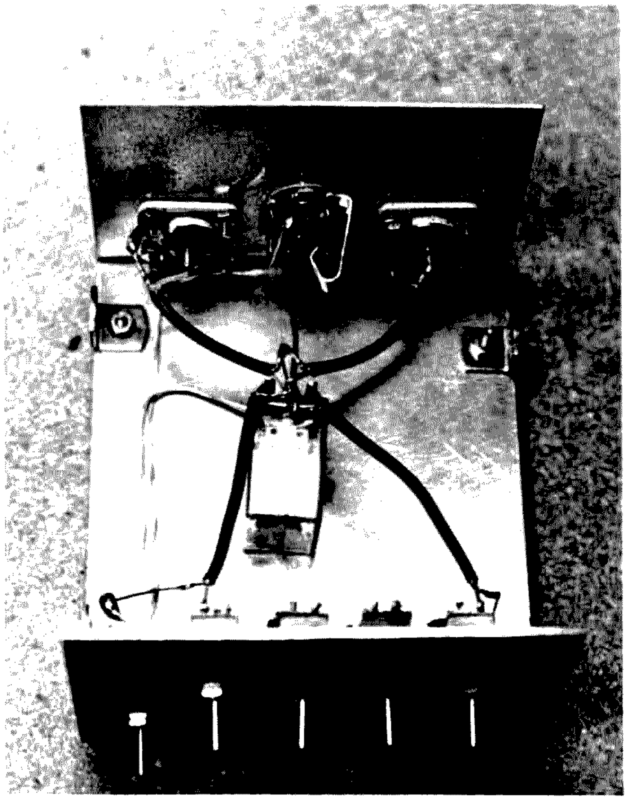
An Amp for QRPp Addicts

—build this resistive step attenuator for low, low power work



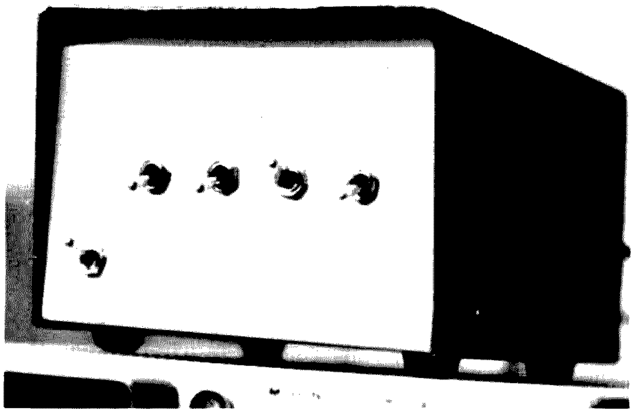
Internal view of QRP Amp showing switches and connections.

After having enjoyed QRP operation and its 2-Watt world for a period of time, it was decided that a new frontier was needed for a challenge. An amplifier was designed and constructed which provided 25 Watts on 160 through 10 meters. Increased signal reports did result, but just about anything you can work on 25 Watts can be worked on 2 Watts. So I felt that a new and somewhat different kind of challenge was still needed—why not an amplifier (an "inverse amplifier")? Rather than increasing the input signal, it "inversely amplifies," or decreases, the input (in a logarithmic manner).

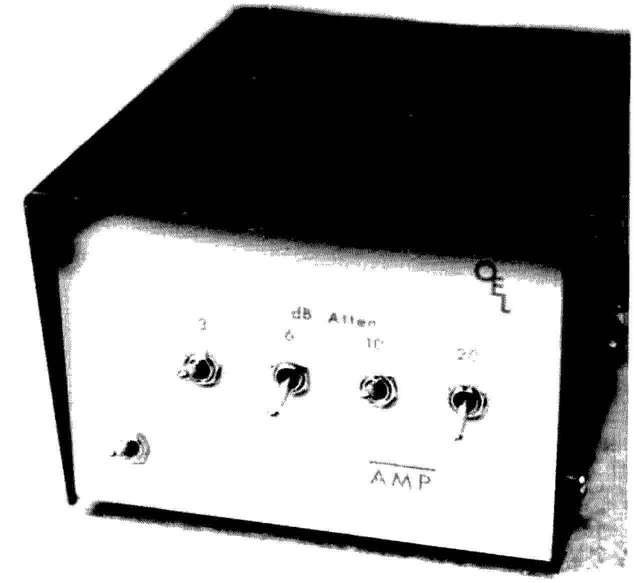
The QRP Amp definitely re-instills the challenge into the sometimes repetitious world of ham radio. It also can be used to allow QRP/QRPp operation with medium-powered transceivers. Better yet, it can be constructed and in use in a few hours with locally purchased parts, for $15 or less. If you have slide or toggle switches in the junk box, then the price is reduced even further. It requires no tune-up or adjustment and is nearly guaranteed to work the first time.

The Amp is actually a step attenuator which provides from 3 to 39 dB of attenuation to your already low-power signal. What this means is that your 2-Watt signal, after passing through the QRP Amp, now becomes anywhere from 1 Watt down to about 200 microwatts! Twenty milliwatts of output power can and does produce plenty of solid contacts, and it opens up a whole new world to ham radio.

Since the QRP Amp is a resistive step attenuator, it requires no tuned circuits, no active circuits, and works on any mode. Referring to Fig. 1, it can be seen that four switches are used



View of QRP Amp shown with 10 dB of attenuation and switched IN.



View of QRP Amp shown with 13 dB of attenuation and switched IN.

in conjunction with half-Watt standard value carbon resistors to produce the necessary attenuation. The double-pole, double-throw switches are set up to produce 3, 6, 10, and 20 dB of attenuation by either switching in the resistors or bypassing them. These switches can be miniature toggle type or, to reduce costs, miniature slide switches.

The desired attenuation is selected in an "additive" manner. To select 13 dB of attenuation, for example, switch in the 3-dB and 10-dB switches. A DPDT 12-V relay purchased at Radio Shack is used to automatically switch the attenuator out during receive. It is controlled by the transceiver driving the Amp. Switch S1 is used to bypass the Amp, if desired.

The Amp can be built in just about any enclosure available to the builder. Small coax (RG-174/U) is used for rf runs between connectors, the relay, and the switches. The resistors should be soldered directly to the switch contacts with their leads kept short to minimize their inductance. Spray paint and dry transfer lettering add a final touch to the simple project.

The only setup required is to supply +12 V and a relay control. Both can be obtained from the driving transceiver. Run a lead from the control side of the transceiver relay to a plug to mate with J1. Verify that K1 closes when your transceiver is in transmit and S1 is in the IN position. Actual attenuation values were verified to be within .5 dB of the calculated values with a Hewlett-Packard 180 oscilloscope. After you have verified that K1 and S1 are operational, apply drive to the box (with dummy load attached). With no switches IN (no attenuation), you should see the same output power as input power. Switch in 3 dB and the output should be decreased by one-half. Remember that most, if not all, power meters become inaccurate below 1 Watt and are usually unreadable below 100 mW, so don't fret when the needle doesn't budge with 10 dB or more of attenuation switched in.

If problems arise, about the only things that can be wrong are soldered connections or misplaced resistors. Also, recheck all wiring between switches, connectors, and relay.

For those who want to use a 200-Watt transceiver, an additional 20-dB attenuator is needed to prevent damage. Use high wattage (20 Watts or more) resistors in that portion of the attenuator.

Operation

Operating the QRP station, a portion of which was described in the December, 1978, issue of *Ham Radio*, has been greatly enhanced using this project. Before describing the results you can expect, you will be interested in a few observations concerning milliwatt operation. Assuming you are using a 2-Watt transmitter to drive the Amp and have switched in 20 dB attenuation, your output will

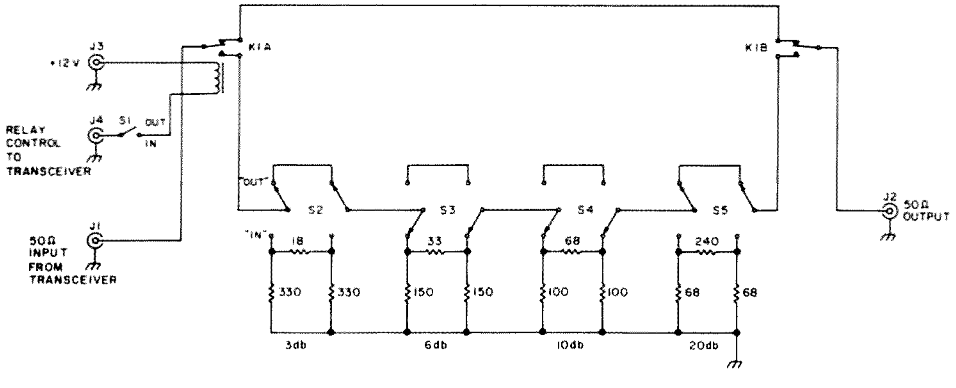


Fig. 1. Schematic, QRP Amp. QRP Amp is a classic pi-type step attenuator using four switches to provide from 3 to 39 dB of attenuation. With switches as shown, 16 dB of attenuation would exist when S1 is switched to "IN" and the transmitter is keyed. J1, J2—SO-239 rf connector. J3, J4—Phone or phone jack. K1—DPDT 12-V relay. S1—SPST miniature. S2-S5—DPDT miniature slide or toggle. All resistors ½ Watt or greater.

be 20 mW. This power level is 30 mW below the FCC specification for total harmonic radiation. Furthermore, a typical SSB transceiver running 200 Watts output might have 40 to 50 dB attenuation of carrier and opposite sideband. The carrier output will then be 2 to 20 mW, the power used with the Amp to make contacts.

A quick calculation reveals that if you can obtain an S9 report with a 2-Watt signal (easy!), then, theoretically, assuming no noise or QRM, an S1 signal would be produced by less than a 200-microwatt signal. This is my present goal with the QRP Amp.

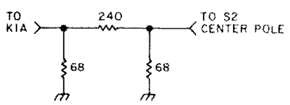


Fig. 2. 20-dB attenuator to enable 100-200-Watt transceiver to be used with QRP Amp. Resistors should be 20 Watts for 50-Watt output, 40-50 Watts for 100-Watt output, and 80-100 Watts for 200-Watt output. Use parallel combinations of smaller wattage resistors to reach these wattage ratings.

Naturally, the purist will balk at the idea of wasting energy by dissipating power in a resistor, but it is the only practical way of generating QRPp levels. Single transistor rigs which would normally generate these levels are subject to chirp, FMing, drift, and a lack of convenience. With the Amp and your normal QRP transceiver, you retain those conveniences and avoid the aforementioned maladies. It also considerably reduces the expense of QRP operation if you already own a regular transceiver.

Both SSB and CW modes are used at my station, with SSB slightly preferred because an in-depth explanation can be made of the low-power experiments. This way, the other station invariably becomes enthused and he, too, wants to see at just what level of power he can hear you.

Contacts have been made, however, with stations who become indignant when told that your power level is 10 mW. Apparently, this pricks their conscience about that shiny, expensive linear sitting in front of them!

During the past three months, 10 states have been worked in casual operation, mostly on 10 meters, using 10 mW of output. A number of contacts have been made in Japan, Hawaii, Canada, and Mexico using 100 mW output. 100 mW on 10 meters provides plenty of in-USA contacts. Even 20 meters can be used for 10- to 20-mW CW contacts. Incidentally, the antennas used at my station are a dipole on 80/40 meters and a 2-element quad on 10-20 meters.

As with any QRP operation, patience is the key word. Not every station called will answer, with the ratio becoming worse as output power is reduced. With a little practice, you'll become familiar with the conditions and signals that will produce a solid contact.

The QRP Amp has provided the challenge that was sought. When you contact a station that is using a linear amplifier, you can reply that your newest homebrew accessory is a logarithmic de-amplifier, built for less than $15. That should make for plenty of interesting conversation! Plus, there is fun in working across the continent on a power level most rigs use to generate spurious harmonics! ■

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The Center-Fed Bizarre

—would you believe an indoor antenna for 80?

More and more of us find that the acreage for that dream antenna farm with phased verticals, rhombics, and giant monoband yagis just isn't available on a lot size within the bounds of our meager earnings. Even when a tidy home on a reasonably roomy lot is found at an attractive price, city ordinances or deed restrictions may make it impossible to erect tall towers or any outside antennas at all. My situation falls into the second category. Not even TV antennas are permitted in my area.

After two years at this address, I finally decided that operating only on two meters with a magnetic-mount mobile antenna in a window wasn't my idea of the ultimate ham station. I grew up as a ham on the 80-meter band and wanted to keep in touch with the friends that I had made over the years. I did have access to the club station at my place of business, but

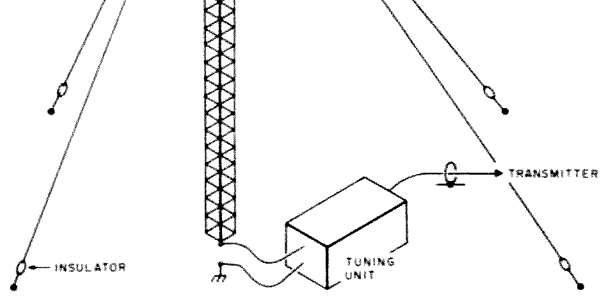

Fig. 1. A common configuration for a VLF antenna using the guy wires for top-loading capacitance.

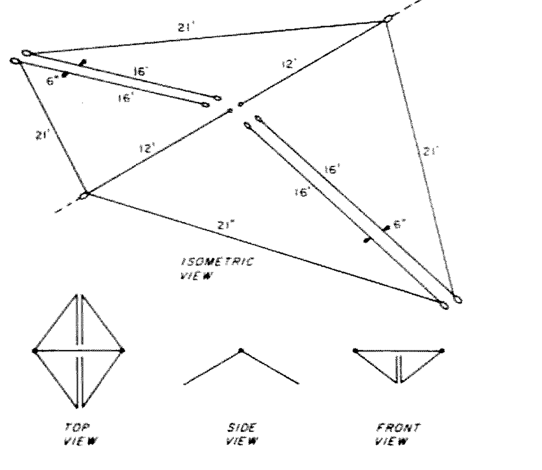

Fig. 2. Final configuration of the attic antenna.

that often proved to be an inconvenient arrangement.

There seemed to be three reasonable alternatives. Put up an inconspicuous outside antenna, load up a flagpole, or try to put something in the attic. The outside antenna was ruled out, since a leading figure in the local homeowners association was my next-door neighbor. Decent flagpoles aren't cheap, and I was advised by a lawyer that I still might be subject to legal action in which it would cost me hard-earned dollars to prove that it was a flagpole. So I crawled up my ladder and made friends with the spiders and the insulation.

Mobile Attenuators

I had acquired a well-respected mobile antenna with a 75-meter loading coil a few years ago, but never used it. As a result, my first attempt at an indoor antenna was to erect it in the center of the attic. Several wires were run around the rafters for a ground system. I was pleased when the swr meter read 1-to-1 near the frequency of interest. I was not at all pleased when most of the stations that I tried to work were barely capable of moving my normally hyperactive S-meter and seldom able to copy me. Some rough calculations showed that I really couldn't expect more than 2% efficiency, since the radiation resistance of the antenna had to be less than 1 Ohm and the other 49 Ohms came from the resistance in the loading coil.

I was generally leery of vertically-polarized antennas in the attic anyway. There were a large number of metal vent pipes and chimneys that were nearby. Most of them had friction joints which could certainly create harmonics or at least be lossy, further soaking up the meager radiated energy.

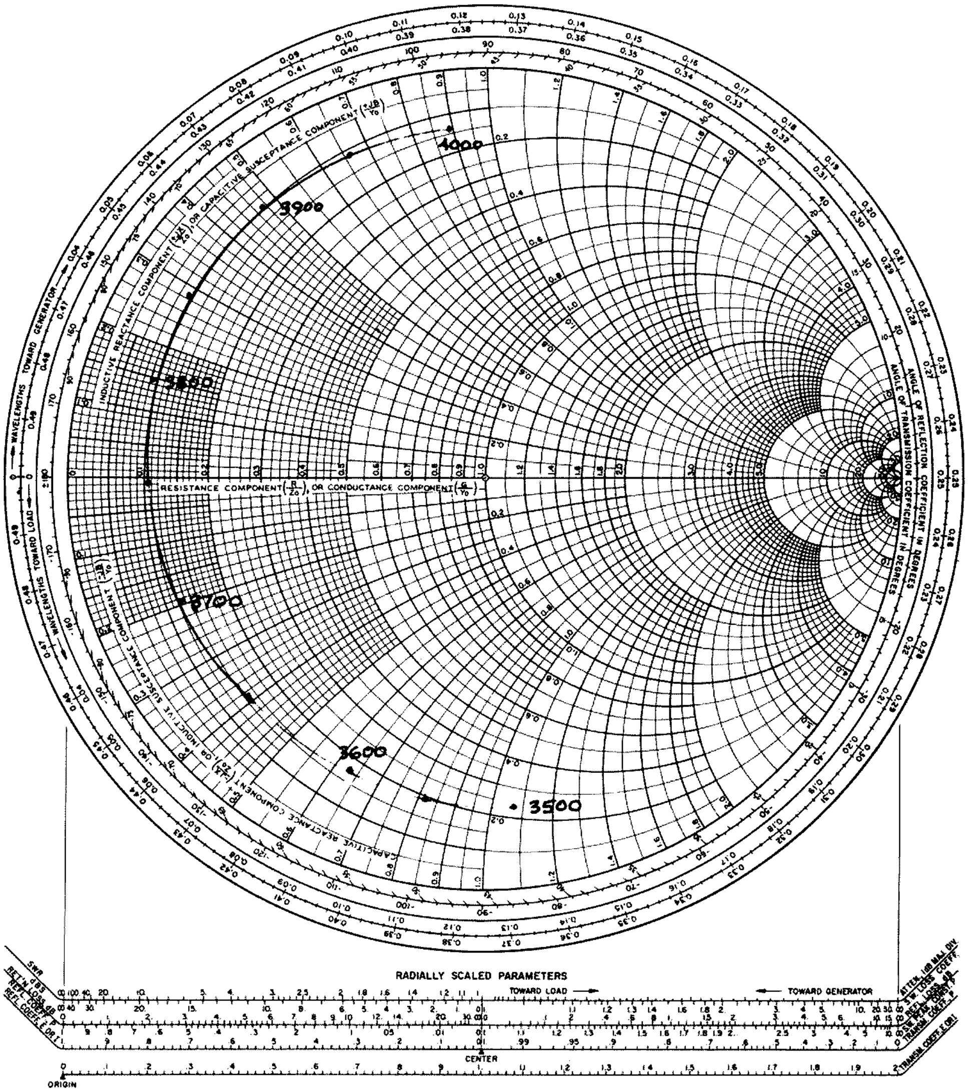

Fig. 3. Measured impedance of the attic antenna. Reference impedance for the Smith chart is 50 Ohms.

Taking a Lesson from the VLF Boys

Compact antennas are nothing new in high-power transmitting installations for use below 100 kHz. A quarter wavelength is well over 2000 feet in this part of the spectrum. Looking at the types of antennas used showed the popularity of top loading. This is no surprise. Placing the loading away from the feedpoint helps keep the base impedance up to reasonable values.

As a rough rule of thumb, the radiation resistance of a base-loaded antenna changes as the square of its length, when the antenna is less than a quarter-wavelength tall (for a vertical). For top-loaded antennas, it changes almost directly in proportion to the length. For example, if the antenna is one-fifth of full size, the base-loaded antenna impedance will look like about one twenty-fifth of its full-size impedance, or about 2 Ohms. The top-loaded antenna will be about 10 Ohms. For very short antennas, this can give a significant increase in efficiency and bandwidth.

One popular configuration for a VLF vertical antenna is shown in Fig. 1. The top guy wires are used as a capacity hat to increase the electrical length of the radiator. I saw no reason why this configuration couldn't be adapted to a balanced horizontal arrangement, since I wanted to avoid vertical radiators.

Wire Everywhere

My attic is about 24 feet wide across the highest part, which is where I wanted to place the main radiating portion of the antenna. The loading wires were bent back at about a 55 degree angle from the

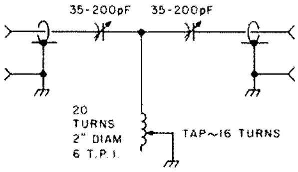

Fig. 4. Schematic of the impedance-matching network used to feed the antenna. This network is at the transmitter end of about 100 feet of RG-8 cable.

flat-top section. I didn't want to run them at right angles, since the walls of my house are stucco and contain wire mesh that could create problems.

As a starting point, I used a total of a half-wavelength of wire. I had to bend the ends of the loading wires back toward the feedpoint to get it to fit. The final configuration is shown in Fig. 2. As you can see, the total length of the wire exceeds a half-wavelength by about one-third. It is resonant near the center of the 80-meter band.

It should now be obvious why this antenna received its name. When I first put it on the air, I tried in vain to explain its configuration to W7ZUL. When it became apparent that he couldn't understand it without a picture, I told him that it was too bizarre to explain. He naturally replied, "Oh, so you're using a center-fed bizarre."

The wire used in the antenna was plastic-insulated #18 with stranded conductors. Three of these wires were laboriously braided together to increase the apparent conductor diameter in an attempt to reduce resistive losses and to help broadband the antenna. The three wires were kept separate everywhere but at the feedpoint. There are three joints at the ends of the radiating portion where the loading wires connect.

Single-wire conductors could have been used just as well, the larger the better. I used what I had available.

Care and Feeding

Upon first inspection of the antenna, I was somewhat alarmed at the magnitude of the feedpoint impedance. Using a noise bridge that was capable of measuring resistance and reactance through a known length of RG-8 coax, I found 5 Ohms of radiation resistance. That's right, the swr was 10 to 1. The Smith chart in Fig. 3 shows the results of my measurements.

The *actual* impedance of the antenna may be even less than 5 Ohms. I did not take into account the loss of the feedline when the measurements were made. I had predicted that the radiation resistance would be closer to 10 Ohms, but the effect of nearby household electrical wiring and the fact that the antenna was only about 0.1 wavelengths above ground could easily lower the impedance. Since the loading wires do not run at a 90-degree angle to the radiating wire, a partial cancellation of the field also results in a lower antenna impedance. In an antenna of this type, a high impedance is sure to indicate undesirable losses.

There certainly are hams who consider a 10-to-1 swr unthinkable. There is salvation for you, but first give thought to this: At 4 MHz, 100 feet of RG-8 (or RG-213) has a loss of about 0.3 dB and the additional loss caused by a 10-to-1 swr is 1.0 dB. A total of 1.3 dB or about 25% of your power is lost in the coax. Foam dielectric coax will be about 1.2 dB, and shorter lengths give proportionately less loss.

No one would think of trying to feed such a mismatch directly from the output of his transmitter. Almost any of the "universal transmatches" will reduce this to an acceptable level.

The matching network I use is shown in Fig. 4. The capacitors are from old ARC-5 equipment. They are adequate for power levels up to 400 Watts PEP or CW input. By the use of a logging scale on the capacitor dials, I can rapidly QSY anywhere within the 80-meter band and still present a 50-Ohm load to my transmitter.

A second method of matching may appeal to those of you who are squeamish about high swrs. There are several nice wideband impedance step-up transformers available that are designed for use with mobile antennas. Using one of them will raise the impedance to nearly 50 Ohms so that the main feedline operates with a reasonably low swr. The catch is that this will only allow operation over a narrow band of frequencies, since the antenna has a fairly high Q.

On the Air

Just because it looks funny, it doesn't mean that it works that way. Stations report respectable signals. Comparisons were made with one local station whose transmitter power is about 3 dB below mine. He uses a normal inverted vee about 40 feet high. No perceptible differences were noted in signal strength, both on close-in (30-mile) and longer-haul (1000-mile) paths. I found this hard to believe at first, too. However, repeated comparisons and several months of successful operation bear out the solid reliability of this indoor radiator. ■

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, Attn: Social Events.

FARIBAULT MN
DEC 6

The Handi-Ham System will hold its annual winter hamfest on Saturday, December 6, 1980, at the Eagles Club, Faribault MN. There will be a flea market, a dinner at noon, a program, and a prize drawing.

OAK PARK MI
JAN 11

The Oak Park ARC will hold its annual indoor Swap & Shop on January 11, 1981, at the Oak Park High School, Oak Park Boulevard (9½ miles west of Coolidge Highway), Oak Park MI. Doors will be open from 8:00 am to 3:00 pm and admission is $2.00 per person. Features will include an ARRL table, a door prize, a YLRL table, food, refreshments, and free parking. Talk-in on 146.04/.64 and 146.52. For more information, send an SASE to Rob Numerick, 23737 Couzens, Hazel Park MI 48030, or call (313)-398-3189.

CHESTERFIELD VA
JAN 11

The Richmond Amateur Telecommunications Society will hold Frostfest 1981 on Sunday, January 11, 1981, at the Chesterfield County Fairgrounds, Chesterfield VA, from 8:00 am to 4:00 pm. New and large facilities include spacious aisles, and plenty of on-site parking, with charter buses welcome. Admission is $3.00 for each four-foot-long flea market table, and $2.00 for each tailgating vehicle. Features will include commercial exhibitors, a flea market, an auction, and prizes consisting of a color TV, a Bird Wattmeter with slug, a digital VOM, and many more. Talk-in on 146.34/.94 and 146.28/.88. For further information, contact the Richmond Amateur Telecommunications Society, PO Box 1070, Richmond VA 23208.

LIVONIA MI
FEB 22

The Livonia Amateur Radio Club will hold its 11th annual LARC Swap 'n Shop on Sunday, February 22, 1981, from 8:00 am to 4:00 pm, at Churchill High School, Livonia MI. There will be plenty of tables available. Other features include door prizes, refreshments, and free parking. Talk-in on 146.52. For further information, send an SASBE (4" × 9") to Neil Coffin WA8GWL, c/o Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48150.

VERO BEACH FL
FEB 21-22

The Treasure Coast Hamfest will be held on February 21-22, 1981, at the Vero Beach Community Center. Admission is $3.00 per family, in advance, and $4.00 at the door. Features will include prizes, drawings, and a QCWA luncheon. Talk-in on 146.13/.73, 146.52/.52, 146.04/.64, and 222.34/223.94. For information, write PO Box 3088, Beach Station, Vero Beach FL 32960.

DAVENPORT IA
MAR 1

The Davenport Radio Amateur Club will hold its tenth annual hamfest on Sunday, March 1, 1981, at the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th Street, Davenport IA, from 8:00 am to 4:00 pm. Tickets are $2.00 in advance and $3.00 at the door. For advance tickets and table reservations, write Dave Johannsen WB0FBP, 2131 Myrtle, Davenport IA 52804.

HAM HELP

I need schematics/owner's manual for an Eico model 625 tube tester. I will pay the postage, copy, and return all material.

Also, I need any modifications for the Globe V-10 vfo. I recently purchased one at a hamfest and the 6CB6 plate circuit doesn't match the schematics. It has a very low output (approximately 0.5 V p-p).

I'm awaiting my Novice ticket; that's why there's no call in my address.

Tim Cook
4536 Knoll Drive
Woodbridge VA 22193

I recently obtained an Allied SX-190 reciever at a local hamfest, but I did not receive an operating manual. If anyone could supply me with a manual or a xerox copy of one (I believe the manual for the AX-190 ham receiver is the same), I would be happy to pay for it. The receivers were produced by Allied/Radio Shack in the early 70s. Thanks!

Gary Toncre WA4FYZ
13764 SW 54th Lane
Miami FL 33175

I would be interested in communicating with anyone who has used the Heathkit SB-610 and SB-620 at i-f frequencies higher than 6 MHz. For example, the Kenwood TS-820S has an i-f output at 8.83 MHz, and I would be interested in any modification which will accommodate the higher frequency.

J.O. Dickinson
1408 Monmouth Court West
Richmond VA 23233

I'm looking for a schematic or instruction manual for a Knight model KG-642-A ultrasonic intrusion alarm, circa 1970, and a schematic for a function generator using the XR-205 chip. I would be happy to pay for an original or a copy. Thanks.

Gene Smarte WB6TOV
Nubanusit Road
Hancock NH 03449

I need circuit diagrams and/or books, as well as information on a vfo and mods, for a Conar 400 transmitter and 500 receiver. I will pay for copies.

Nate Bushnell KAØDGN
7175 S. Grant St.
Littleton CO 80122
(303)-794-6956

I need all the information I can get on converting a J.C. Penney's Pinto SSB rig to 10m.

John Lynn
1456 Cheyenne Street
W. Fargo ND 58078

I need operating manuals and schematics for a Collins 75A transmitter and 75A-2 receiver. Can someone help? I will pay for copies.

Bill Morehouse
PO Box 214
Waukesha WI 53187

Does anyone have any information or a schematic for a Motorola T71GJT-1100? I will buy a manual for the above or pay for a copy. Thank you.

Fred Martin
16 Reid Street
South River NJ 08882

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Clean Sweep for the FT-221

—don't miss the action

SSB on two meters is becoming more popular in my area, and activity centers around the national calling frequency of 144.200 MHz. So, whenever I am in the shack, I turn on my FT-221 and position the vfo on that frequency. Several times I have listened for hours to the rush of the receiver, not hearing a peep, only to move the vfo dial when passing the rig on the way to the 807 locker and find a QSO in progress a few kHz away.

This half-hearted monitoring causes me to miss much of the local activity. In order to solve this problem, I have added a clarifier sweeper to the rig. This allows me to monitor 144.200 ± 8 kHz in a sweeping mode.

The Yaesu FT-221 has a broad clarifier which uses a varactor diode in the local oscillator module. By varying the voltage on the varactor from one to eight volts, the clarifier has over ± 8 kHz of tuning range. The circuit in Fig. 1 provides an inexpensive pseudo-triangle wave generator with an output of one to eight volts, and a sweep time of one complete sweep approximately every four seconds.

The circuit is designed to be both small and inexpensive. The 555 timer is wired as an astable square-wave generator, and R1C1 forms an integrator which converts the square wave into a triangular wave. See Fig. 2. For the purist, an op-amp integrator could be substituted for R1C1. See Fig. 3.

Once the sweeper is assembled, check the output voltage. The output should swing slowly towards Vcc and then slowly back to about 1.0 volt and start over again.

Installing the sweeper in the FT-221 is a matter of preference. A simple toggle switch could be used to control the sweeper, as shown in Fig. 4. If you are the type who hates to cut holes in a $600 rig, you might try substituting a new clarifier pot and SPST switch for the original pot. See Fig. 5. This method is my choice. Only the new pot and two diodes need to be added. When the clarifier knob is rotated fully until the switch clicks, the sweep mode is engaged. When the clarifier knob is in any other position, it functions normally.

The circuit itself is very small and mounts anywhere room is available. However, there is a good spot just in front of the crystal deck. The eight volts dc to run the sweeper is easily obtained from the clarifier pot itself. See Fig. 5.

Happy sweeping! ■

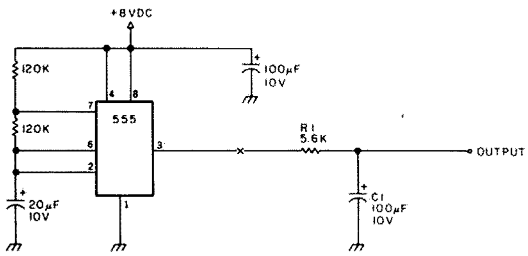

Fig. 1. Pseudo-triangle wave generator.

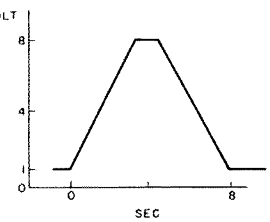

Fig. 2. Waveform from square-wave generator and R1C1 integrator.

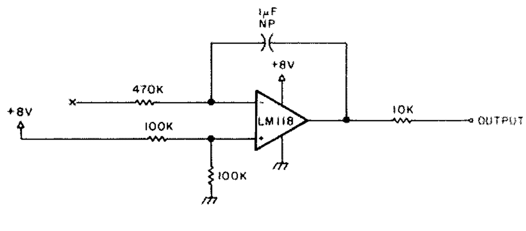

Fig. 3. Op-amp integrator using LM118.

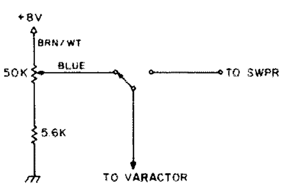

Fig. 4. Hookup using toggle switch.

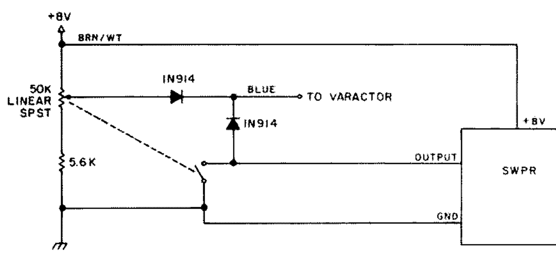

Fig. 5. Hookup using new clarifier pot with SPST switch.

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Birmingham AL 35210

A New Frontier

—weekends were made for . . . 10 FM!

During recent years, FM has become one of amateur radio's most popular and widely accepted modes of UHF communication. The convenience and flexibility of channelized, squelch-muted equipment continuously appeals to numerous amateurs.

The excitement of low-band DXing, however, embraces a unique pleasure which all amateurs cherish—a thrill as old and irreplaceable as ham radio itself. Wouldn't it be interesting to combine these two modes and enjoy intercontinental FM operations? Imagine an ample supply of remote-base setups and repeaters capable of practically worldwide communication in this vision and you have an accurate description of 10-meter FM—a frontier which is presently blowing wide open with excitement.

Photo A. Recipe for mountaintopping fun with 10 FM includes (left to right) a Cushcraft 10-meter FM Ringo, an MFJ antenna tuner with knapsack full of loose and long wires, Comtronix FM-80, and a 2-meter hand-held talkie.

Although FM communications have been taking place on the high end of our 10-meter band for several years, this mode only recently gained widespread popularity. Two of the prime reasons for this upsurge are the increasing sunspot activity and the availability of commercially-manufactured 10-meter FM equipment. The introduction of Yaesu's FT-901DM all-mode 160- through 10-meter deluxe transceiver and the Comtronix FM-80 10-meter FM transceiver substantially promoted 10-FM activity. During the period of a few

Repeater Inputs	International Direct Frequency	Repeater Outputs
29,520 kHz		29,620 kHz
29,540 kHz	29,600 kHz	29,640 kHz
29,560 kHz		29,660 kHz
29,580 kHz		29,680 kHz

Table 1. Ten-meter FM band plan. "Direct" operation on repeater output frequencies is acceptable provided deliberate interference isn't created.

months, 10 FM actually came alive with worldwide FM operations. This activity continues to grow each day, as innovative-minded amateurs clamor to join the fun.

Overview of 10-FM Operations

Although a number of in-band repeaters are operational on 10 FM, most of the activity is "direct" communications on the International Direct Frequency of 29,600 kHz or the repeater output frequencies of 29,620, 29,640, 29,660, or 29,680 kHz. Thus far, the use of direct communications on repeater output frequencies has proven quite acceptable on 10 FM, provided it doesn't interfere with the normal repeater activities on that channel. Due to the limited spectrum allocation for 10 FM, a tight-fitting and conscientiously adhered-to band plan is necessary. As this is being written, 29,600 kHz is being used for brief QSOs and as an international calling frequency with resultant additional communications being carried out on 29,620, 29,640, and 29,660 kHz. 10 FMers realize the long-distance propagation effects of this band, and during such times their gentlemanly procedures are generally beyond reproach. Several repeater groups are presently investigating ways of improving the 10-meter FM band plan, but it appears that the one shown in Table 1 will be retained for many more moons.

While 10 FM is alive and active almost every day and evening, this band's most exciting times usually occur during weekends. The fun starts early each Friday afternoon and continues full bore until the band closes each Sunday night. During these times, signals from European, South American, and Japanese amateurs have been heard working various stations through repeaters in the northwestern United States, and New Zealand stations have been heard transmitting through repeaters in the California area. It's not extremely unusual, either, to hear two or three European amateurs communicating with each other through a US-based repeater during a weekend on 10 FM—and this situation should also exist in reverse in the near future.

All of the US-based repeaters on 10 FM employ PL™ tone encoding to prevent unwarranted in-band interference. Right now, the most common PL frequency in use on 10 FM is 107.2 Hz. When the control operator is monitoring a system during the weekend, however, some repeaters switch to straight COR control to permit various forms of DX operations through their machine.

An uncounted number of remote base setups are operational on 10 FM. Some of these systems are permanent arrangements used by many amateurs, while other remote bases are private systems created by interconnecting one's 10- and 2-meter FM units as desired. Another possibility for the near future is that of mobile remotes, produced by interconnecting one's 10- and 2-meter mobile FM rigs. These units can be used separately while mobile, or the 10-meter unit can be 2-meter-accessed by the operator's HT when he leaves the car. An in-car rubber ducky 2-meter antenna will restrict the 2-meter access range of this system.

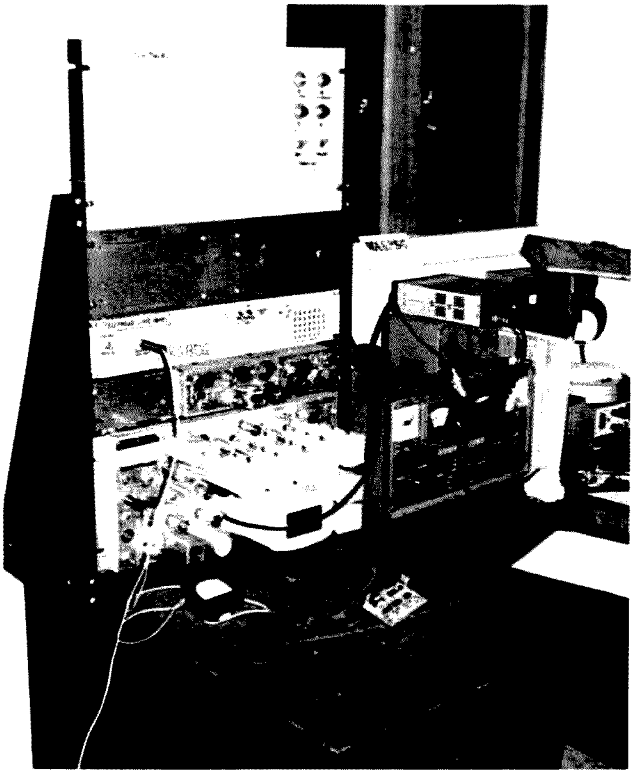

Photo B. Receiver section of WR6BDG, the 29,620-kHz FM repeater in Sierra Madre, California. This repeater is maintained by David Findley N6DF and John Portune WB6ZCT. During weekends, Dave and John occasionally switch this machine to straight COR function for "open" access. The transmitter of WR6BDG is approximately one mile away, at the QTH of WB6ZCT.

Equipment

As previously mentioned, the introduction of Yaesu's FT-901 series transceivers and Comtronix's FM-80 units has been a contributing factor in the recent growth of 10 FM. Prior to this evolution, the bulk of 10-FM equipment consisted of converted low-band (30 to 40 MHz) business radios. Both the Yaesu and the Comtronix are superb performers on 10 FM.

FM capability is standard on the FT-901DM and an available option on the FT-901D and DE transceivers. Power output is approximately 20 Watts in the FM mode. The unit's memory is perfect for programming repeater "splits," and its squelch circuit operates very smoothly.

The Comtronix operates 80 discrete channels of 10 FM, and the standard 10-FM repeater offset of 100 kHz is accomplished by a switch on the unit's squelch control. The rig's front-panel meter reads S-units on receive and relative output power on transmit. Additionally, a front-panel LED varies in intensity according to transmitted modulation, while another LED (bipolar) lights green during receive and red during transmit. Power output of the

Comtronix is 10 Watts (high power) or 1 Watt (low power). The low power of both the Yaesu and the Comtronix is synonymous with 10 FM. 50-Watt stations are considered high power, and 250-Watt signals are "super power"—and usually are unnecessary.

Commercially-manufactured antennas for 10 FM also are beginning to gain in polularity. Cushcraft recently introduced a 10-FM Ringo which looks very similar to their 2-meter Ringo except that it's much larger (17 feet tall—and it's great!).

Newtronics recently introduced their HOT 10 trunk-lip-mounted, center-loaded mobile antenna for 10 FM.

There are a number of antenna tuners which the 10-FM enthusiast will find beneficial when tuning a beam or random length of wire for operation on 29,600± kHz. MFJ Enterprises manufactures a full line of these items, and any of their tuners that I've tried have worked extremely well.

Finally, there are a large number of CB sets which may easily be converted for 10-meter FM operation. Basically, this conversion involves three steps: Move the unit up approximately 2.5 MHz in rf range, replace the AM modulation with an FM modulator, and change the receiver's AM detector to an FM counterpart. Several articles concerning CB-to-10-FM conversions have been published in amateur magazines recently.

Getting Started On 10 FM

Joining the fun of 10 FM will probably bear a striking resemblance to the time you first became involved with 2-meter FM. You'll probably locate and convert a business radio for 10 FM, convert a CB set to 10 FM, or purchase a Yaesu or Comtronix for 10 FM. Operating techniques may seem different from 10-meter SSB activity, but you'll get the hang of it within a couple of days—and wonder why you didn't try 10 FM sooner.

Remember to keep your transmissions short when there's any possibility of interfering with distant QSOs, and never conduct lengthy direct communications on a repeater input frequency. As with any new mode of communications, the prime key to successful operation involves listening extensively to learn the techniques of that mode. 10 FM doesn't hold a money-back guarantee of fun, but you can feel relatively confident that there will be numerous amateurs waiting to purchase your used 10-FM gear should you decide to sell out and return to SSB-only activities.

Conclusion

The amateur frontier of 10 FM is growing at a fantastic rate, and this mode has an extremely promising future. Long-distance communication via FM is a unique experience—and this aspect blends perfectly with today's frantic lifestyle and mobile operating techniques. This band is much smaller in rf spectrum than other FM bands, so considerate and sophisticated operating techniques are a vitally important consideration.

All aspects considered, 10 FM should prove an exciting experience for the progressive-minded amateur. Its DXing, casual operating, and mountaintopping pleasures add new life to an amateur's interests. Here's listening for you on twenty-nine six! ■

Tom French WA4BZP
All Systems Co
PO Box 915
Winter Garden FL 32787

Scanner Magic for Heath's 2036

—grab your October '79 issue for part I of this project

Parts List

R1	90k (value varies, depending on level of threshold signal—see text)
R2, R3	1 meg
R4	1k
C1	0.01-μF disc
Q1	2N2222
IC1-3	SN74LS163
IC4	NE555
misc.	DPDT scan operate switch, push-to-scan switch, 2" × 3" perfboard

In the October, 1979, issue of *73*, an article entitled, "An LED Display for the HW-2036" really excited a number of Heathkit® 2036 and 2036A users. As mentioned in the article, a scan board circuit could be piggybacked to the 2036-DB Display Board. Below are a few hints on how to build this board and check it out.

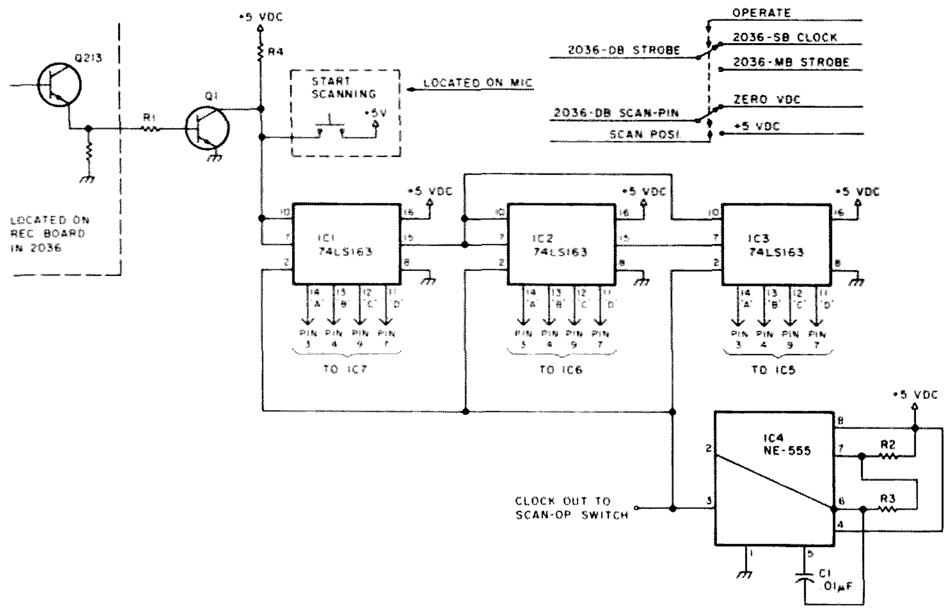

Fig. 1. 2036-SB Scan Board schematic diagram.

Acquire a 2" × 3" piece of perforated board and mount it for sizing on the forward 2¼" screw above the 2036-DB. With the board piggyback on the 2036-DB, position all three 74LS163 chips and also the NE555; don't forget to leave a little bit of room for Q1 and R1 through R3. After marking the parts locations, remove the board. The components then can be inserted, leads bent, and all required connections made with wire-wrap as shown in Fig. 1.

R1 is a threshold-setting resistor and its value is dependent on what signal strength you wish the scanner to lock. The higher its value, the more signal is required to lock the scanner on a carrier. A trimpot here would make adjustment easier.

Clock Out from the NE555 will go to the new scan operate switch (0/5 kHz), to provide a strobe pulse for the SN74LS298s. Install the push-to-scan switch on your mike at some place convenient (best location is on top) and use one of the extra wires in

the mike cable for the signal back to the 2036-SB.

Next, install the respective wires to IC5 through IC7 from the 2036-DB to the 2036-SB (see Fig. 2). Remove the scan bridge on your 2036-DB and solder in the wire from the scan operate switch. Reassemble your unit and apply power. Throwing the scan operate switch to Scan should cause the display to count from .000 to .999 and cycle again. If this does not occur, check the 2036-SB to verify that the scan clock is active. Also read the signal at the 2036-DB on pin 10 of IC4 through IC7; these should also toggle.

To scan 147.000 to 147.999, key in 7-7-7-7, then switch to scan. The switch should be toggled slowly. This scan modification is used to enable the user to locate new repeaters in a new city, and by no means is it competitive with professional scanners.

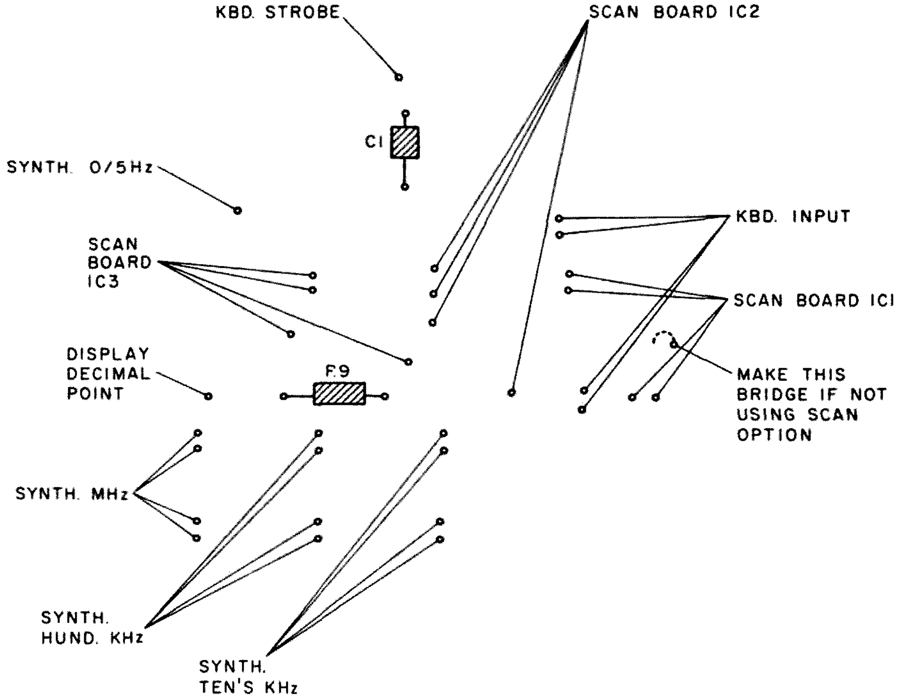

Fig. 2. 2036 Display Board connections.

If your synthesizer is not locking on frequency in the scan mode, it is recommended that the scan clock be slowed down. This is accomplished by increasing the value of the two 1-megohm resistors, R2 and R3 (see Fig. 1). ■

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HV Power Rectifiers

—amplifier builders should read this one

Hams seem to have a propensity for using general-purpose techniques in specialized applications. For example, a fellow may try to use an inch-and-a-quarter TV mast to hold up his TH6DXX beam because it is the only size that fits through the bearing in his tower. Lousy reason . . . and the result will be a perfectly good antenna strewn about his yard after the first real windstorm. Another ham may use an RG-58/U feedline to connect up his kW on two meters; after all, it handled the power just fine on 75. See my point?

One mistake hams nearly always seem to make is to use low-voltage technology applied to high-voltage circuits. This approach falls well in line with the mast and coax examples above. An amateur who designs his new kW plate supply using a long string of 1N4000-type plastic rectifiers is making a mistake which likely will remind him of his error just when he begins calling that FO8!

There are different technologies currently employed by the manufacturers of silicon power rectifiers, and only a few lend themselves to high-voltage applications. The always-available "1000-piv, 1-A" plastic diodes you find at flea markets and on retailers' shelves—usually priced at 15¢ each or so—just aren't. Aren't 1000 piv or 1 A, that is. These cheapie products nearly always are high-leakage commercial devices with weak reverse "knees" (V_R/I_R characteristics) and limited surge capabilities. After all, if these diodes were so good, why wouldn't their source sell them to high-reliability industrial houses, where the demand is high and supply is short, for much higher prices? Reason is, the manufacturers of these cheapie devices know the value of their product: nearly zero.

A ham may build just one kW amplifier in his lifetime; he'll look everywhere for Eimac tubes, Jennings tuning capacitors, Dow-Key relays, and the like—all high-quality products. Why endanger the usefulness of this major investment by using scrap power-supply components?

I have seen rectifiers which were marked "1500 piv, 2.5 A" for sale at a local electronics retailer priced at 6 for $1.00. Hmmm. I looked at them: They measured 0.125" in diameter, were 0.250" long, were made of plastic (epoxy), and had plated copper leads. I purchased 12 of these gems and made a few measurements on them when I brought them home. The very best diode of the lot "broke down" (exceeded 100-uA reverse current) at slightly over 700 volts. In the forward direction, at 2.5 A, they averaged 1.3 volts forward drop. This represents 3.25 Watts of power dissipated in only one direction. Add in the 100 uA of leakage at 700 volts in the other direction (70 mW) and we find that this diode would have to dissipate 3.32 Watts minimum in a 700-V ac application—an awful lot of power for a device the size of a ½-Watt resistor.

When you consider that these devices are soldered together, i.e., the leads are formed like nail-heads and soldered to the metallized silicon die inside the diode, it becomes very evident that the overall reliability of a device of such small volume dissipating over three Watts of power is questionable. Have you ever touched a ½-Watt resistor which was actually dissipating one-half Watt? *Ouch*!

Another limitation of the soldered-together approach is surge current capability. Ever turn on a piece of gear which immediately blew a fuse? Often, it is the power rectifiers which blew, from surge or inrush current. In a typical power supply, the rectifiers charge a capacitor which represents a very low impedance at the operating frequency (in a line-operated system, this is 60 Hz for half-wave, 120 Hz for full-wave designs). Before the capacitor charges up to its working dc potential, it may look like a

dead short, drawing, for the first few cycles of operation, considerably higher current than the rectifiers can withstand. In fact, it is not uncommon for (low-voltage) computer-grade electrolytics to be such effective shorts that they attempt to draw several hundred Amperes of inrush current, limited only by the resistance of the power transformer and the saturation effects of its core. This surge current may be a hundred times the normal operating output current of the supply and can cause rectifier failures in an otherwise sound design. The problems caused by surge currents are numerous, but one may be solder fatigue in the rectifiers: The solder bonds soften as the result of prolonged high-current operation, then harden when the power is removed. This thermal cycling weakens the bonds and may cause a failure.

So much for surge currents. How about avalanche characteristics? This term describes the manner in which the silicon junction breaks down in the reverse mode (in normal line rectifier applications, this mode occurs at a 60-Hz rate) and at what voltage the junction enters breakdown. Typical double-diffused junction rectifiers—the most common type used for commercial applications, due to the inexpensive process employed—can be built easily to block 500 volts or so in the reverse direction.

1000 volts is an entirely different story and requires higher-resistivity silicon and tighter process controls. It has been my experience, after testing many lots of devices, that most "1000-volt" double-diffused parts, like the 1N4007, break down well below their rated 1000 volts. What can we do? Sue the manuacturers? Nope. You see, unless one is very careful, the reverse-voltage test can be destructive, and most manufacturers accept no responsibility for devices which are field-tested unless tight testing controls are employed and proven acceptable.

Where does that leave us hams? Holding the bag, I'm afraid, unless we deal exclusively with sources which have high scruples and specialize in high-voltage technology.

Even if the rectifiers used actually meet or exceed their rated reverse voltage specifications, what happens if they're not matched for this characteristic? Absolutely nothing, *as long as no one diode in the string is approaching breakdown or avalanche*. We can assume that even a poorly-made power rectifier in the one-to-three-Amp region probably does not exceed 10-20-uA leakage at room temperature if operated *well below* its rated breakdown voltage. Except in extremely high-voltage (or low current) applications, this represents such a small amount of power (e.g., 500 V × 10 uA = 5 mW) that it is not worth worrying about.

Equalizing resistors wired across every rectifier in a string are, therefore, a waste of power and money and create an additional liability in the system: A resistor could fail.

By the way, the temperature coefficient of breakdown voltage for a silicon junction is positive—the hotter the junction, the higher the breakdown voltage. This is, of course, a positive feature of a silicon rectifier. An effect to consider, however, is the increase in leakage current with an increase in junction temperature. Silicon devices double in leakage about every 10° C,[1] and in many power-supply applications, the junction temperatures will exceed 100° C; often, power rectifiers will exceed 100-uA leakage at this temperature. At 500 volts V_R, this is 50 mW, not an insignificant value.

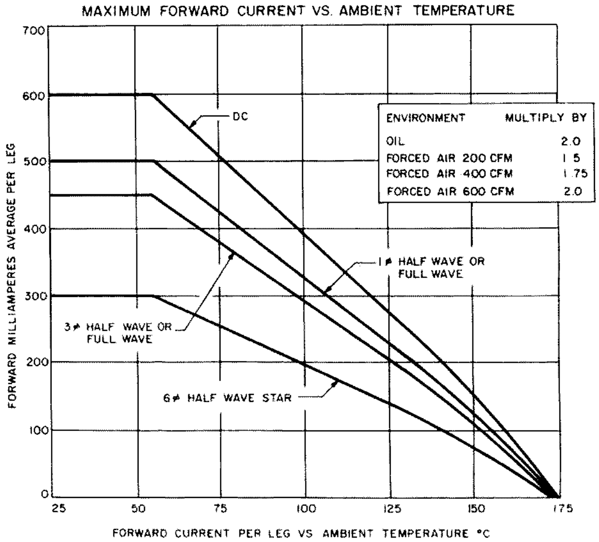

Fig. 1.

Matching rectifiers for forward characteristics can be important since it is in the forward—or conduction—mode that the rectifier will be dissipating real power. Fortunately, most silicon power devices built with the same technology will offer similar forward characteristics—roughly one-volt drop per junction at rated I_o and 25° C. The temperature coefficient of this characteristic is negative, i.e., the hotter the junction, the lower the forward drop at a given current.

Packaging also is a consideration which will determine the reliability and life of a silicon rectifier. Many inexpensive devices are cased in epoxy, a hard plastic molded around the tiny silicon die to protect and insulate it and the fragile lead bonds. Some diodes use a glass sleeve to hermetically seal out contaminants which would gradually increase surface leakage of the silicon and lead to a failure; sometimes, the glass sleeve also holds the leads on. This is not a great way to build power semiconductors! Old-fashioned, "top hat" leaded rectifiers built in type DO-1, DO-2, and DO-3 cases are just that: old-fashioned. They rely on the thermal impedance of a soft-solder bond to just one side of the silicon die to conduct heat away from the junction; they also are "cavity" devices, whose characteristics can change as the result of mechanical shock. Not a great choice for that contest rig which gets bounced up the side of a rocky mountain.

As this discussion relates primarily to ac-line-operated linear-type power supply designs (direct conversion of 60-Hz power to dc power), we have intentionally avoided the subject of switching characteristics of rectifiers. These characteristics, called forward-recovery and reverse-recovery expressed in subsecond increments (or dv/dt expressed in volts per time interval, usually us), do not normally become important until operating frequencies far exceed 60 Hz. However, a considerable mismatch in t_{rr} (reverse-recovery time) characteristics, especially if one or more diodes in a string are very slow to recover from forward saturation, can

cause the fastest diode in that string to be overstressed for a lengthy enough period to cause its deterioration or destruction.[2] It is wise, therefore, to use at least medium-recovery rectifiers—typically rated 2 to 5 us—in reliable 60-Hz power supply designs where the devices are used in series.

So far, we've discussed a lot of "don'ts":

1. Don't use long strings of low-voltage rectifiers.
2. Don't use cheapie devices whose ratings are nearly always overstated.
3. Don't use miniature diodes which will dissipate excessive power in your application.
4. Don't use devices with limited or unknown surge current ratings.
5. Don't use "1000-V" diodes at this rating, but operate comfortably below their V_R capability when using in series.
6. Don't use equalizing resistors—they're just a cover-up for having selected the wrong semiconductors for the job.
7. Don't use power rectifiers which are built like small-signal devices, e.g., epoxy, glass-sleeved pressure-bonded, top-hat axials, etc.
8. Don't use devices of unknown or poor reverse-recovery characteristics, especially in a series string.

Well, what *should* we do? Thought you'd never ask.

When possible, use high-voltage rectifier assemblies manufactured by a reliable power rectifier house, rather than building your own assembly by wiring a string of discrete devices in series. These high-voltage assemblies are made of several rectifiers in series, of course—it is very difficult to manufacture a single junction which can block much over 1000 volts successfully and otherwise maintain the characteristics of a rectifier—but the manufacturers of these assemblies are much better equipped than the average ham to select the proper devices to use and then measure the overall results.

A conscientious manufacturer will use hermetically-sealed, internal heat-sink devices, which are high-temperature metallurgically bonded (not soldered) together, then screened and selected for characteristics which will allow trouble-free series operation, before assembling the finished product. This may sound like an expensive process, but manufacturers set up to build such assemblies in large quantities can do so quite economically.[3]

Calculate the piv requirement of the rectifier or assembly selected. For example, if the configuration is a full-wave center-tap, each rectifier has to block 2.82 times the rms voltage of half the transformer's secondary; for a full-wave bridge, each rectifier must block 1.41 times the rms voltage of the transformer secondary.

To further illustrate the examples in the last paragraph, if you have a plate transformer whose secondary voltage is 2000 V rms and you desire to use a full-wave bridge rectifier circuit, each leg of the bridge must be capable of blocking at least 2000 × 1.41 = 2820 volts with each half cycle. This assumes a nominal ac line voltage equal to and never exceeding the primary voltage rating of the transformer; this also assumes that under no-load conditions, the rms voltage delivered by the transformer doesn't rise above its full-load voltage (transformers are typically rated at some rms voltage at some load current, like 2000 V at 500 mA). These are poor assumptions!

Normally, a transformer rated at 1 kVA (equivalent of 1-kW resistive power)—say, 2000 V at 500 mA—will rise in secondary voltage under no-load conditions by about 10% or, in our example, to 2200 V. In addition, it is not uncommon for ac line voltage fluctuations to swing "upward" another 10% or so—say, from 117 V rms to 128.7 V rms—which transforms to 2420 V in our example. This would require a rectifier bridge rated at 3412 V per leg as a minimum, and even this value does not include any protection factor for short-duration transients.

So, you see that while our initial calculations led us to believe that a 2800-piv rectifier assembly might be used in each leg of the bridge described, in truth we should use at least 3500-piv assemblies as an absolute minimum; 5000-piv rated assemblies would not be overkill to afford us some protection against unexpected transients.

Next, estimate surge current requirements. I say "estimate" because there usually are unknown factors involved, like transformer efficiency, saturation effects of its core, and the discharged resistance of the input filter capacitor. However, one can make a worst-case surge current calculation based on transformer secondary resistance. If the resistance of your transformer secondary winding is 20 Ohms and the secondary voltage is 2000 V rms, the worst-case surge current is E_{pk}/R (2800/20), or 140 Amperes.

Actually, the surge current will not be quite this high. If your transformer secondary winding resistance measures very low or your input filter capacitor is very large, you may wish to add some series resistance in each input leg to the rectifier bridge to act as surge-current limiters.

A 35-Ohm, 10-Watt resistor in series with each ac input to a bridge as described above (2 kV rms secondary) will limit surge current to 40 Amperes maximum while dissipating only 8.75 Watts per resistor and degrading power supply regulation by about 1%. A compromise, surely, but not a bad one; surge protection may be switched "out" just a moment after turn-on if one wishes to conserve power and enhance regulation during normal operation.

Next, determine the continuous operating current requirements placed upon the rectifiers based on circuit configuration and operating habits. I always design a power supply for continuous duty unless size and weight restrictions are a consideration. AM, FM, RTTY, and SSTV are pretty much continuous-duty modes. SSB and CW may be low- or high-duty cycle modes, depending upon voice characteristics, audio processing, keying characteristics, etc. The thermal time constant of most rectifier assemblies in the low kilowatt region (say, ½ to 3 kW) is very short, which means the rectifiers will reach operating temperature from internal heating rapidly—probably in less than one minute of key-down time. Therefore, just because one keeps his transmissions reasonably short does not mean that the rectifiers aren't reaching their operating temperature.

Most kW-region, high-voltage supplies will never have to deliver more than one Ampere dc continuous. Those folks who are fortunate enough to own a pair of 4-1000s or 8877s may wish to design a power supply capable of delivering 2 A dc, but don't brag about this on the air, lest the FCC wonder why you need such a big supply!

In a full-wave circuit, each rectifier conducts for

only half the input wave, and therefore must handle only half the dc output current. Even a two-Amp supply can be built using rectifiers rated at one Amp I_o (continuous output current), as long as the rectifier rating is compatible with its operating temperature. It is wise to assume that under some conditions the rectifier junction temperature will be at least 100° C. This may sound very hot (and it is, for human beings), but silicon power rectifiers normally work in this region and they don't mind, as long as one derates them properly. The derating curves for one popular kW-level rectifier assembly are shown in Fig. 1.[4]

As you can see, the single-phase, full-wave current rating for this assembly is 500 mA from 25° C (77° F) to about 55° C (131° F); then it derates in a nearly linear fashion to zero current at 175° C (347° F). This represents a derating factor of about 4.17 mA/°C (2.31 mA/°F), calculated: $[(I_o @ T_a) - (I_o @ T_{max})]/(T_{max} - T_a)$ Amps/degree, where I_o is rated output current, T_a is ambient temperature (usually 25 or 55° C) and T_{max} is the maximum rated temperature of the device or assembly.

At 100° C, then, the "500-mA" rectifier assembly shown is actually rated at about 312 mA; at 125° C, it is rated at about 208 mA. Operating temperature equals ambient temperature plus thermal rise from junction heating and is sometimes difficult to calculate. To allow margin for error, it is best to use assemblies rated for your actual operating current at some rather high temperature (like 100° C).

It is wise to take manufacturers' data sheet ratings literally and not exceed them. Note that the temperatures expressed in Fig. 1 are ambient, for free air. There is a multiplier table shown which reveals that the current rating for this assembly is substantially higher if external (oil or forced-air) cooling is introduced, as is often the case in industrial or military designs.

Another consideration is insulation resistance across high-voltage terminals or from them to ground. At working voltages normally encountered in amateur amplifiers, even big ones, this is not a real problem, since most of us are working below 5 kV. A good rule-of-thumb dimension for high-voltage spacers or standoffs used to mount rectifiers and other high-voltage components is 0.10″ per 1000 volts minimum.

The same rule holds true for package length of high-voltage rectifiers. Beware of a ¼″-long diode rated at "5 kV." The silicon junctions inside may not break down until that level is reached, but what about the package itself or the air around it? Many subminiature high-voltage rectifiers were designed to be used in dielectric oil or fluorocarbon, *not in air*, and should be avoided for amateur applications.

Silicon high-voltage rectifier assemblies are available as complete center-taps and bridges as well as half-wave devices. In fact, it is a good choice indeed to use a commercially-manufactured complete rectifier assembly (such as a full-wave center-tap) when economically feasible, since the manufacturer has used well-matched devices therein, ensuring good balance and long life. A typical full-wave center-tap high-voltage rectifier assembly data sheet is reproduced in part here (Fig. 2[5]) as an example of a readily-available industrial product and its ratings. The SDHC-prefix devices asterisked are the center-tap assemblies and are, therefore, rated at twice the dc output current; the SDH- and SDHD-prefix devices are half-wave diodes and voltage-doubler configured arrays. (A doubler is two rectifiers in series with the center anode-to-cathode connection brought out for connection to external high-voltage capacitors.) Note the V_F—forward voltage—specified for each assembly; this is a clue to the *number* of junctions contained in each.

Type No.	Peak Inverse Voltage Per Leg	Average Rectified Current	Maximum Forward Voltage @500 mA/Leg	One Cycle Surge Current	Reverse Current/Leg @ PIV	Case Length
	55°C	55°C Mtg.	25°C	55°C	25°C	A
	Volts	Amps	Volts	Amps	uA	Inches
SDH5KM	5 kV	1.0	7	50	1.0	3.36
SDH10KM	10 kV	1.0	14	50	1.0	3.36
SDH15KM	15 kV	1.0	20	50	1.0	4.04
*SDHC5KM	5 kV	2.0	7	50	1.0	4.72
SDHD5KM	5 kV	1.0	7	50	1.0	4.72
*SDHC10KM	10 kV	2.0	14	50	1.0	4.72
SDHD10KM	10 kV	1.0	14	50	1.0	4.72
*SDHC15KM	15 kV	2.0	20	50	1.0	6.09
SDHD15KM	15 kV	1.0	20	50	1.0	6.09

Fig. 2.

This discussion, lengthy as it is, leaves out much information; it is important to note that many of the rules outlined here do not apply to low-voltage, high-current designs. If there is enough interest generated by this article, I will follow up with articles on p-n power semiconductor junctions, assembly techniques, thermal impedance ratings, switching power designs, etc.

In the meantime, most amateurs who have absorbed the material presented here should have a better understanding of high-voltage power rectifiers and their applications and ratings. Next time you look inside a kW amateur-band amplifier, see what type of high-voltage rectifier system is used. It can tell you a great deal about how smart the amplifier's designer was . . . and how much he cared about building a reliable product.■

References

1. W. Shockley, "Problems Relating to p-n Junctions in Silicon," *Solid State Electronics*, vol. 2, c. 1961.
2. H.W. Henkel, "Germanium and Silicon Rectifiers," *Proceedings of the I.R.E.*, vol. 47, c. 1958.
3. Semtech Corporation, 652 Mitchell Rd., Newbury Park CA 91320. Examples of construction and design technology used here are taken from ideas used in Semtech products. Other manufacturers of high-voltage rectifier assemblies include: Edal Industries, 4 Short Beach Rd., E. Haven CT 06512; Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers NY 10710; International Rectifier, 233 Kansas St., El Segundo CA 90245; Unitrode Corp., 580 Pleasant St., Watertown MA 02172; Varo Semiconductor, PO Box 676, Garland TX 75040; and Westinghouse Electric Corp., Semiconductor Div., Youngwood PA 15697.
4. Courtesy of Semtech Corporation.
5. Courtesy of Semtech Corporation.

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Cheap Connectors for Half-Inch Hardline

—at your neighborhood hardware store

You've just become the owner of some really nice half-inch, 72-Ohm CATV hardline, but where, oh where, will you find connectors for this prize? What will you do? What *will* you do? To make matters worse, you know that even if you had the money to purchase commercial connectors, they would not fit anything in your shack. And what if your fellow amateurs found out that you weren't innovative enough to come up with something as simple as a cable connector!

Don't despair; you're not alone. I found the answer after several weeks of thinking, looking, asking, and trying every harebrained idea that came along. I found it across town in the plumbing section of the local hardware store, for less than a dollar.

Another Way

WA4VYR, a good friend and the inspiration for my original idea, has successfully used the following method of solving this problem without *any* cash outlay. He simply strips the half-inch hardline just as you would strip RG-8. Using two pairs of standard pliers, he screws a PL-259 connector up onto the aluminum jacket and solders the center in the normal fashion. I tried this method—and tried, and tried, and tried, until I finally decided that there had to be an easier way. (The one I did get to work lasted only two weeks before Mother Nature produced a break where the 259 and aluminum jacket joined.)

My Way

After the trip up the tower to find the broken connection, I dried my eyes and resumed my quest for a better way. When you don't know where you're going, I had been told, make an outline. Just what did I need to do the job? I wanted a coupling that was compatible with the existing system, namely, with SO-239/PL-259 hardware. And the joint needed reinforcing, I decided, in the light of my previous experience. The coupling must be small and have no clamps or sharp edges. It also would be nice if it could be weatherproofed easily. And, above all, it must be simple and cheap.

As I mentioned, the solution to all this was found in the local hardware store. This particular store had a display of brass fittings used for the installation of copper gas and water lines. Among them was a *half-*

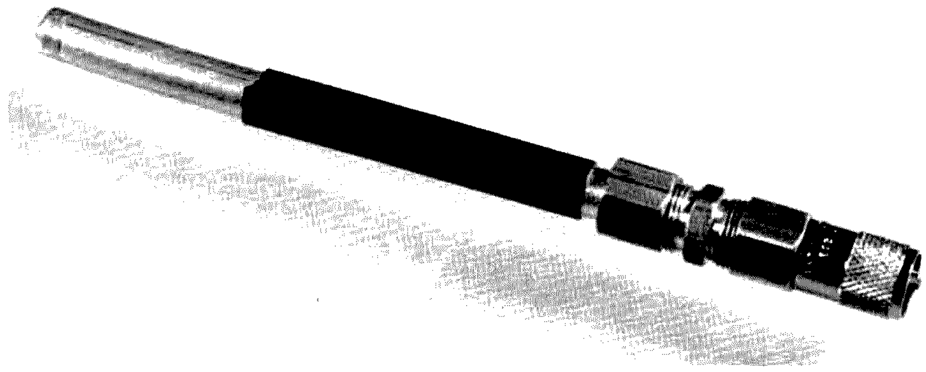

Photo A. The completed connector.

inch brass compression coupling.

This connector is a perfect adapter. It will fit almost perfectly over the aluminum jacket of the commonly-available, half-inch CATV hardline. It consists of the five parts shown in Photo B: the main body, two brass collets—one inserted into each end of the main body, and two brass caps. These collets constrict around the tubing being joined when tightened correctly and form an airtight, firm connection. To make matters even simpler, the main body has a rim centered inside. This allows the cable to be inserted and seated properly before tightening.

So much for the history and sales pitch. Get your parts up and follow me through the simple ten-minute assembly.

Assembly

Prepare the end of the hardline as shown in Photo C. Cutting is done best with a small tubing cutter because of its smooth cutting action. Loosely assemble the brass fitting and twist one end onto the prepared end of the CATV cable. This will be simple to do correctly since the cable will stop when it contacts the inner rim inside the brass fitting. Since the main body and end caps are machined for gripping with standard wrenches, use two wrenches and tighten this end very snugly. Be careful not to strip the brass threads, but do make sure you tighten the cap enough to compress the collet around the hardline jacket. Don't worry if the union crooks slightly. I said the fit was *almost* perfect!

Next, it is very important to scrape all the enamel coating from the center conductor. It won't solder if you don't. Now we are ready to slip a PL-259 onto the center by screwing it onto the foam insulation and up into the brass fitting. It probably won't go far enough to seat against the inner rim, but it will be far enough to allow the collet to tighten properly. Don't overdo the insertion bit here; remember, you'll need to be able to turn the cap of the PL-259! The rest should go without further detailed description.

Solder the center in the normal fashion and trim any excess length from it afterwards. Don't tin the inner conductor before insertion because you will find they fit very closely, and it probably wouldn't fit afterwards if you do. Presto! You now are back on familiar ground. The 259 connector should be readily adaptable to most of your amateur needs.

When I showed my discovery to KA4DPF, a close friend who is an engineer for the local power company, he remarked that this connector had a very important virtue that I had overlooked. Since direct connection of dissimilar metals always produces some corrosion, the power company uses brass intermediate connectors to prevent eventual problems. Hence, this configuration should provide years of trouble-free operation, especially if taped well when installed.

Installation

By now you should have surmised that I am relatively non-technical and am far from being an expert on antenna technology. However, some remarks about matching 72-Ohm cable with a 50-Ohm system are in order. I am told by those more knowledgeable than I am that the following conditions are found in this situation. Provided the antenna is an acceptable match to the transmitter and the 72-Ohm cable is *exactly* a multiple of one-half wavelengths long at the operating frequency, the transmitter will effectively "see" the antenna load at the other end regardless of the characteristic impedance of the line. Further, the expected loss from this line mismatch would be only around 1.6 to 1: probably a good tradeoff relative to a long run of RG-8, especially from a receive-loss standpoint.

I matched the system at K4QT/RPT and at my home station by inserting different lengths of RG-8/X between the hardline and the transmitter until I found one that made the total cable length appear to be the proper length. The reflected power shown on a 50-Ohm Bird 43 was less than one Watt with twelve Watts out of the transmitter. The flexible jumpers are a welcome addition also when moving and installing equipment.

I am certain that this method has its faults and I would welcome any constructive advice concerning better methods. The repeater, which was constructed from an old Heathkit® HW-202, has been operating on this system for about a year now without incident. This doesn't prove anything except that a solid-state transmitter can operate well when used in the manner described.

Perhaps these ideas will be of some help to you when you come across that old CATV cable someone else doesn't want or couldn't figure out how to use! ■

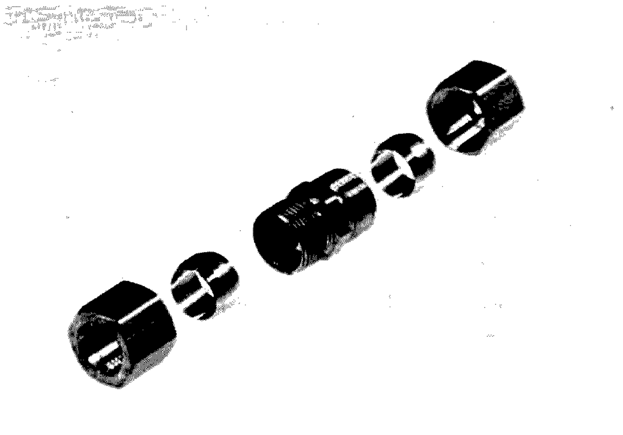

Photo B. The five-part brass adapter.

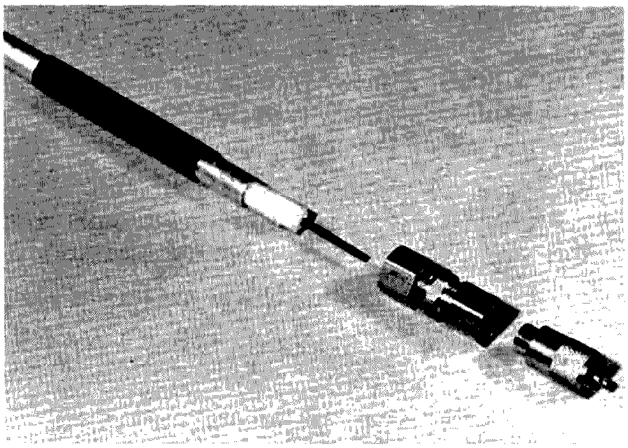

Photo C. Half-inch CATV hardline, adapter, and PL-259.

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The Microwave Midget

—this WEFAX converter features something different—an active mixer

Several years have passed since NOAA (National Oceanic and Atmospheric Administration) graduated from VHF WEFAX (Weather Facsimile) satellites to geosynchronous microwave satellites. True, some of the polar-orbiting satellites transmitted data on S-band, besides the low-frequency product usually found on 137.5 and 137.62 MHz, but only the bravest of souls attempted to track such a fast-moving target with a narrow beamwidth dish. Besides, I was content to extract weather pictures from the low-altitude polar orbiters and occasionally, for some real DX, from ATS-1 or ATS-3 parked some 22,500 miles above the equator.

In April, 1976, NOAA published Technical Memorandum NESS 54, by John Nagle, entitled "A Method of Converting the SMS/GOES WEFAX Frequency (1691 MHz) to the Existing APT/WEFAX Frequency (137 MHz)." This was followed up with an APT Information Note (76-W4) in September, 1976, advising all ground stations of the proposed S-band broadcasts and schedules. Clearly, the handwriting was on the wall, and many of us (some reluctantly) were dragged into the realm of microwaves.

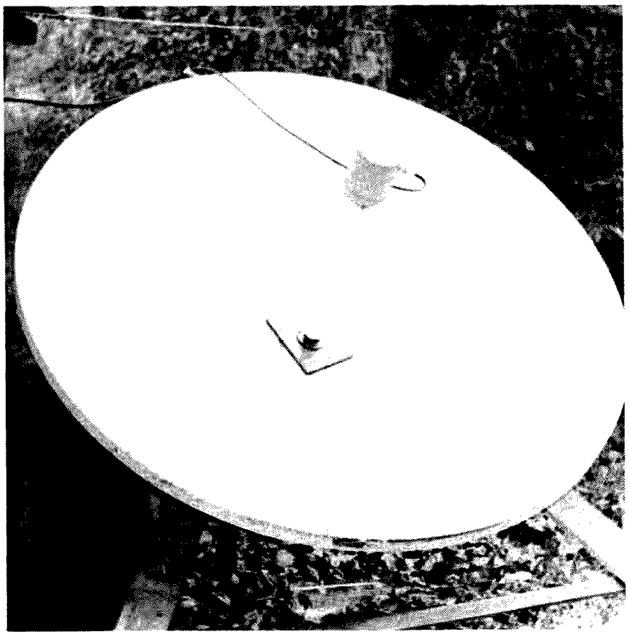

Photo A. The six-foot dish and feedhorn.

The rush to 1691 MHz was not especially spectacular, and for most of us, it resembled a slow and laborious climb. Microcomm rose to the occasion with a line of inexpensive modules, and a fine article by WB8DQT[1] showed us how to use them, besides providing a wealth of data on dishes, gain figures, path loss and margins.

The annual gathering of weather-satellite buffs at the Dayton Hamvention in 1979 unearthed several home-brew devices, but I believe none has been described in print with the exception of one produced by G8FCD. He wrote about his METEOSAT (Europe's counterpart to GOES) Earth station in recent issues of *Wireless World*.[2]

The heart of my system is an *active* mixer—a mixer with conversion *gain* rather than the conversion loss associated with diode mixers. The expected ground-level signal of −134 dBm is not exactly an S-meter needle bender, so every bit of help you can get in the way of gain in the system is to

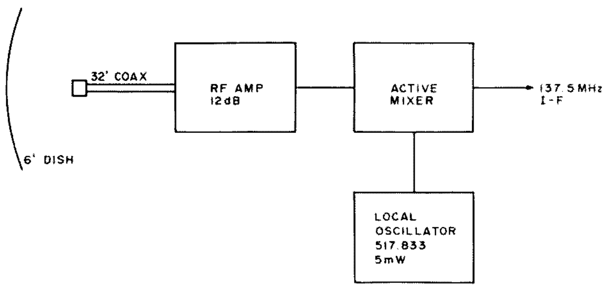

Fig. 1. System configuration for the active-mixer converter.

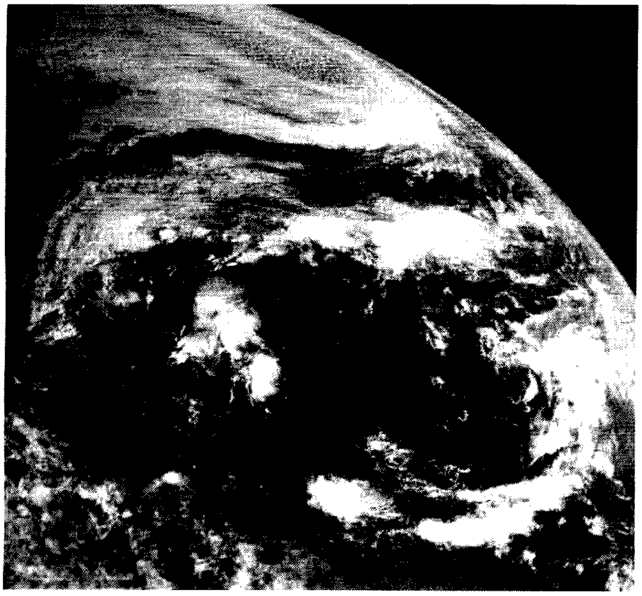

Photo B. No land mass is visible in this photo of the NE quadrant. Placed above and overlapping Photo C, covering the SE quadrant, complete coverage of the eastern half of the hemisphere is obtained.

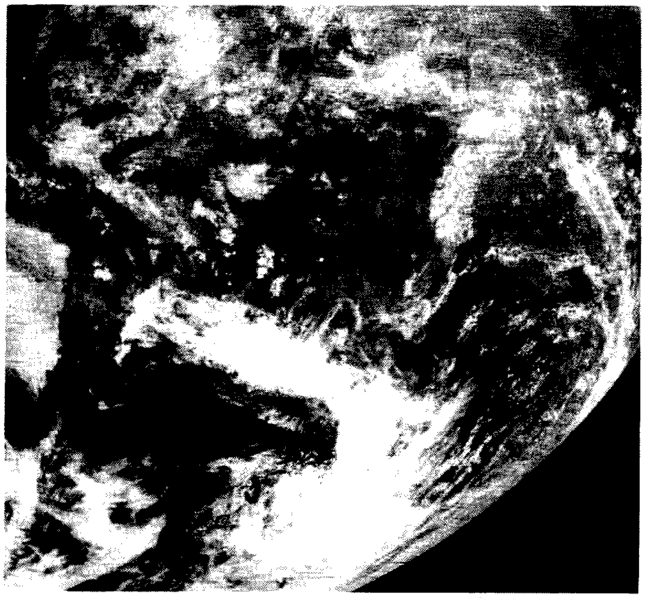

Photo C. South America's west and east coasts are visible in this picture, at lower left.

your advantage (and of benefit to your wallet) because high-gain preamps and transistors at this frequency still cost a few bucks. I was convinced of the worth of an active mixer by W6KT through correspondence and because of his success with such a device—although his differs considerably from the one about to be described. I used an almost exact copy of an active mixer described by Larkin Crutcher WA5WOW[3] for 1296 MHz, with a few modifications necessary to achieve similar results.

Circuit Description and Layout

The active mixer consists of two half-wavelength lines of #10 soft-drawn copper wire grounded at both ends of their respective cavities and tuned at their center point with 10-32 brass screws. The brass nuts are soldered inside the cavities. At one end of the multiplier cavity, a signal from the local oscillator is injected at 517.833 MHz at 5 mW, which, in turn, is multiplied by 3 to 1553.5 MHz. The output signal from this cavity is coupled to an inductive link at the other end of this line. The input signal at 1691 MHz is coupled to the input cavity via a capacitive probe at one end of the line and taken off the other end of the line with a capacitive probe.

This probe and the inductive link of the multiplier cavity are composed of one piece of #14 wire bent into a U shape, 20 mm long with 12-mm legs. The difference signal, 137.5 MHz, is coupled to the mixer transistor by connecting a 100-pF disc ceramic capacitor from the center point (10 mm) of the U-shaped link to the base of the MRF901. The collector of this transistor uses a conventionally-tuned output circuit to the 137.5-MHz wideband FM receiver. No preamp was necessary.

The active mixer box is constructed entirely of double-sided PC board. The base is slightly longer than 88 mm × 54 mm, and the four walls plus the center partition are made from 1-inch-high strips. The actual box dimensions are 88 mm × 50 mm × 25 mm. The

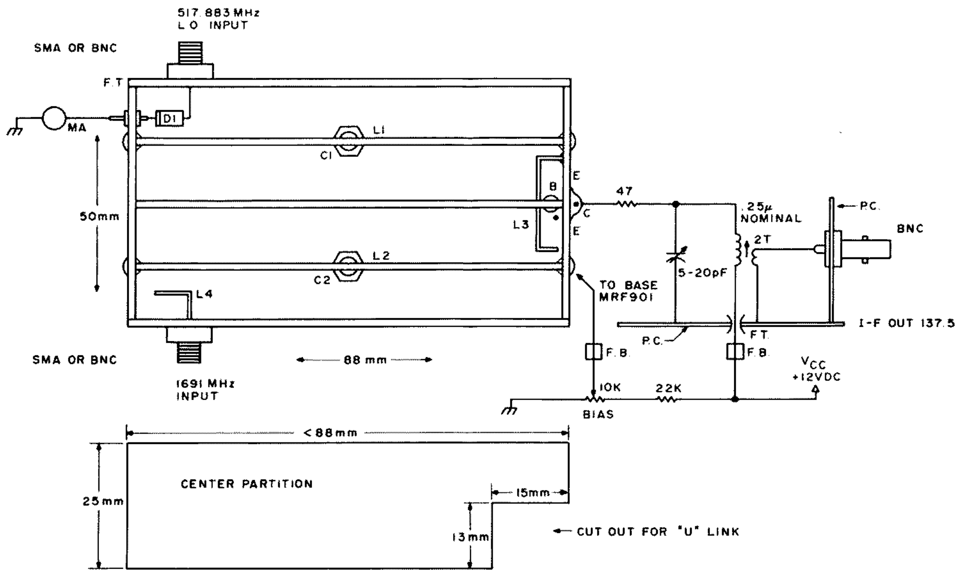

Fig. 2. Schematic of the active mixer. L1, L2—#10 wire; C1, C2—10-32 nuts and bolts; L3—20 mm × 14 mm U-shaped link, #14 wire; D1—MA4882 mixer diode; L4—12 mm × 7 mm × 2 mm tab.

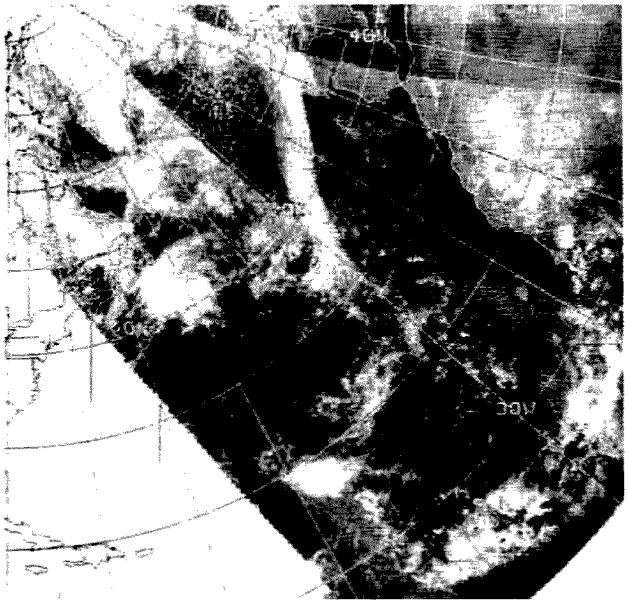

Photo D. NOAA product from low-altitude satellite Tiros N relayed from the ground through uplink.

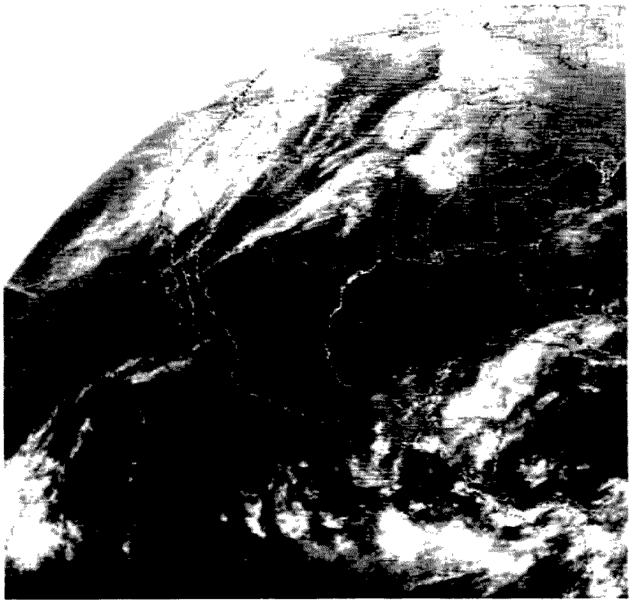

Photo E. Daytime infrared photo, NW quadrant.

center partition is slightly shorter than 88 mm to fit in the center of the box, and is notched at one end with a 13 mm × 15 mm cut out to accommodate the U-shaped link. A hole is drilled in the end wall adjacent to the link for mounting the MRF901.

A very small hole is drilled into the baseplate near the wall for a piece of #30 insulated wire to pass through and connect to the base of the transistor to provide the necessary bias. The rest of the transistor lives outside of the cavity. The low-frequency circuit for 137.5 MHz was built on a small piece of PC board and tack soldered to the back side of the baseplate for isolation. An additional one-inch strip was soldered to the baseplate parallel to the long walls and drilled for mounting on a 19-inch aluminum panel. SMA connectors were used for the input and output ports to match the Microcomm rf preamp and local oscillator, but BNC connectors should work as well.

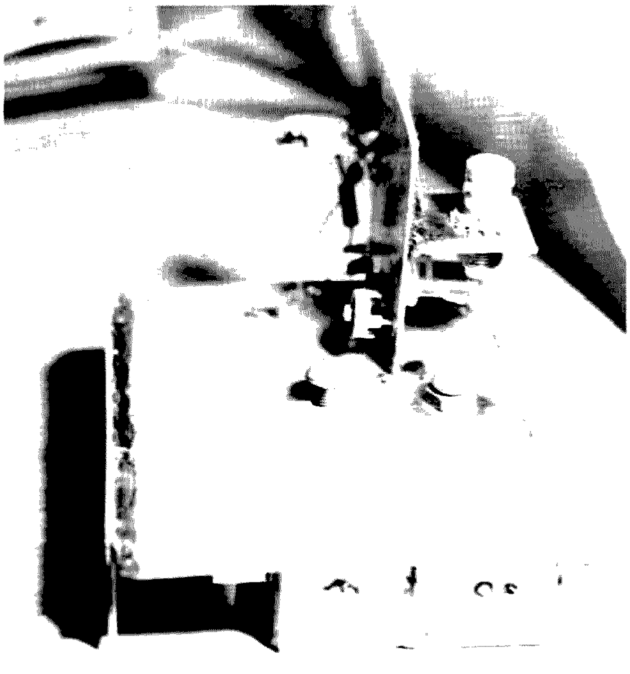

Photo F. Back side of the active mixer.

Tune-Up and Operation

I wish I could say that everything went as smooth as silk with this project, but I traipsed with Murphy down the garden path for several months until I finally discovered that I had the collector circuit tuned to about 300 MHz. The microwave portion of the mixer apparently worked well from the start. I used a Hewlett-Packard HP-614A signal generator for a beacon/signal source for testing. Initially, I biased the MRF901 for a collector current of about 800 microamps without oscillator injection, fired up the oscillator and tuned the multiplier cavity for maximum collector current which, at this point, was 1.2 mA. By bending the U-shaped link closer to the multiplier line, squeezing the multiplier diode closer to the line, and slightly deforming the line itself downward by about 2 mm, I picked up an additional 600 microamps of collector current.

Initially, I constructed the mixer with inductive links throughout, but in actual practice ended up with more gain by cutting the input link to the signal line from ground and also the signal line portion of the U-shaped link. I accomplished this tweaking by setting the signal generator to 1691 MHz and the power to 0 dBm and turning down the calibrated attenuator. The tuning screw in the signal cavity tunes with the 10-32 screw almost all the way out with about one thread left in the cavity. The multiplier screw needed a 12-mm disk of thin brass or copper soldered to the end of its 10-32 screw to tune the line since it is too short, but the disk, with its added capacity, nicely pulls it down lower in frequency.

With one 12-dB gain Microcomm preamp connected ahead of the mixer and a properly functioning output circuit attached to the MRF901, the attenuator was cranked into more than −125 dBm with plenty of

signal showing on the receiver, so I moved everything outdoors. I attached the system to a 6-foot dish and a homemade feedhorn sporting an N connector through ten feet of RG-9 cable and picked up a full-quieting signal from SMS-GOES East. After optimizing the feedhorn for focus and polarization angle, I removed the preamp, and though the signal was a bit noisy through ten feet of cable, I think it would have made a useful picture.

Since most of the users have devised ways of mounting their converters and preamps at the antenna site, I assumed that it would be impossible to use only one preamp and expect to use the system indoors through a long run of cable. Taggart devised such a scheme using a Coleman insulated cooler and an incubator device. My dish is situated more than 25 feet from my shack and "looks" through an ancient sugar maple tree about 70 feet high with about 30 feet of leaves and branches in the way. I'm sure there is some signal absorption when the sap flows.

To satisfy my curiosity, I attached another 22-foot piece of RG-9 to the existing ten-foot piece and still received a full-quieting signal! I now have the entire system indoors except for the dish, feedhorn, and thirty-two feet of RG-9 cable and one foot of RG-142/U with a total of six connectors in the line: one SMA male, four series-N males, and a double-female N "barrel" connector. (I believe I have some loss there.) The pictures shown were made with this cable configuration, but someday I hope to replace it all with one piece.

Conclusion

For my money, the active mixer is definitely the way to go at these frequencies. I didn't use any bandpass filters in the front end because I live in a natural dish in a rural area. For a more hostile rf environment, their use probably will be necessary. The Microcomm LO is exceptionally clean, so I got away without one between it and the multiplier diode. If for some reason this local-oscillator module is not available in the future, you should be able to construct one from N6TX's article[4] or build your own. W6KT built a simple oscillator chain for 259 MHz and multiplied by six by replacing the multiplier diode with an MRF901.

I monitor the multiplier-diode current of the MA4882 with a 0-15-mA meter. Nominal current is between 4 to 7 mA. The collector current of the MRF901 also is monitored with a 0-10-mA meter. By varying the bias pot, a satisfactory operating point would be from 900 microamps to about 2 mA, with some mixer noise becoming evident above this figure. The current was brought up to 7 mA without a tendency to oscillate, but the noise was objectionable and the gain started downhill.

Finally, NOAA, unlike the private sector of the satellite business, welcomes the use of their service by amateurs. Bob Popham,[5] the coordinator for the NOAA satellite service, has attended the weather satellite symposiums at Dayton for the last several years as one of the principal speakers.

The weather pictures for this article were produced on a facsimile device described in my previous articles.[6,7]

I think I'll get out my PC board and try for some converters for 1296 and 2304. ■

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4. Paul Schuch N6TX, "A UHF Oscillator for the Purist," *Ham Radio*, July, 1979.
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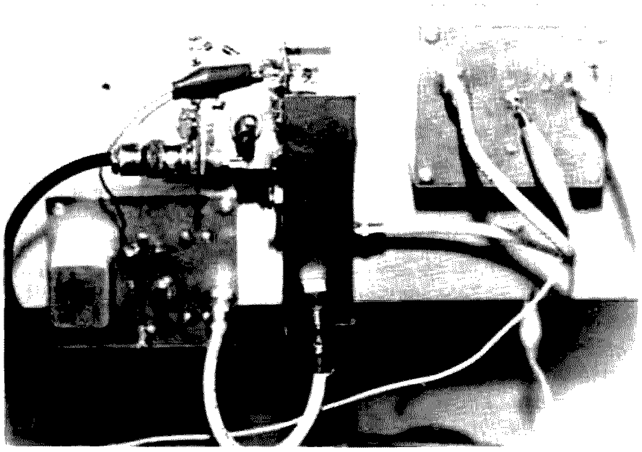

Photo C. From left to right: the oscillator, active mixer, and preamp.

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OH 43160

The Amazing Bobtail ...Our Readers Respond

—more ideas for using and modifying this easy-to-build antenna

The first week after the Bobtail article was published (May, 1980, *73 Magazine*, page 44), four hams wrote me that they had built the antenna and agreed with my evaluation.

The first was Jim Gray W1XU, who tried the idea which I had failed to try completely—feeding it with coax at a high-current point. He said it worked perfectly.

He used 984/f, the normal quad formula, and had 34.44 feet for the separation of the top sections between verticals and 17.22 for the verticals. It was 1:1 at 14.250 MHz and 2:1 at 14.000. He planned to lengthen it a couple of inches.

He worked EI2EC with a barefoot TS-820S. He then called "CQ Pacific" and landed VK1DH.

He wrote, in part, "Now let the guys know that the antenna can be fed with coax—with low swr, too. It saves wear and tear on tuners and tuning. I like it, and so does the DX." More later on the feedpoint.

Ron Chiappari N6AUV put the antenna up with three elements on 40 meters and fed it at the top with coax; he phoned me from California to tell me about it. He said it tuned up easily and was 1:1 at the design frequency.

Merl W9ZSI built the antenna with voltage feed and wrote me that it was a great antenna. I then told him to try current feed, and he said it tuned up perfectly 1:1 at 14.250 MHz. He is now going to put up another complete Bobtail and phase the pair with quarter-wave spacing, driving both antennas.

Bill W8YFB in Elyria, Ohio, wrote to say that he was feeding the center element voltage-fed with open-wire ladder line on 80/20/15/10 and then tied the two feeders together for a Bobtail on 40.

Dave W7TO wrote me that he had talked one evening to Bob K8FN in Troy, Ohio, who had the strongest signal from the east one night while running only 25 Watts. Of course I wrote Bob, and he said his Bobtail was suspended from three towers, and he had hung old tires at the bottom of the vertical wires so that he could mow under them. How about that?

I also received a letter from "Judge" Ganzer K7SCO who has written books on antennas. He said he calls this type of current top-fed antennas "blacktop antennas" because they do not have to use buried radials in the ground.

You may have guessed—there are no grounds on the top-fed antennas. The center of the coax goes to the top of the vertical in the center, or at one end (as I do), and the shield goes to the flat-top horizontal section.

I received a surprising number of letters from people merely telling me that they had used the antenna and that I was right about it. All agreed that it was a quiet antenna, and some wondered why. Verticals are not usually quiet.

It is a long-range antenna and is at its best when the path exceeds 2500 miles.

This is important—when you feed it, connect the center of the coax to the vertical. I first thought I would run the coax up the center of the quarter-wave tubing and feed the top section, with the shield going to the vertical as in the case of the balun. This might work, but it would change the phasing. The three verticals are in phase because the two top sections are cancelled out when center-fed.

I am using mine with the coax to the top of the end vertical because it is more convenient. I believe that the pattern is skewed toward the west (driven) vertical and that this method is related to a full-wave longwire. I get strong reports from both the SW Pa-

cific area and the NE European area. This happens to suit me fine. I think my pattern is a four-leaf-clover pattern with the accent on the western lobes, but I cannot prove this by driving around locally with a field-strength meter for a pattern measurement.

Most of the hams who wrote to me used the usual formula and made the top sections 33′ long and the verticals 16′ 6″. I used 34′ at the top for each section, as Jim Gray did, and tried the verticals at 17′ 3″, but I had to cut the verticals back to 16′ 6″ to get the swr to 1:1. In the usual manner of phased verticals, I believe that the length of the top sections is uncritical, as in the spacing of phased verticals. It affects the pattern but not the resonance. The antenna is tuned to resonance with the vertical radiators.

Now you know the rest of the story. No grounds; top-fed with coax; tune the vertical sections. However, Ron N6AUV said that no verticals worked well at his location in California because of poor grounds. I told him to try a method which I advised a friend in Connecticut to use one time: Lay a roll of fence wire under the antenna. He used chicken wire and it worked beautifully. No connection to the antennas—just a reflecting surface. You can buy green vinyl-covered fence wire now and lay it on the grass. It blends with the grass and you can mow over it.

I noticed one thing—most of the letters were from very experienced hams, not newcomers. I hope some new people will try it and let me know, now that voltage feed is not necessary. ■

Single-Tone Paging for Wilson HTs

—simple circuit should work with many rigs

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Tampa FL 33604

The small size of the new generation of two-meter HTs permits them to be carried almost anywhere, giving instant communications capability either direct or through repeaters. In my specific aplication, my wife and I use Wilson MK IIs to keep in touch on an unused simplex frequency, and the channel can be monitored constantly for any calls to each other. Sometimes we are too far apart for reliable simplex communications, however, and must switch over to one of the local repeaters. Naturally, the wide-coverage repeaters are fairly busy, and monitoring all the repeater activity for a specific call is very distracting, especially in a business meeting or restaurant. What we each needed was a way to be alerted to an incoming call without constant attention to the HT.

Selective Calling

Commercial users solved this problem many years ago by the use of selective calling. Selective calling permits a receiver to monitor a frequency for calls and unsquelch only when specifically addressed. Thus, a user can go about his business without any conscious attention to the receiver and yet immediately be alerted to any incoming call. The most common form of selective calling used in commercial paging applications is some form of two-tone sequential encoding-decoding. This is accomplished by transmitting an rf carrier which is modulated by a series of two audio tones. Each paging recipient carries a receiver that responds to a particular sequence of different audio tones. The receiver remains muted until the proper tones are received, after which an audible alert tone is produced. In the case of a tone-only page, this alert tone is a signal for the paged person to perform some prearranged action, such as calling a telephone number or reporting to a specific location. For a tone and voice page, the alerting tone is followed by a voice message. The decoders in the receiver are immune to false alarms by virtue of the sequencing requirement, decoder bandwidth, and slow response time. Typically, over 100 different codes are available on any given frequency.

Adding a suitable high-performance sequential tone decoder to an already crowded HT is not easy, unfortunately, and the problem is further complicated by the need for a compatible encoder when the signaling of another unit in the network is required.

Single-Tone Paging

For many amateur applications, large numbers of different signaling codes on any given channel are not required and a simpler form of selective calling can be used. Encoding and decoding a *single* audio tone can be implemented with a minimum amount of circuitry and can provide very effective results if certain precautions are taken. As in the case of sequential tone decoding, the response time of the decoder must be slow so that voice or other momentary in-band signals do not trigger the squelch. Additionally, the frequency separation of the different tone frequencies must be compatible with

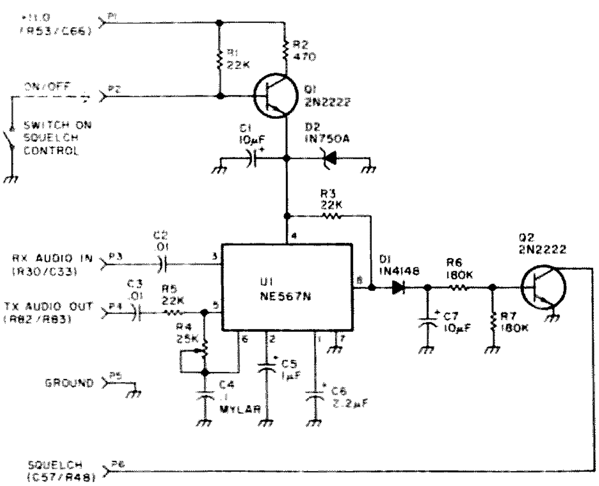

Fig. 1. Single-tone encoder-decoder for the Wilson MK II/IV.

low-cost decoders. Close frequency spacings allow more individual codes, but require tighter bandwidth control in the decoder and encoder, complicating the design and increasing the size and cost.

While researching this problem, I noticed that the eight frequencies used in touchtone™ signaling (assuming 16 digits) use 10% frequency spacing for each of the 4 high-group and 4 low-group tones. Using this as a starting point, the group of tones shown in Table 1 was developed. Note that all the frequencies have a 10% offset from each adjacent frequency, except for the 1075-Hz tone. This was arbitrarily chosen to be midway from the 941-Hz and 1209-Hz touchtone frequencies. Eighteen different audio tones within the normal voice band permit up to 18 different paging networks to operate on any given channel. By using tones in the voice band, as opposed to subaudible tones, repeaters may be used as the paging transmitter since the originating tone can be transmitted by any station capable of accessing the repeater. Of course, the system will also work on simplex channels.

There is no advantage in using the 8 touchtone frequencies in this plan, since in normal autopatch use any specific tone is usually transmitted for less than 1 second, and a 3-second response time on the single-tone decoder allows it to effectively ignore the single tone associated with the dual-tone touchtone signal. Actually, there is some advantage to using touchtone frequencies in this tone plan since any of the 8 users of these frequencies can be paged by anyone equipped with a touchtone HT or by use of a touchtone phone on a reverse autopatch. Repeater groups might want to assign these tones to key individuals in the organization such as members of the engineering committee or emergency coordinators.

Tone Coordination

In order for this tone plan to be successful, some form of tone coordination on any given channel is necessary. Since most repeaters are operated by well-organized groups, the 18 available tones can be assigned and their use administered in any manner that suits the group. The main consideration is to avoid duplication of tones so that users of the service are not bothered by unwanted pages.

Circuit Design

I have had excellent results using the single tone encoder-decoder shown in Fig. 1. The circuit uses an NE567 tone-decoder chip to detect one of the 18 different tones. The filter bandwidth is compatible with the 10% tone separation, and the operating frequency can be set to any of the 18 tones by the adjustment of R4. In addition, the circuit also generates the exact frequency which it decodes, permitting the encoder to alert any other receiver in the same network. The circuit is insensitive to voltage variations from 7.5 to 16 volts and varies less than 1% in frequency over the −10°-to-60°C temperature range.

Operation and Circuit Description

As installed in my Wilson MK II, the decoder is activated whenever the squelch control is switched to the Tone position. This tone feature was intended by Wilson to activate a subaudible tone squelch, but it works fine for this application. With the squelch control in this position, the normal carrier squelch is disabled, but the receiver remains squelched by the saturated output from Q2 in the decoder. Whenever a signal appears on frequency modulated by the correct tone, the output of U1 goes low. After about 3 seconds, as determined by C6 and R6, the collector of Q2 goes high and the MK II unsquelches. Once unsquelched, the activating tone is heard in the speaker indicating a page. The receiver squelches as soon as the rf input or tone is removed. Once the alert tone is heard, the squelch control is rotated to the normal carrier squelch position and the frequency monitored for information from the paging station, and two-way contact can be carried out if desired. If paging of another station in the same tone network is desired, one first checks for a clear channel, identifies, and then transmits a 5-second tone by switching back to the Tone position while keying the MK II. The 5-second tone transmission allows about 2 seconds of the tone to be heard in the paged receiver.

Construction

The entire encoder-decoder fits on one single-sided PCB. A full-size layout of the board is shown in Fig. 2 and the parts list is shown in Table 2. All the parts are available from advertisers in *73* or most Radio Shack stores. I've also made arrangements for

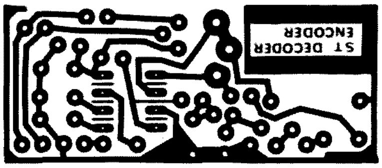

Fig. 2. Full-size layout of PCB for the single-tone encoder-decoder.

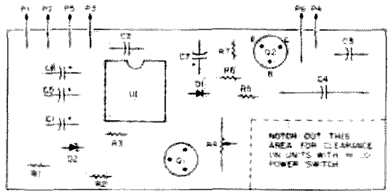

Fig. 3. Component layout.

Tone Channel	Frequency	
1	515	
2	570	
3	630	
4	697	Low-group touchtone
5	770	Low-group touchtone
6	852	Low-group touchtone
7	941	Low-group touchtone
8	1075	
9	1209	High-group touchtone
10	1336	High-group touchtone
11	1447	High-group touchtone
12	1633	High-group touchtone
13	1805	
14	1995	
15	2205	
16	2437	
17	2694	
18	2977	

Table 1.

the PCB alone, or a complete kit, to be made available from a source listed in the parts list. Mention the ST Encoder-Decoder when ordering.

All the parts are mounted as shown in Fig. 3. Note that the resistors are mounted vertically to save space. If your MK II or MK IV has the Hi-Lo power switch, it will be necessary to notch out the rear corner of the PCB to provide clearance. The solid copper area bordering the board name provides the proper guidelines for this operation. Six #26 stranded wires about 7" long are connected to the unit for testing and eventual connection to the MK II or MK IV PCB.

Testing

To avoid any extra trouble, I recommend testing the encoder-decoder externally and then connecting it to the MK II or MK IV. Referring again to Fig. 1, connect +12 volts to P1 and ground to P5. Connect a frequency counter to P4 and adjust R4 for the desired tone frequency. Then apply a 100-mV rms audio signal at the desired tone frequency to P3. Before the tone is applied, the base of Q2 should be at .7 volts. This should drop to 0 volts about 3 seconds after the tone is applied. Verify that the on/off switch works by grounding P2. The transmit output signal at P4 should disappear, and the base of Q2 will go to 0 volts. Once the board has been tested, insulate the entire bottom of the PCB with electrical or vinyl tape to prevent shorts when it is installed in the MK II or MK IV.

Installation

The first step is to remove the top and bottom covers from the MK II or MK IV to gain access to the switch contacts on the squelch control. Run a jumper from one of the switch contacts to the ground plane on the main PCB of the MK II or MK IV. Next, connect the wire from P2 to the other switch contact. Note that this wire must be routed from the backside of the PCB to the switch contact on the squelch control. The connections of each of the leads from the encoder-decoder to the MK II is shown in Fig. 1. In each case, the reference designator shown on the schematic beside each lead number refers to the connection point on the MK II. These points are best located by referring to the circuit board overlay on page 18 of the Operating and Service Manual for the MK II/MK IV.

The encoder-decoder is secured inside the radio by pressure from the top cover. Now, carefully reinstall the top and bottom covers and check for proper operation. If you have a deviation meter, check for about 3-kHz tone deviation. This is more than adequate since the decoder will function with deviations from transmitters as low as 1.5 kHz. Have someone transmit a signal with the correct tone frequency and check for proper receiver operation. The receiver should unsquelch about 2.5 seconds after the tone is transmitted.

How Does It Perform?

I can monitor a busy repeater all day and never once hear the squelch break, yet as soon as I am paged, the paging tone comes through loud and clear. I've had the opportunity to try the page feature through a number of different repeaters and it has never failed to work. When readable signals are present, the encoder-decoder works every time.

Incidentally, when switched On, the encoder-decoder adds about 6 mA of additional current drain. This is of no consequence since the average drain in the Tone position is much less than in normal squelch because battery life is directly proportional to the amount of audio coming from the speaker. With the decoder turned on, *nothing* is ever heard except the desired paging tone.

Use of Encoder-Decoder in Other Equipment

I haven't had the chance to investigate the use of the encoder-decoder in other equipment, but aside from physical constraints, the unit should work with most negative-ground solid state equipment. I will be glad to answer any specific questions on interfacing it with your rig if you include a copy of the schematic and an SASE. ■

Parts List

R1, R5, R3	22k, ¼ W	
R2	470, ¼ W	
R4	25k Pot	Radio Shack 271-336
R6, R7	180k, ¼ W	
C1, C7	10 μF, 16 V	Radio Shack 272-1411
C2, C3	0.01 ceramic	
C4	0.1 mylar™	Radio Shack 272-1053
C5	1 μF, 35 V	Radio Shack 272-1406
C6	2.2 μF, 35 V	Radio Shack 272-1407
D1	1N4148	
D2	1N750A	
U1	NE567N	
Q1, Q2	2N2222	

A complete parts kit, including drilled and plated PCB, is available from Coggin Mfg., P.O. Box 44, Cedar Rapids IA 52404, $15.95 (postpaid). The PCB alone is $3.50 postpaid.

Table 2.

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Northbrook IL 60062

Teletext and Viewdata: Are You Ready for the Information Boom?

—coming soon to a living room near you: video data services

Specially equipped TV receivers are now available to provide us with current weather, sports, news headlines, tonight's television shows, local events of interest, and many other interesting bits and pieces of information. The magic word in this scenario is *information*. Almost anything of general interest can be formatted and sent to your home by the systems to be described in this article.

In England, a set-top adapter currently available for this service is priced at $250. The cost of the LSI integrated circuits that will form the heart of these adapters is less than $50. I feel that there is the possibility of adapting this hardware, which will be produced in large volume for consumers, for use on the ham bands.

Teletext is a generic term for television-based systems broadcasting pages of information along with the normal TV signal. This information is digitally encoded and sent during the vertical-retrace interval when the scan of your TV receiver is off screen. What the viewer sees on the screen of his teletext TV is a page of characters, 40 in a row, 20 to 24 rows, 800 to 960 characters per page. These characters can be presented in eight colors, including colored backgrounds. Included in the character set are all the letters of the alphabet (both uppercase and lowercase), numbers, punctuation marks, special symbols, and graphics. The graphics can be as simple as 64 special graphic symbols, called mosaic graphics, or higher density if one is willing to pay the price.

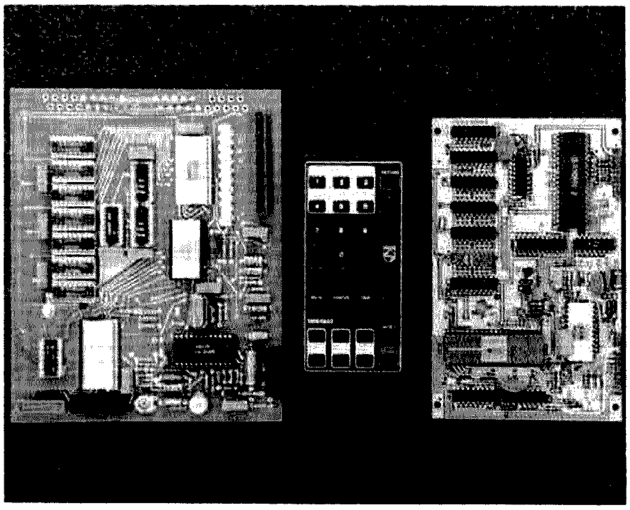

Photo A. Typical teletext hardware. Left to right: Mullard module, remote control, and Texas Instruments module.

Each page is identified by a page number and typically will be displayed on the screen in less than a minute after the desired number is entered via the keypad. Several hundred pages can be transmitted in less than a minute in a serial fashion, one page after another. The teletext adapter grabs the appropriate page as it comes by and immediately displays the selected page on the screen. Index pages are provided to help the consumer determine pages of interest.

Where does all this information come from and why does the broadcaster want to transmit it to your home? One way to answer this question is to consider teletext as a new publishing medium. As advertising supports most mass-market publishing efforts, so would it play in this one. As an interesting example, the news headlines could be brought to you by your local paper in an effort to sell you today's edition containing more details on the stories. It is expected that most pages broadcast by commercial TV stations would include such advertising.

On the public TV stations, information would be financed by the same sources that contribute to their normal program funds. Obviously, most major corporations and many government agencies have

much material that would be suitable for this system of distributing information. Many data bases already exist and are being made available to hobbyists with home computers via dial-up telephone networks. Much of this information is directly presentable on teletext systems. There seems to be no lack of available material, and there are many organizations willing to finance its presentation.

Now that we have the information, how does it get from the source to your home? To begin with, the desired page is composed within the display format specification previously highlighted. If this composing is not done directly in the broadcaster's studio, it probably will be sent to him either over the telephone line or in the form of a digital cassette or floppy disk (i.e., in computer-compatible form). At the station, this data is loaded into a piece of apparatus which encodes it into a digital *serial* data signal. This signal is appropriately filtered (bandlimited) and inserted in unused scan lines during the vertical retrace portion of the current video signal being broadcast. A decoding apparatus connected to your TV will accept this special signal and when the requested page is being transmitted, will grab it and load it into a television display memory. The pages are transmitted row by row, one page after another, and then the whole sequence is repeated. Hence, if the page you requested had just been sent, you will have to wait while all the other pages are sent—until the sequence cycles back to your page.

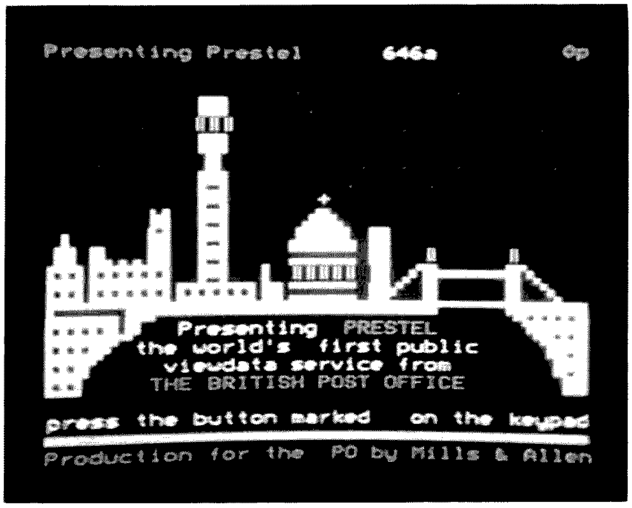

Photo B. Prestel page. Both teletext and viewdata pages will look like this.

Since the television broadcast system deals with analog and not digital signals, special precautions have to be taken with both the broadcast and reception equipment. The digital signal leaving the studio encounters many places where distortion can occur. Some of these are in the studio-to-transmitter link, the transmitter, in reflections caused by large objects, in your TV antenna and lead-in, and in the television receiver and decoder input circuitry. All these effects are being considered by the organizations trying to propose standards in this country.

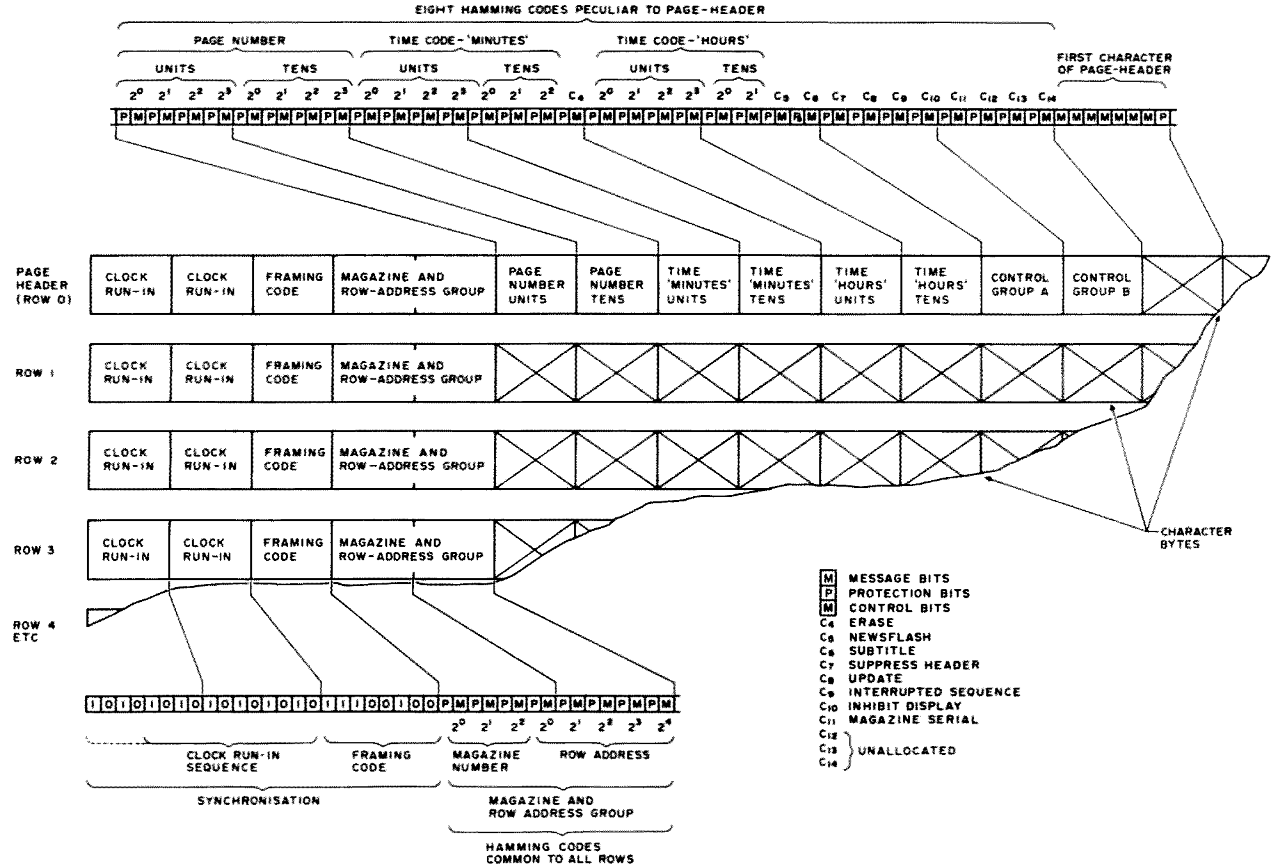

Fig. 1. Transmission format for British teletext.

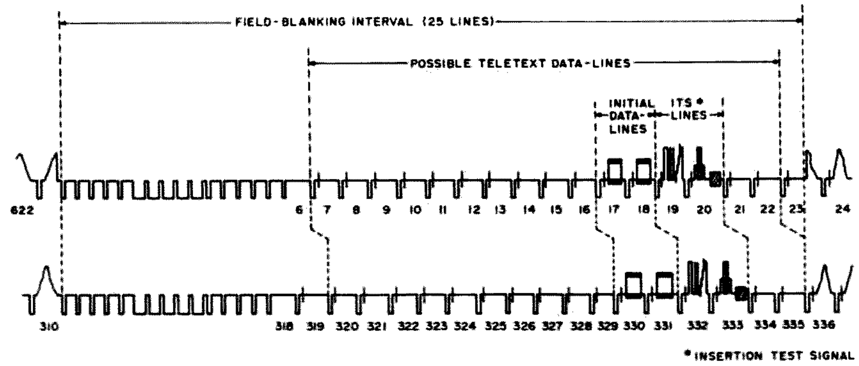

Fig. 2. Insertion of teletext signal in 625-line video signal.

Teletext: Current Systems Being Proposed for North American Use

At the present time, there is no standard for the broadcast of teletext in North America. In Europe, there are systems in place and regularly broadcasting, with the largest number of receivers in England. There currently are three major contenders for teletext standards in this part of the world: 1) British teletext, 2) French Antiope, and 3) Canadian Telidon proposals. Also, a system called Captions for the Deaf (CFD) should be mentioned since it shares some similar characteristics.

The British teletext system is probably the simplest because it has a fixed-transmission format. This is likely to lead to the cheapest decoder design, which is important in the consumer product marketplace. There are two names by which these systems are identified. The British Broadcasting Corporation (BBC) has called its system Ceefax. The Independent Broadcasting Authority (IBA) calls its version Oracle.

The French system, Antiope, is based on packets of data which are efficient representations of only the displayed characters on any page. On pages sparsely covered, the Antiope system requires less time to transmit than British teletext. On full pages, this is not the case.

The Canadian system, Telidon, proposes a generalized technique for transmitting higher resolution graphics displays. As mentioned earlier, the basic graphic character set is 64 mosaic symbols. Originally, this was proposed as a way of improving the appearance of the primarily text-oriented displays. However, as more experience has been gained, the graphics feature has been found to be a very useful and definitely desirable aspect of teletext.

The approach suggested by the Canadians is to transmit Picture Description Instructions (PDI). These instructions describe images in terms of basic geometrical shapes. Included are line, arc, polygon, point, and area. To describe a line, a starting point and a final displacement are sent instead of characters corresponding to each section of the line. Decoders could be built with various degrees of resolution in the display, with higher resolution being more costly. Most likely, these would have to be microprocessor based, since software algorithms would be needed to "draw" the shapes into the display memory. The minimum decoder, which would perform similarly to the 64-character mosaic approach, likely would be more expensive than a system which is tailored only for simple graphics. However, the appeal of high-resolution graphics is likely to influence system development in this country also.

Captions for the Deaf is a system intended primarily for sending captions for hearing-impaired viewers. As such, much lower data rates are adequate (about 10 times slower). As one provision of the system, called info-text, 15 lines of 32 characters can be displayed. Currently, the FCC has authorized the use of TV scan-line 21 for this purpose. All the teletext systems have provision for captioning services, including foreign language subtitles.

British Teletext: A Detailed Description

To make these systems affordable for the consumer, several LSI integrated circuits will be required. At the present, these chips are available only for the British teletext system. Several manufacturers including Mullard, Texas Instruments, and General Instruments offer chip sets for this purpose. To understand how these circuits work, a description of the page encoding scheme must be studied.

The standard character set is shown in Table 1. If you are familiar with ASCII coded symbols, you will notice a great similarity between the two character sets. There are several characteristics which should be noticed about this set. The 64-character, mosaic-graphic set is shown in columns 2a, 3a, 6a, and 7a. The digital code which represents these characters is the same as that for the symbols in columns 2, 3, 6, and 7.

How can this be? The answer is contained in the first two columns (0 and 1) of *control characters*. Each row of displayed text is assumed to be transmitted under an initial set of conditions shown in Table 1. The

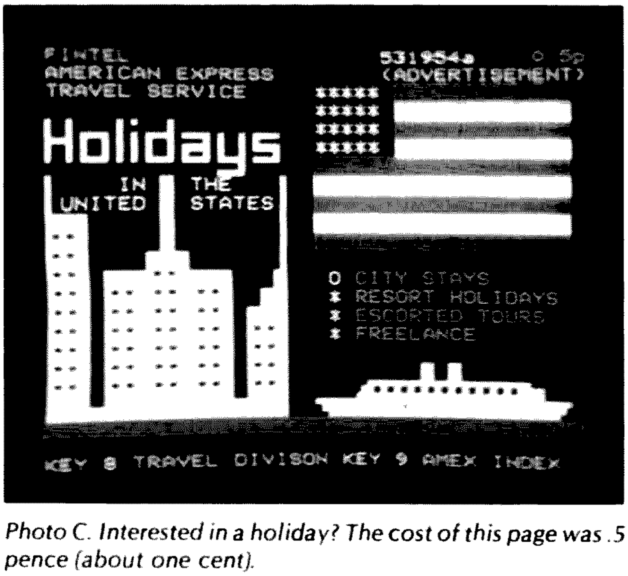

Photo C. Interested in a holiday? The cost of this page was .5 pence (about one cent).

"alpha" control characters tell the decoder to use 2, 3, 6, and 7, or, for "graphics" characters, to use 2a, 3a, 6a, and 7a. Therefore, as an example, it is impossible to mix lowercase letters and mosaic graphics without sending a control character to switch the character set. All control characters are displayed as spaces.

In the British system, 24 rows of text are transmitted per page. The first row is special and is given the name *page header*. It includes 32 characters to be displayed and special page descriptors which are not displayed. All other rows have 40 characters. See Fig. 1, which shows the makeup of these rows. Each row starts with a *clock run-in* and *framing code* for hardware synchronization. Then the *magazine* (0-7) and *row address* (0-23) are sent. (The three-digit *page* number can be from 0 to 799 with the most significant digit being referred to as the magazine number.) Finally, 40 characters are sent. The page-header row has the page number, time code, and special control bits followed by 32 characters. The magazine, row address, page, time code, and control bits all are encoded with special protection bits forming a Hamming code. This code is made up of *message* and *protection* bits shown in Table 2. The other characters use a single bit, b8, to form *parity*. Parity refers to the number of bits which are equal to 1; in this case, an odd number is sent for protection purposes.

b7 b6 b5 →					0 0 0	0 0 1	0 1 0		0 1 1		1 0 0	1 0 1	1 1 0		1 1 1	
Bits b4	b3	b2	b1	Row \ Col	0	1	2	2a	3	3a	4	5	6	6a	7	7a
0	0	0	0	0	NUL[1]	DLE[1]			0		@	P	—		p	
0	0	0	1	1	Alpha^{n} Red	Graphics Red	!		1		A	Q	a		q	
0	0	1	0	2	Alpha^{n} Green	Graphics Green	"		2		B	R	b		r	
0	0	1	1	3	Alpha^{n} Yellow	Graphics Yellow	£		3		C	S	c		s	
0	1	0	0	4	Alpha^{n} Blue	Graphics Blue	$		4		D	T	d		t	
0	1	0	1	5	Alpha^{n} Magenta	Graphics Magenta	%		5		E	U	e		u	
0	1	1	0	6	Alpha^{n} Cyan	Graphics Cyan	&		6		F	V	f		v	
0	1	1	1	7	Alpha^{n}[2] White	Graphics White	'		7		G	W	g		w	
1	0	0	0	8	Flash	Conceal Display	(		8		H	X	h		x	
1	0	0	1	9	Steady[2]	Contiguous[2] Graphics	)		9		I	Y	i		y	
1	0	1	0	10	End Box[2]	Separated Graphics	*		:		J	Z	j		z	
1	0	1	1	11	Start Box	ESC[1]	+		;		K	←	k		¼	
1	1	0	0	12	Normal[2] Height	Block[2] Background	,		<		L	½	l		‖	
1	1	0	1	13	Double Height	New Background	-		=		M	→	m		¾	
1	1	1	0	14	SO[1]	Hold Graphics	.		>		N	↑	n		÷	
1	1	1	1	15	SI[1]	Release[2] Graphics	/		?		O	#	o		■	

[1] These control characters are reserved for compatability with other data codes

[2] These control characters are presumed before each row begins

Codes may be referred to by their column and row e.g. 2/5 refers to %

Character rectangle

Block represents display colour

White represents background

Table 1. Teletext character codes. Notice the similarity to ASCII.

From Fig. 1, you will find that there are 360 bits (or 45 bytes) per row. All these bits (one row) are transmitted on one horizontal scan line during the vertical blanking interval. As shown in Fig. 2, lines 17, 18, 330, and 331 are used by the British in their 625-line television system. Since only two lines are transmitted per field, it takes 12 fields (6 frames) to send a page of text. To transmit 360 bits, a rate of 6.9 Mbits/sec is used. This raises compatibility questions for use in this country where we have different TV standards.

The decoder chip set functions in real time as the data is received. On each line, bit synchronization is achieved using the clock run-in, and then word synchronization is determined with the framing code. Next, the magazine and row address are grabbed and Hamming decoded. In the page header row, additional Hamming encoded data are processed. For the character bytes, the parity is checked and, if correct, the character bytes are loaded into display memory. During the display time, these characters are read out of memory and, using a color-character generator, are shown on the screen. The user specifies the desired page by punching data into the chip set via a small hand-held keyboard.

Viewdata: Telephone Systems

A similar service is possible using telephone line, two-way communications. Instead of serially broadcasting a fixed set of pages, the user asks for specific

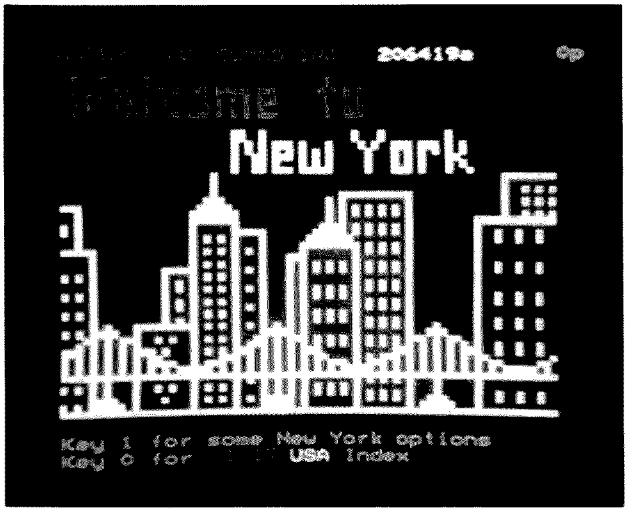

Photo D. Visiting New York? Check out some options for your stay.

pages from a large data base. In England, there are currently over 150,000 pages on their Prestel system. (See "The Ultimate Consumer Computer," by Derfler, *Kilobaud Microcomputing*, October, 1979.) The main difference from teletext is that only the pages you request are sent. This gives apparent immediate access to a very large amount of information.

The catch in using this system is a financial one. Since you are in direct communications with a computer, it is very easy to charge you for this information on a page-by-page basis. However, with each

MESSAGE BITS

b_8	b_7	b_6	b_5	b_4	b_3	b_2	b_1
0	0	0	1	0	1	0	1
0	0	0	0	0	0	1	0
0	1	0	0	1	0	0	1
0	1	0	1	1	1	1	0
0	1	1	0	0	1	0	0
0	1	1	1	0	0	1	1
0	0	1	1	1	0	0	0
0	0	1	0	1	1	1	1
1	1	0	1	0	0	0	0
1	1	0	0	0	1	1	1
1	0	0	0	1	1	0	0
1	0	0	1	1	0	1	1
1	0	1	0	0	0	0	1
1	0	1	1	0	1	1	0
1	1	1	1	1	1	0	1
1	1	1	0	1	0	1	0

HAMMING CODE BYTES

PROTECTION BITS

Table 2. Hamming protection of four-bit binary values.

user having a unique access code, there are also advantages such as the possibility of having a complete shop-from-home service. With so many pages of information, a user normally would refer to a guide to locate pages of interest, or it would be possible to step through menu pages, narrowing the topic as you go. This is described as a tree searching method, where you *branch* into more specific areas.

The hardware for teletext and viewdata is similar. In fact, viewdata adapters are based on teletext systems with the addition of a microprocessor and telephone modem. Basically, this doubles the cost of the integrated circuits (over a teletext only system).

Prestel: The British Viewdata System

In England, the British Post Office controls all communications for the country. This has helped considerably in allowing them to develop both teletext and viewdata systems with similar standards. From the user's point of view, the text display looks identical for both systems.

The actual communications is accomplished using FSK modulation. The computer sends the characters at 1200 baud (1300 Hz for binary 1 and 2100 Hz for binary 0). The user responds at 75 baud (390 Hz for 1 and 450 Hz for 0) when the keypad is punched.

The character set is the same as that previously described in Table 1, with some additional codes. Some of these codes are cursor controls, page deliminators, and other computer symbols. Since two-way interaction occurs in this system, the keypad requires a few more buttons than the one solely for teletext. Two of these are * and #. These are used as page deliminators. As an example, if page 123 is desired, you would enter *123# directly instead of continuing with branching from page to page.

One nice feature of this system is the automatic dialing of the computer's telephone number. All you need to do is push the viewdata button and the system in the TV does the rest; when the access procedure is completed, the system is ready for your first page request. Many variations on this theme are possible, including a completely automated system that would access data in the middle of the night when phone rates are the lowest and store the information on inexpensive audio cassettes.

Amateur Radio: Possible Applications

Now that I have described these consumer systems, you may be asking yourself how to apply the technology from these systems towards our hobby. In all honesty, I don't have the answer. Even as this is being written, new circuits are being developed which might be applicable for use in an amateur radio system.

In the tradition of amateur radio experimentation, I expect that some pioneers will devise a way to send these pages of information using the ham bands. A system similar to viewdata could be envisioned, since it uses audio bandwidth channels which we already possess. This might be implemented similarly to slow scan, where pages of information (and graphics) are sent instead of pictures. Hopefully, we all can learn quite a bit and have a good time doing it.

Since teletext and viewdata are not yet widely available in this country, getting information normally requires correspondence to Europe. However, there are two publications which I can suggest for those who are anxious to learn more.

"Consumer Text Display Systems (Teletext and Viewdata)," *IEEE Transactions on Consumer Electronics*, July, 1979, volume CE-25, number 3, is available for $15 from IEEE Service Center, 445 Hoes Lane, Piscataway NJ 08854, or from your local library. It is composed of two hundred pages of general articles on the various systems. For the most part, these are not written at a high technical level.

Multitext Technical Information is available for $5, check or money order, from Signetics Corp., Publication Services—Bin 027 MTB, 811 Arques Ave., PO Box 409, Sunnyvale CA 94086. It is a fifty-page brochure describing the Mullard (Signetics) teletext and viewdata chip set and system operation. There are 35 color photographs including many sample text pages. (Only a limited quantity of these brochures is available.)

I would like to thank Neal Williams for arranging the availability of the Multitext brochure and Merv Cox for his photographic work. Several figures were obtained from the *Broadcast Teletext Specification*, jointly published by the BBC, IBA, and BREMA.■

Double-Duty CW Keyboard

—helps you on receive as well as transmit

Robert C. Spindel K1GN
Box 169
North Falmouth MA 02556

Morse code keyboards are a popular station accessory, as witnessed by the numerous designs available.[1] The beautiful, rhythmic sound of near-perfect CW is easy to achieve with these units. Merely striking the keys on a typewriter-type keyboard produces perfectly formed Morse characters.

But sending flawless CW is only half the battle. You have to be able to copy it as well. And with the speed attainable with keyboard units, that means copying at higher rates.

This keyboard has a unique feature to help you receive code accurately so that you can keep up with your ability to send at high speeds. With the flip of a switch, the Morse keyboard becomes, voilà, a tireless instructor sending a continuous stream of random letters or five-letter code groups at any speed.

The Instructor-Keyboard is also the perfect device for giving new Novices code practice. Someone who does not know Morse can type to the neophyte, or he can use the Instruct mode to copy random letters. It allows practice at times when W1AW cannot be heard or when a receiver is not available. Since it sends letters randomly, there is no danger of the memorizing of practice material which often limits the usefulness of tapes and records. Needless to say, its utility is not restricted to beginners. A little time spent copying high-speed, random code groups should have you copying W1NJM's transmissions with ease.[2] Switch to the Keyer mode, and you can send at that speed, too.

Although available keyboard designs differ in detail of execution—some employ scanned keyboards while others use diode matrices, some have character buffers and some have message memories—they all operate in the same fundamental way. A single switch closure is used to produce a logic signal. A separate switch is provided for each desired character (letter, number, punctua-

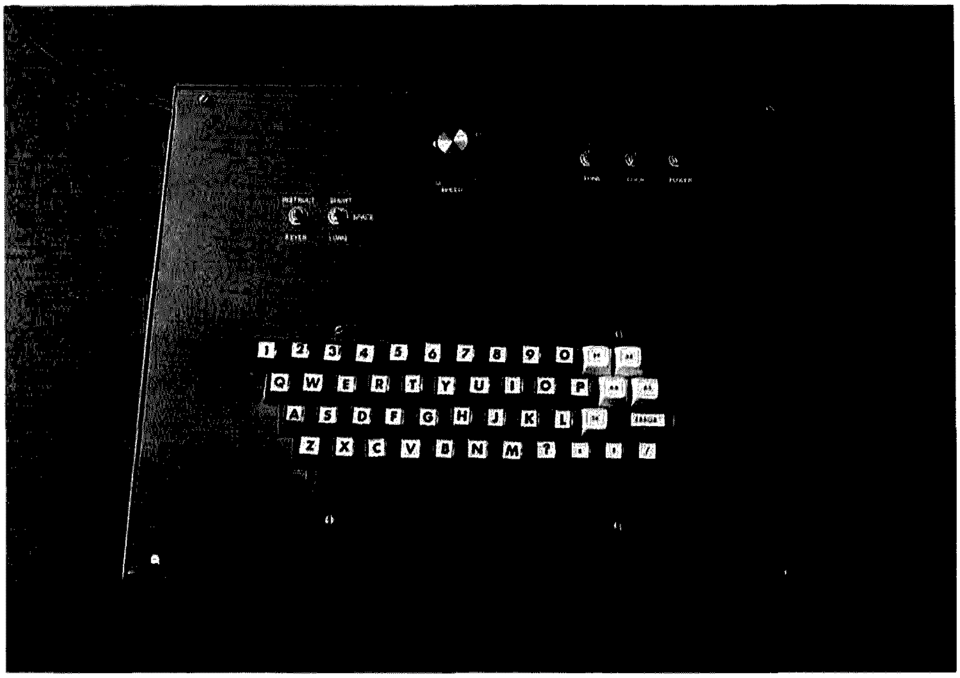

Photo A. The Instructor-Keyboard is built in a homemade case. The front panel is made of galvanized sheet metal painted with spray enamel. The keyboard keys have been relabeled with transfer letters. To the left are the Instruct/Keyer and Space switches; the speed control is in the upper center; to the right are the Tune, Sidetone on-off, and Power on-off switches.

tion, or special symbol such as $\overline{AA}$, $\overline{AS}$, $\overline{AR}$, $\overline{BT}$, etc.), and the switches are arranged in a standard typewriter format. The operator strikes a series of keys to generate a sequence of characters. The resulting logic signal is used to key a transmitter, FSK converter, sidetone oscillator, or other device. This keyboard uses a diode matrix to encode switch closures into logic signals, and in the Instruct mode it uses hard-wired CMOS digital logic elements to simulate switch closures in a random manner. Thus, the logic replaces the action of the keyboard. In fact, as will be pointed out below, it is quite simple to build the Instructor without the Keyboard, thereby yielding a simple code-practice machine.

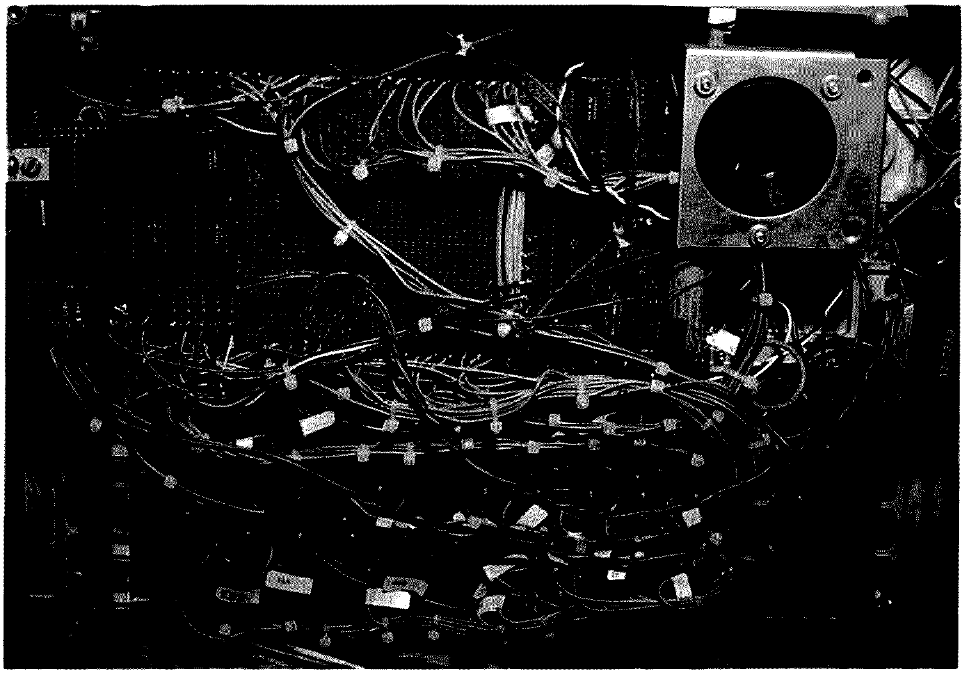

Photo B. Perfboard and wire-wrap sockets are used for the two electronic boards. The diode matrix and keyer are on the lower board. The Instructor electronics are on the smaller board on the left, partially obscuring the diode matrix.

Circuit Features

The Instructor-Keyboard has been designed without unnecessary frills. It is capable of sending all letters, digits from 0 to 9, common punctuation, and special symbols $\overline{AR}$, $\overline{SK}$, $\overline{BT}$, $\overline{AA}$, and $\overline{AS}$. It has two-key rollover, which means that a second key can be depressed while the first is held down and, provided the first is released, two successive characters will be sent with perfect inter-character spacing. Holding a single key down will cause that character to be sent repetitively, again with perfect spacing.

The keyboard is completely debounced so that only a single character is sent when a key is struck even though the switches themselves may bounce open and closed for several milliseconds after being struck. Furthermore, the Instructor-Keyboard is constructed from readily-available and inexpensive components. A perusal of the back pages of *73* indicates that the CMOS logic elements should cost less than $15 to $20. Keyboards are available from a number of surplus dealers at reasonable cost.

The digital logic for both Keyboard and Instructor is all CMOS, selected for its tolerance to power-supply variations and its high immunity to electronic noise. I have not observed any rf interference with the operation of the Keyboard even in the presence of my 1-kW linear amplifier.

There are three main subsections in the Instructor-Keyboard. The first is a diode matrix for encoding a switch closure into a unique digital signal representative of the desired character. This is fed to the second subsection, the digital keyer logic, that converts it into appropriate dots and dashes. The third subsection is the Instructor itself. It automatically generates digital signals identical to those created by switch closures so that letters are sent without striking keys. They are also sent without the need for a diode matrix so that an Instructor can be built without the keyboard-matrix combination. By the same token, the unit can be constructed without the Instructor electronics and used as a conventional keyboard.

In the Instruct mode, three spacing options are provided. The Instructor-Keyboard can be set to issue a continuous stream of random letters with the proper three-element intercharacter spacing. Alternatively, random five-letter code groups can be sent with either a long or short pause between groups. Letter spacing within groups is always precisely correct for the speed being sent.

As described below, the Instructor sends only letters. It was felt that sending letters only provided a cost-effective realization of an automatic Morse code generator easily adaptable to many existing keyboards. The unit can be altered to allow automatic generation of numbers and punctuation in the Instruct mode at the expense of an increased parts count.

The Diode Matrix

All characters are encoded into an eight-bit digital word by the diode matrix. The coding scheme is the same as that used by Bryant W4UX and Horowitz W1HFA. A diode is used for each dash, no diode for a dot, and a final diode to signify the end of the character. Diodes are used for dashes because there are fewer dashes than dots in Morse code, thus reducing the number of diodes needed. The first few letters and numbers are wired as shown in Fig. 1. The remaining pattern of diodes should be obvious if it is kept in mind that a diode is wired in place for a dash and also to terminate the character.

The bits in the code word are labeled B1 through B8. Note that with no keys depressed, all bit lines are held high (+12 volts) by a single 10k pull-up resistor on each bit line. Depressing a key (closing a switch) causes only those bit lines connected to the switch by di-

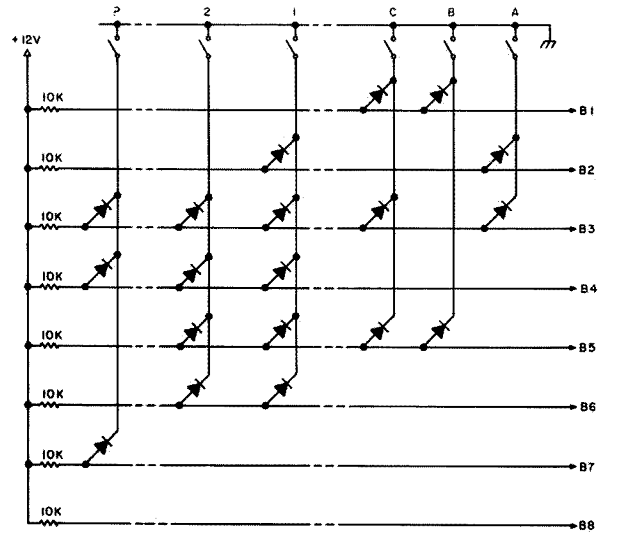

Fig. 1. Wiring diagram for diode matrix. All diodes are general-purpose switching diodes such as 1N914s. If constructed as an Instructor only, diodes are not needed, but the 10k pull-up resistors should be connected to all bit lines.

odes to be forced to ground (0 volts). Thus, the pattern of bits appearing on B1 through B8 for the letter A will be 10011111 where we have used a 1 to denote a high voltage level and a 0 to denote a low, or zero, level. Depressing the B key will create the pattern 01110111, and a question mark will be 11001101. These are the unique digital codes that the keyer portion of the unit translates into appropriate dots and dashes. Incidentally, these are the codes that the Instructor portion of the unit also must simulate.

The Keyer

The heart of the keyer consists of an 8-bit parallel-to-serial (P/S) shift register, IC9, dot-dash generator flip-flops IC7a and IC7b, and an end-of-character recognizer, IC6. Additional logic is used to debounce the keyboard and to insert a proper space between characters. This space is exactly three code elements long (a dot is two elements long) as required in Morse code. A dash is four elements long (three on and one off). Interword spacing is seven elements in length.

Detailed operation of the keyer logic can be deduced from one of the excellent manufacturer's data books on CMOS logic. The following is a brief explanation of the general sequence of events that occurs after a key is closed.

The bit pattern, or code produced by the diode matrix, is inverted by IC5 and part of IC1 so that the letter A becomes, for example, 01100000. The shift register accepts this code on its 8 input lines and immediately transfers it to its output lines if the P/S line is high and if the A Enable (AE) line is high. When AE is low, the input lines are disabled and information present on them is ignored. This feature is used to debounce the keyboard. Now, when the P/S line is low, input data is ignored similarly, but the register is converted to its serial mode. Data stored in the register then can be clocked out by pulses applied to the CLK input.

Each positive transition of the clock signal transfers the bit pattern one step through the register. Bits at the top (IC9-1) "fall out," while the empty spaces at the bottom of the register are filled with whatever signal is present on the serial-input (SI) line. Since this pin is grounded, as the bits are shifted through the register they are replaced by zeros at the bottom. The bit present on IC9-1 turns the dash flip-flop on and off depending on whether it is high or low, respectively. Meanwhile, IC6 constantly monitors the status of the output lines of the register in order to detect an end-of-character condition. When an end-of-character occurs, the lines monitored by IC6 are all low, its output goes high, thus terminating keyboard output through IC1 and IC3b. At this time, IC9-1 will be high since a diode has been inserted at the end of each character. One more clock cycle makes this low and IC3a turns the shift register back into its parallel mode allowing it to accept a new code word, the next character. This extra clock cycle ensures that there will be a three-element space between successive characters.

Note that in its idle state the keyer logic has the code word 00000000 on the output lines of IC9. The inputs to IC6 are low; its output is therefore high. Upon striking a key, at least one of the bits at the output of IC9 goes high so that the output of IC6 goes immediately low. This triggers the one-shot, IC4, and it responds with a 2-ms pulse which is applied to the AE input of IC9. It has the effect of disabling the input lines of the register for sufficient time to allow all contact bounce to subside.

The keyer clock is a simple oscillator made of two CMOS inverters. With the parts values shown, the speed is adjustable from about 5 to 50 wpm. Variation of speed in either direction can be achieved by changing the value of the 10k resistor or the 1-uF capacitor. The sidetone oscillator also is constructed with two inverters, and gives an approximate 700-Hz tone. The output of the sidetone oscillator is gated on and off by the keyer through IC3c and is then applied to Q1. Q2 drives a small relay to key a transmitter. S1 closes the relay for tune-up purposes. If desired, a solid-state keying circuit can be substituted for the relay; a reed relay, however, is fast enough to follow 60-wpm keying and allows the keyboard to be used with virtually any transmitter. To prevent relay sticking with those transmitter keying circuits that draw more than a few milliamps, it often is a good idea to place a 20- to 50-Ohm resistor in series with the output line.

The Instructor

A careful examination of the digital code words produced by the diode matrix for the 26 letters of the alphabet indicates that they use only bits B1 through B5. These five bits allow 32 combinations of zeros and ones. Now, a five-bit binary counter will count sequentially from 0 to 31 and in the course of doing so will present at its output every one of the 32 possible bit combinations. If we devise circuitry to select only the 26 output states corresponding to the letter codes, and then apply the output of the counter to the B1 through B5 input lines of the keyer, the counter will effectively act as a substitute for the keyboard and diode matrix. If the counter is clocked slowly, the keyer will generate a sequence of letters corresponding to the bit codes at the output of the counter and will repeat this sequence ad infinitum.

In order to generate letters in a random sequence with no repetitions, binary counter IC9 is clocked at a frequency that is high compared to keying speeds.

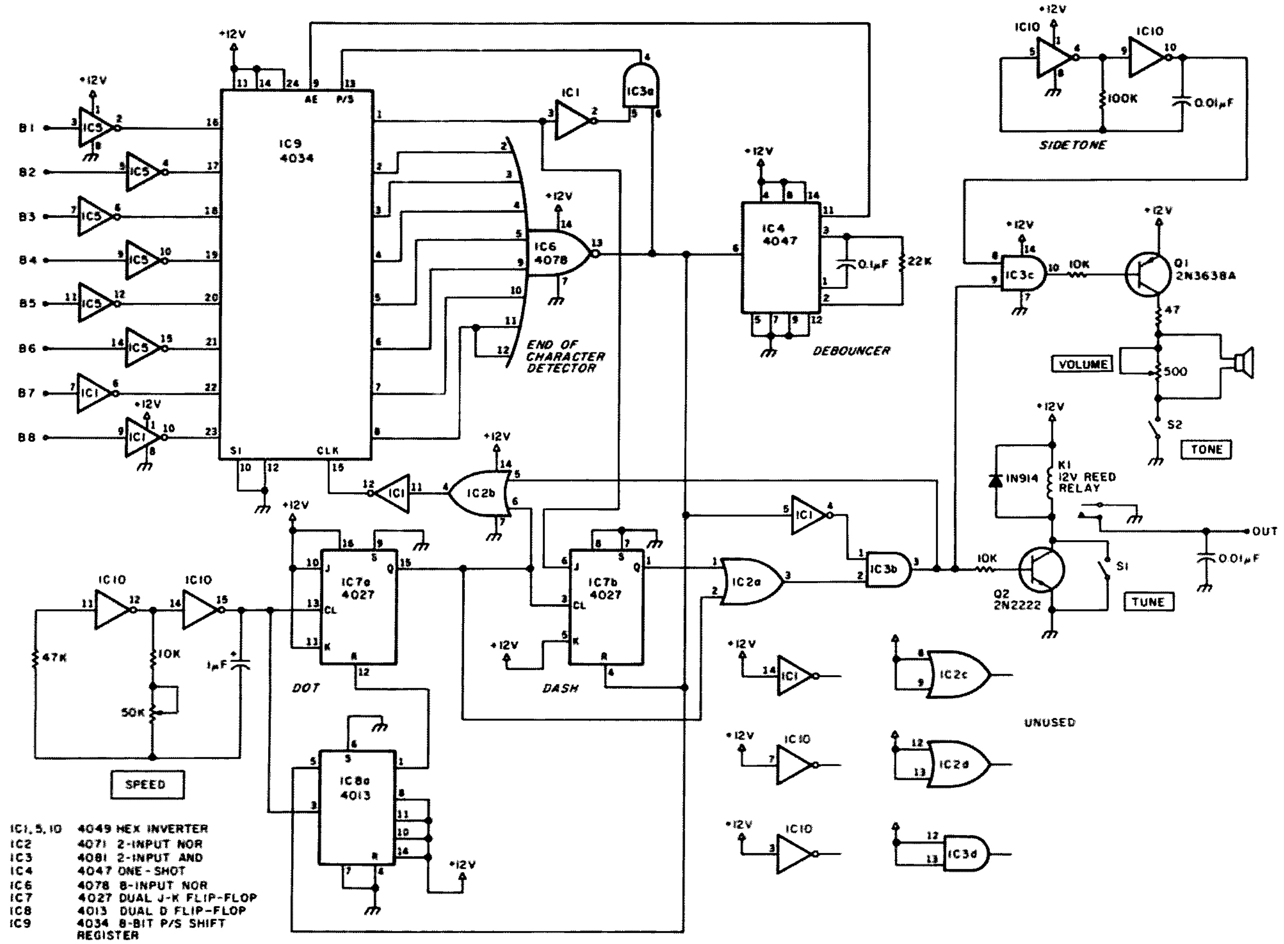

Fig. 2. The keyer subsection uses CMOS integrated circuits. All unused CMOS gate inputs are tied to 12 volts as recommended by the manufacturer. Q1 and Q2 are general-purpose transistors, and many substitutions will work.

NOR gates IC6a and IC6b are wired as inverters to form a CMOS oscillator running at about 700 Hz (60 wpm corresponds to about 25 Hz). Thus, a new bit code appears at the output of the counter every 1/700 of a second.

The keyer logic responds to whatever code is presented to it, generates the appropriate letter, and returns to its ready state. Because the generation of the letter is slow compared with the speed of the counter, the counter has counted from 0 to 31 many times during the time it takes for a letter to emanate from the keyer. The code present at the input of the keyer upon completion of the letter will therefore be a function of the letter length, the frequency of the counter oscillator, and the frequency of the keyer oscillator. Since these are unrelated quantities, the bit code present at the counter output when the keyer is ready to generate a new letter will be independent of the bit code of the previously generated letter. Thus, random letters are generated.

Only 26 of the 32 possible counter states represent valid letters. Rather than detect these 26 states, we detect only the 6 states that are invalid and disable the Instructor output if one of these should occur. In fact, we need detect only 5 illegal states since the state 11111 corresponds to the condition of the keyer with no keys depressed and no output will ensue. Logic gates IC2, IC3, IC4, and IC1a and IC1b comprise the unwanted-state detector. The output of IC2d goes high whenever one of the forbidden states occurs. This high is passed through IC6a and IC6b and holds the register, composed of D-type flip-flops IC10A, IC11, and IC12, in a set mode. That is, the output lines of the register are held high (11111), which is equivalent to having no keys depressed. No letter is generated. For all other combinations of B1 through B5, a letter is sent. There is no apparent pause in the output of the Instructor since new combinations of bits are created every 1/700 second.

Switch S1 in Fig. 3 allows the Instructor to be turned off by holding the register in a continuously high, or set, mode. The keyer may then be activated by the keyboard and diode matrix. When S1 is grounded, the Instructor sends random letters in a continuous sequence. In its middle position, S1 is connected to the output of one-shot IC7. IC8 is wired as a four-bit counter that is clocked by the P/S line of the keyer. Since the P/S line goes from low to high after the generation of each letter, IC8 is clocked one count. When four letters are counted, the one-shot is triggered and its output goes high for a period of time determined by R1, R2, and C1. This high disables the D flip-flop register by setting it. The fifth letter is completed, but a new one is not generated until IC7 goes low. This period of silence can be made long, short, or nonexistent depending upon the position

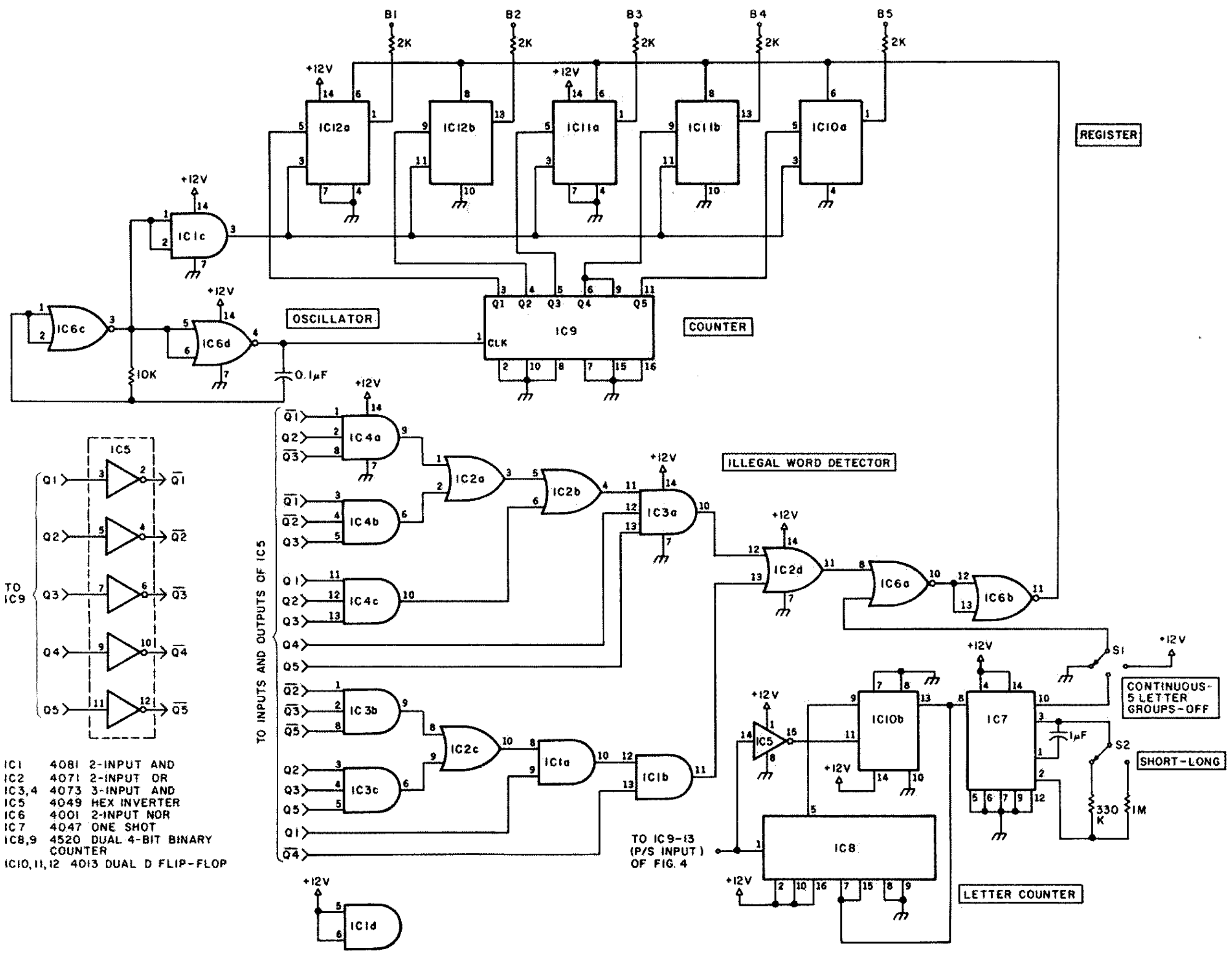

Fig. 3. The electronics of the Instructor. Not all connections are shown to avoid confusion in the diagram. All points labeled Q1 to Q5 are connected together. Similarly, all those labeled $\overline{Q1}$ to $\overline{Q5}$ are connected together. All unused CMOS gates are tied to 12 volts.

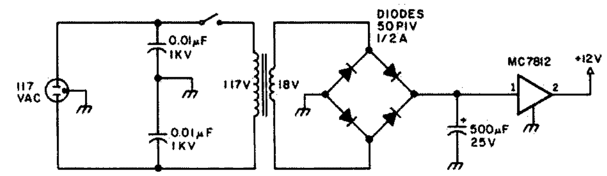

Fig. 4. The power supply is not critical, and any voltage from 5 to 12 will work.

of S2.

Construction

Parts placement and inter-component wiring are not at all critical. I prefer to use wire-wrap techniques for digital logic circuits because it is fast and reliable. All the wiring can be completed in an evening or two. Care should be exercised in construction of the diode matrix, if it is included. With so many diodes, it is easy to make an error. However, troubleshooting, if required, can be accomplished with simple equipment. A voltmeter will indicate high or low states or an LED driven by a transistor will serve the same purpose. One of these simple tools will allow diagnosis of almost any possible problem.

The power supply is not critical. I chose to use a 12-volt regulator (Fig. 4), but anything from 5 to 12 volts will work and regulation is not necessary. It is a good idea, though, to filter the power supply adequately. Oscillators like the keyer clock have a tendency to synchronize with power supply ripple. If this occurs, speeds will appear to jump from one to another as the speed control is rotated, rather than to vary smoothly.

Variations

The Instructor portion of the circuitry can be used as is with many existing keyboards, and can be adapted simply for use with others. If the coding scheme in your keyboard uses diodes for dashes and character termination and operates from 5 to 12 volts, just connect the Instructor directly to it. If you can identify a portion of your keyboard logic that produces a low-to-high transition after each letter, connect it to IC8-1. If you cannot find such a point, leave out IC7, IC8, and IC10b. Then switch S1 to ground for continuous letter generation or to 12 volts for resumption of normal keyboard operation.

With keyboards that use other coding schemes, the illegal-logic-state detector must be modified. This should not prove to be difficult once it is understood exactly how the detector works. If, for example, your existing keyboard uses diodes for dots instead of dashes, simply reverse all $\overline{Q1}$ to $\overline{Q5}$ and Q1 to Q5 leads. Other coding

schemes will require similar simple changes.

As mentioned above, the Instructor-Keyboard also can be constructed without the keyboard or diode matrix and used as an Instructor alone. Simply construct keyer and instructor electronics as shown in the figures and attach 10k pull-up resistors to lines B1 to B8 of Fig. 2.

Numbers and punctuation can be added to the Instructor's vocabulary, if desired. However, this will require the addition of extensive detection circuitry to eliminate unwanted codes. In order to accommodate these additional characters, a total of 8 bits in a code word is needed. There are 256 combinations of zeros and ones in an 8-bit word, but the Instructor uses only a small number of them. Thirty-six are needed for letters and numbers. Adding a comma, question mark, and period gives 39; special symbols will add a few more. In this case, we would have to detect 217 illegal words (ignoring special symbols which are not really needed for practice). It would undoubtedly be easier to detect the 39 legal ones, allow them to be passed through the register to the keyer, and reject all the rest. To do this, one simply would invert the output of the detector logic at IC6b. IC9 would have to be wired as a full 8-bit counter and two more D flip-flops would have to be added to the register. ■

References

1. Bryant, "Touchcoder II," *QST*, July, 1969; Horowitz, "Compucoder," *QST*, June, 1975; Crom, "This Station Plays Beautiful CW," *73*, March, 1979; Helfrick, "An Inexpensive Morse Keyboard," *QST*, January, 1978. These articles contain additional references.
2. Hart, "High Speed CW, Anyone?" *QST*, June, 1979.

Sixteen Channels of Digital Delight

—do-it-yourself data acquisition

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1498 Holland Street
Melbourne FL 32935

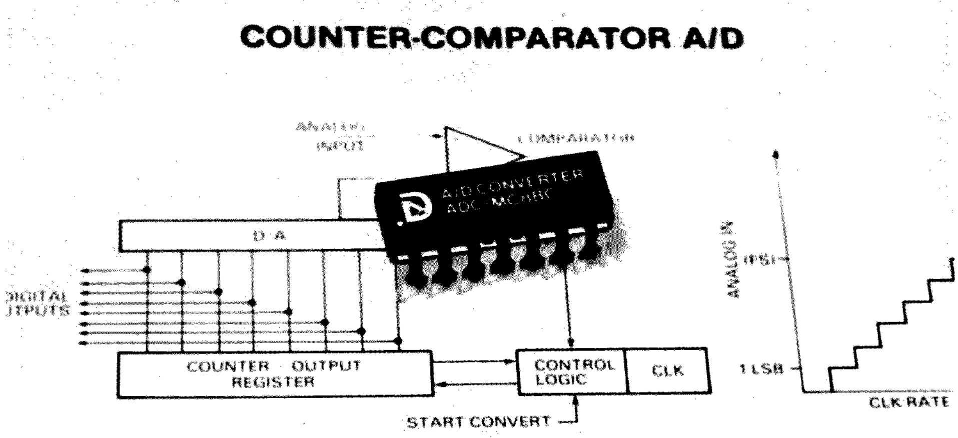

Photo A. A good, low-cost 8-bit A/D made by Datel. Its output coding is in binary, it runs off 5 volts, and it has a conversion time of only 500 µs. Its current selling price is about $8.00. (Photo courtesy of Datel)

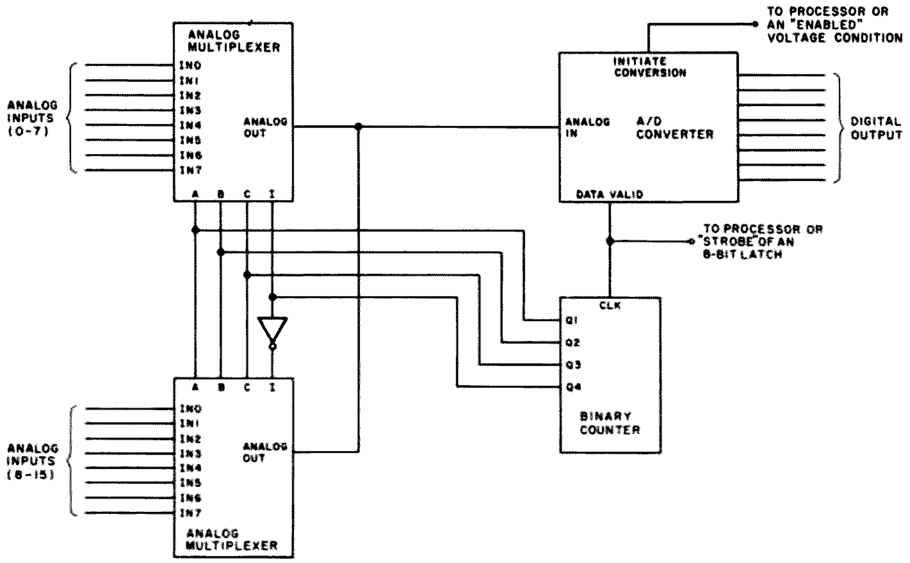

Fig. 1. A block diagram of a complete 16-channel DAS that you can build with almost any A/D converter on the market today.

In my last article on A/D conversion (November, 1980), I covered some theory to help you understand the principles. Now we'll put that knowledge to work and build a complete 16-channel Data Acquisition System (DAS—a 16-channel A/D converter).

Background

A portion of my last article dealt with the process of choosing the right A/D for a specific function. The gist of that section was that there are literally hundreds of A/D converters on the market today, and choosing the right one for your needs could be quite a difficult process if you don't know what to look for. The average hobbyist just does not need extreme accuracy or extremely fast conversion times. He is looking for an A/D which: (1) runs on common supply voltages, (2) covers the needed analog input range, and (3) has a digital output which is compatible with his interface circuitry.

There are quite a few low-cost A/D converters on the market which should satisfy most any hobbyist (see Photos A and B). But

the purpose of this article is to show you how you can use that A/D to build a complete 16-channel DAS.

What is a DAS?

We know from my previous article that an A/D takes a single analog voltage and converts it to digital form. There are a lot of different conversion processes possible and a few different digital-coding techniques utilized in various A/D converters, but the end result is always the same—some kind of digital word representing the analog voltage level present at the A/D's input. This is just fine, but what if there were several different analog voltages which we wanted to digitize? Of course, if we had 16 different analog voltage levels to measure, we could go out and buy 16 A/D converters and wire

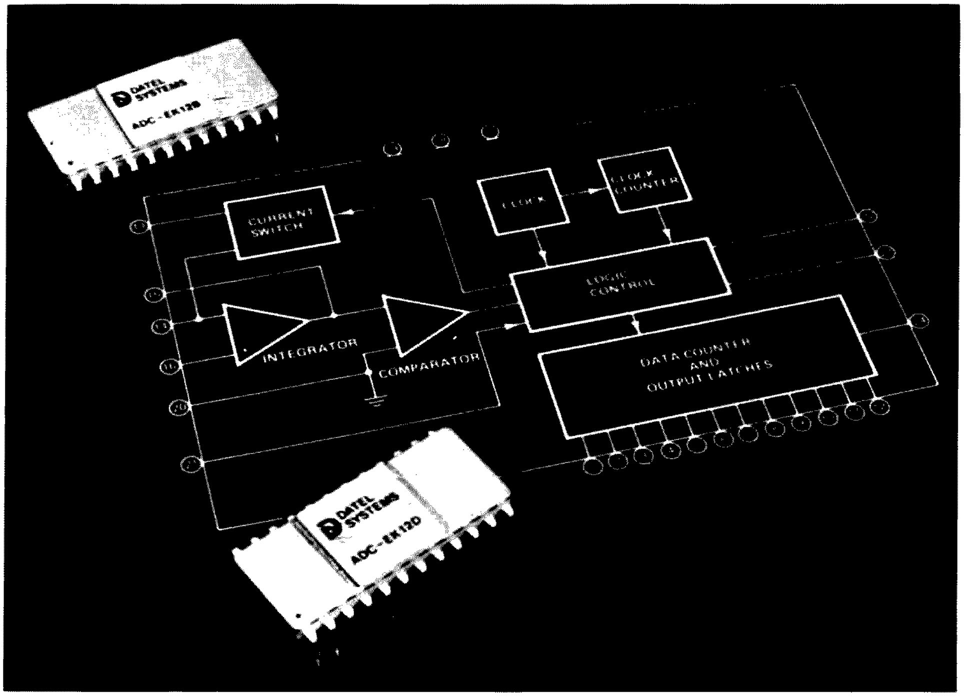

Photo B. Another Datel device which is a bit more expensive ($34.00). It is a 12-bit binary or 3½-digit BCD coded A/D converter, and it runs off ±5 volts and has a 20-ms conversion time. (Photo courtesy of Datel)

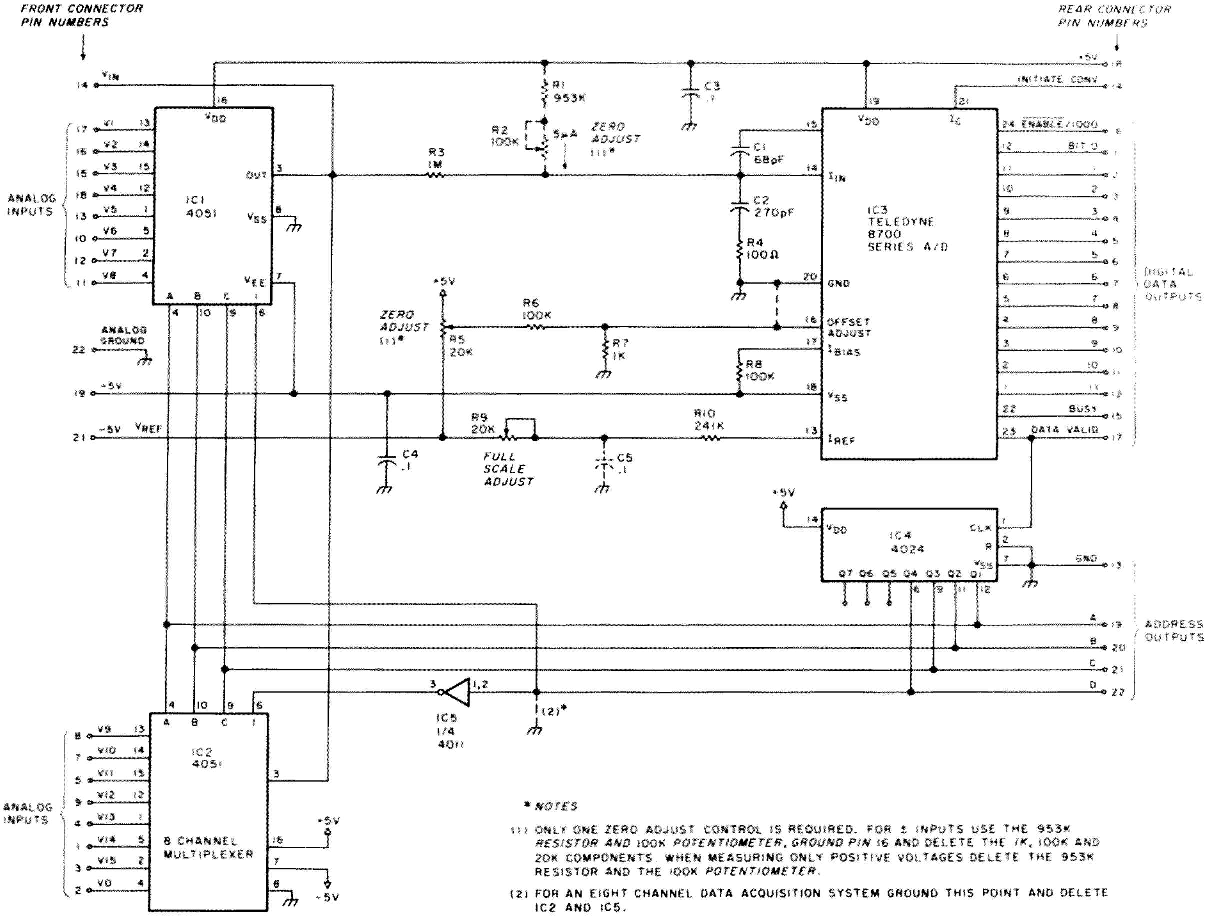

Fig. 2. The complete schematic for the 16-channel DAS utilizing the Teledyne 8700 series of A/D converters.

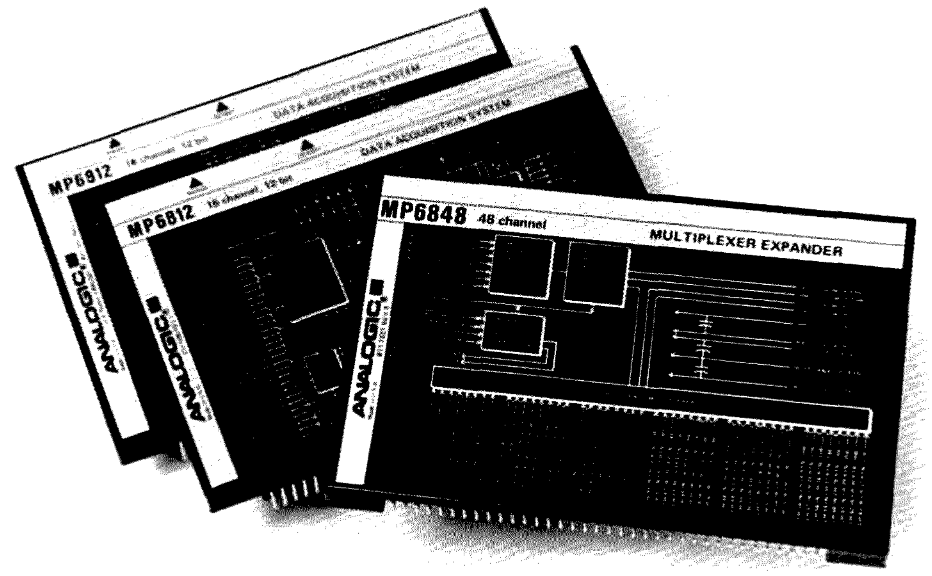

Photo C. This is what the big boys use for a 16-channel Data Acquisition System. The MP6812 can be had for a mere $200.00. (Photo courtesy of Analogic)

them up in a maze of confusion. But if you're anything like me, you don't have the time or the money to throw away on such a huge project. You could, however (with a minimum of time, effort, and money), build the complete 16-channel DAS described in this article.

Fig. 1 is a block diagram of one possible candidate for a complete DAS. Basically, all we need to add to our A/D is a counter, two 8-channel multiplexers, and possibly some chip-select circuitry for the analog multiplexers. With the addition of this minimal amount of circuitry, we now can look at 16 different analog voltages without the maze of confusion mentioned above.

The operation of the DAS is really very simple. Let's assume an initial starting point for the DAS with the counter set to binary zero. In this state, the address inputs to each analog multiplexer will also be at binary zero and the chip-select line will choose only one of the multiplexers to be active. Thus, the analog voltage at switch address zero will be connected to the A/D and the conversion process will begin. When the A/D has converted the analog voltage to digital form, it outputs a pulse from "Data Valid" to clock the counter and to let the output circuitry know that the digital data at the output of the A/D is ready for use.

When the counter is clocked, it is incremented to binary 0001, and the analog voltage at switch one is now connected to the A/D for conversion. Again, the A/D performs the conversion process and outputs a pulse when it is finished, and, in this manner, all 16 analog voltages are converted to digital form in a multiplexed fashion until you tell it to stop. Another variation to this approach would be to get rid of the counter and to address the analog multiplexers directly with a microcomputer or thumbwheel switches. Therefore, any one analog channel could be accessed directly at any time and for any length of time you wish, without having to cycle through all 16 channels.

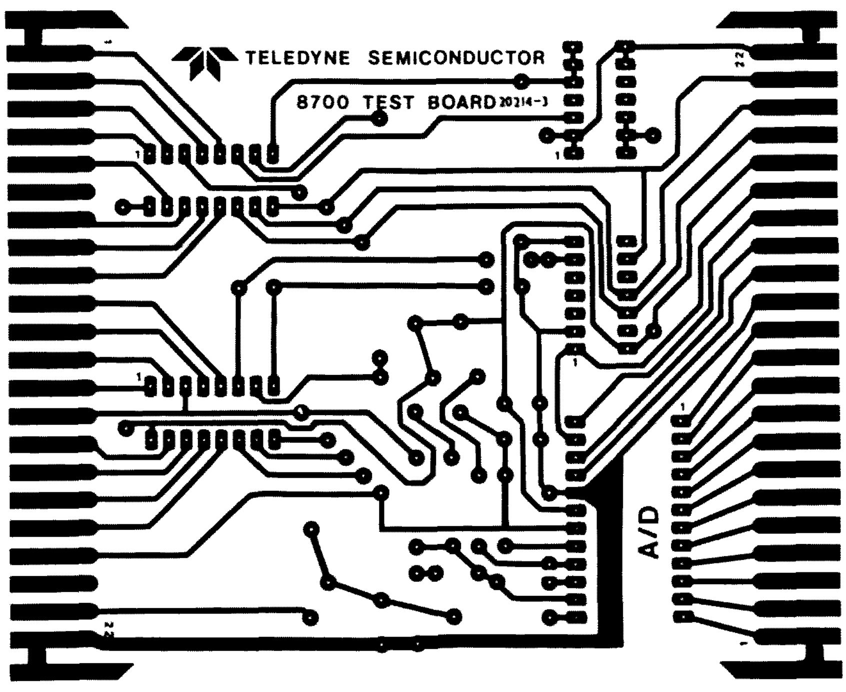

Fig. 3. The PC board foil pattern for the schematic of Fig. 2. The pattern is shown from the foil side.

Building the DAS

Fig. 2 is a complete schematic of a 16-channel DAS utilizing the Teledyne 8700 series of A/D converters.[1] The 8700, 8701, and 8702 are 8-, 10-, and 12-bit monolithic CMOS analog-to-digital converters, respectively, in a 24-pin DIP. Output coding is in binary, and its conversion time is fast enough for our purposes (1.8 ms for 8 bits). Its operation is exactly

as was explained for the block diagram in Fig. 1, so no other explanation should be necessary.

Figs. 3, 4, and 5 (which were graciously supplied by Michael Paiva, A/D Product Manager at Teledyne Semiconductor) show the foil pattern, pinout, and component layout for a single-sided PC board of the complete 16-channel DAS shown in Fig. 2.

For those of you who do not wish to make your own PC board, it is available directly from Teledyne or any of their distributors for \$5.00. Just ask for the 8700 Test Board. Of course, a PC board makes things nice and neat, but you can build your own through wire-wrapping or direct wiring.

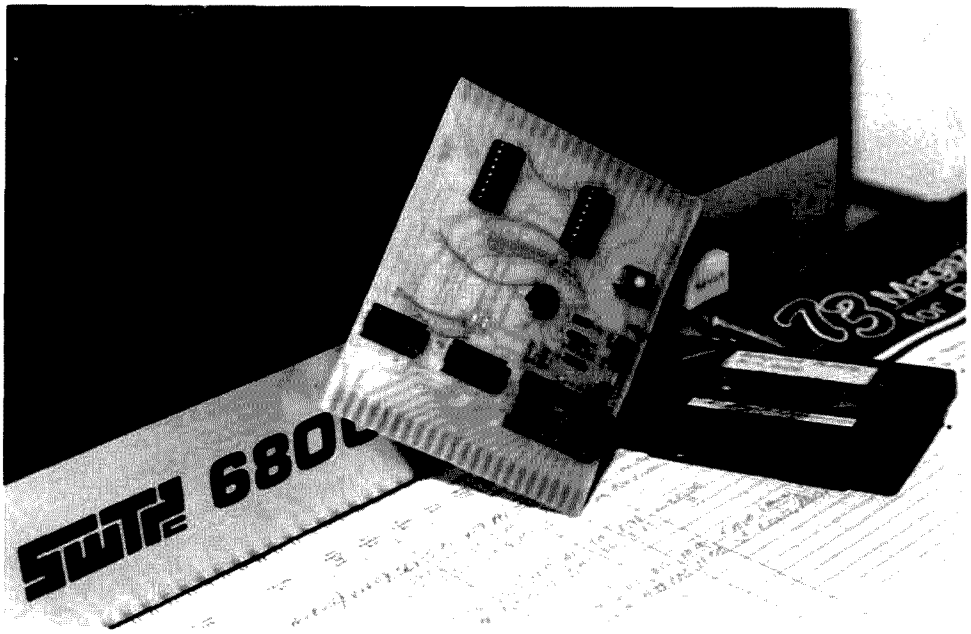

Photo D. Our finished product is propped up against my computer system.

In the Parts List for the DAS, some components are marked with an asterisk. These are somewhat critical. The stability of the system is directly affected by the stability of these components. For standard hobby use, however, some substitutions could be made. For example, if an 8-bit A/D is used at room temperature, then 5% carbon resistors could be used in place of the 1% resistors because the resolution of an 8-bit A/D is only 0.4%. With a 12-bit A/D, however, these components will be very critical if full 12-bit accuracy is needed.

Following are a few suggestions that you may want to consider before building your DAS:

First, as in any project handling both digital and analog signals, keep analog signals as far away from digital signals as possible. To avoid ground loops, isolate the analog ground from the digital ground by using the system ground as the only common point between the two. Use adequate bypassing of supply voltages and, finally, make sure your reference voltage, V_{ref}, is as stable as you can make it. For example, an 8-bit A/D should require

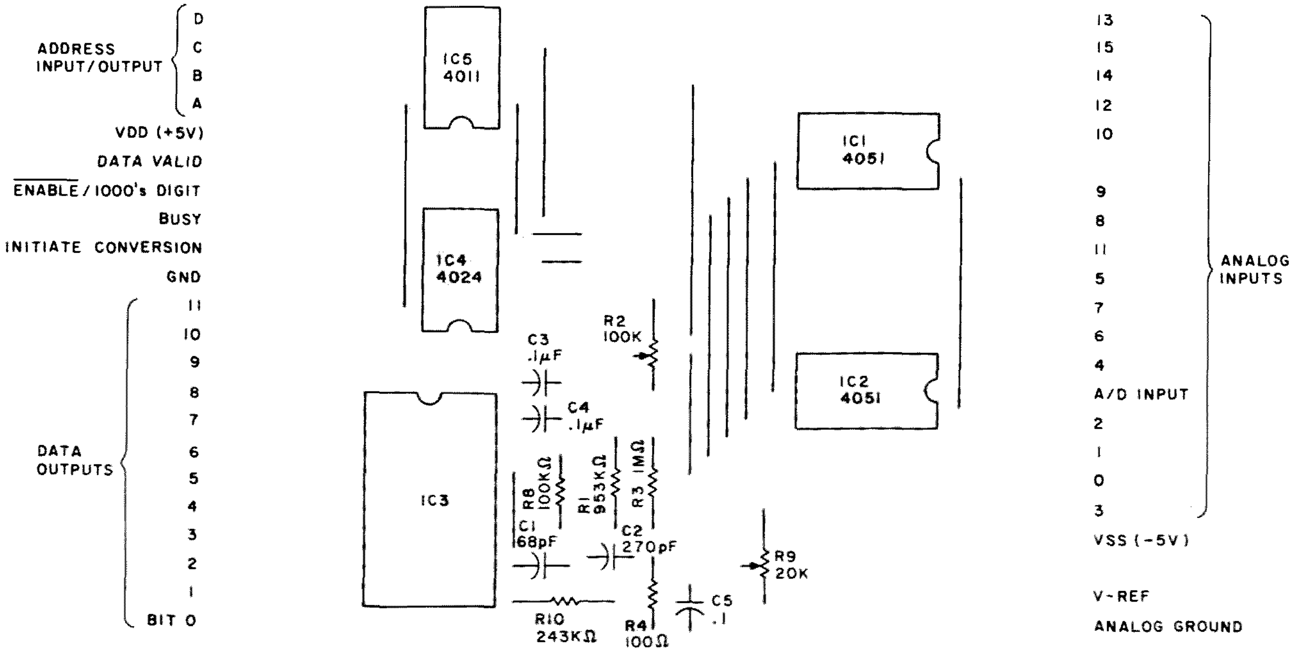

Fig. 4. Component layout and edge connector pin assignments. Look carefully for all jumpers.

Parts List

	Part Number	Description
IC1, IC2	4051	CMOS—8-channel analog switch
IC3	8700 type	CMOS—Teledyne A/D converter
IC4	4024	CMOS—7-bit binary counter
IC5	4011	CMOS—quad 2-input NAND gate
C1	68 pF ± 10%	Low leakage mica, ceramic, etc.
C2	270 pF ± 20%	Ceramic, mica, etc.
C3, C4, C5	0.1 μF ± 20%	Ceramic, mylar, electrolytic, tantalum, etc.
R1	*953k ± 1%	Carbon, carbon film, metal film, etc.
R2	*100k ± 10%	Trimmer resistor
R3	*1 megohm ± 1%	Carbon, carbon film, metal film, etc.
R4	100Ω ± 10%	Carbon resistor
R5	20k ± 10%	Trimmer resistor
R6	100k ± 5%	Carbon resistor
R7	1k ± 5%	Carbon resistor
R8	100k ± 10%	Carbon resistor
R9	*20k ± 10%	Trimmer resistor
R10	*243k ± 1%	Carbon, carbon film, metal film, etc.

*See text.

0.04% voltage regulation (one-tenth of its resolution). Photo D shows my completed DAS in front of my computer system. ■

Reference

1. Teledyne Semiconductor, AN-9, "Applications of the 8700 Series of CMOS A/D Converters."

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A Computer-Controlled Talking Repeater

—part III: interfacing to the microcomputer

The first two parts of this article provided an overview of the project and microcomputer hardware and software nucleus details. This final part describes interfacing of various peripheral circuits to the microcomputer.

Speech Synthesizer

The most distinctive characteristic of the repeater is its voice, provided by Telesensory Systems' S2B and S2C Mini Speech Synthesis PC boards. Each board has a vocabulary of 64 words. The S2C contains the ASCII character set and the S2B provides 64 additional words such as ten, eleven, twenty, thirty, hundred, clear, Hertz, and other useful radio-type words. The speech synthesizer is used for IDing the repeater, reading back commands, and for reading out signal strength and frequency error measurements. The boards are perfect for countless other microcomputer-based applications including remote bases, home remote-control systems, and speech-response terminals.

Each board is about 3" by 3" with a 20-pin connector on one end. They contain a 40-pin LSI synthesizer chip, 24-pin ROMs containing the vocabulary, and a couple of resistors and capacitors. The internal clock frequency is controlled by an RC network, but if desired, the board can be driven by an external clock for more precise pitch control.

To generate speech, a six-bit binary code representing the desired word is applied to the board and the start input is pulsed. The busy output signal goes low, remaining low until the word is complete. The code for the next word can then

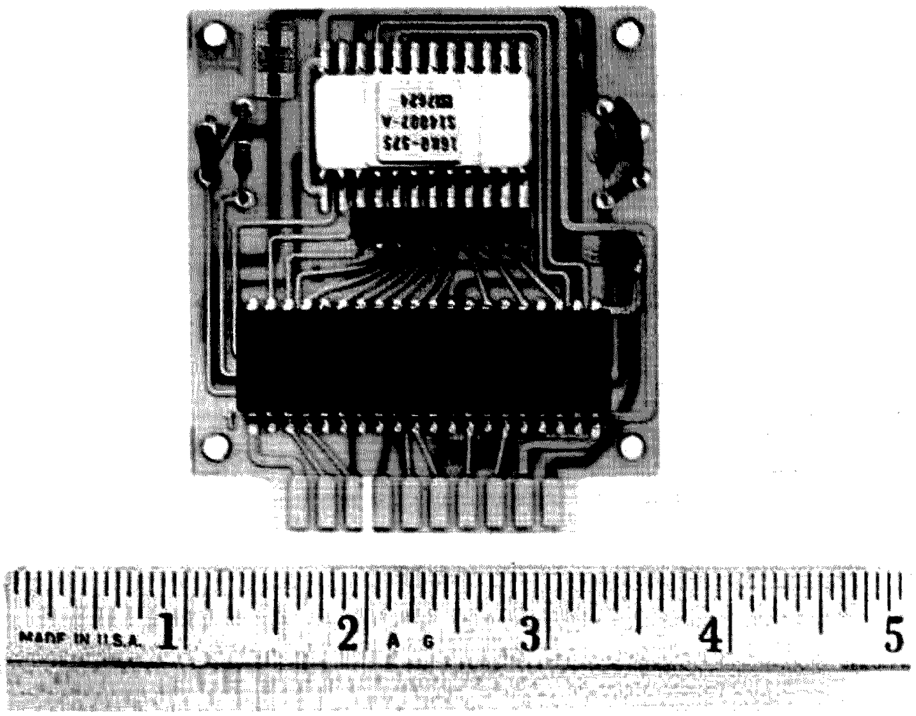

Photo A. Telesensory Systems speech synthesizer board.

be applied, the start input pulsed, etc. It couldn't be easier!

The Telesensory speech synthesizers are fundamentally different from synthesizers that have been available for hobby computers. Control requires only presenting the six-bit representation of the word desired. Other synthesizers require a complex construction of commands for each word, and it becomes a game to understand what the machine actually said. Such systems are really toys—not tools. If only a limited vocabulary is required, the Telesensory boards are the perfect solution. The voice sounds authoritative, rather than friendly like the voice of the TI Speak and Spell™, and is more intelligible and punches through any background noise.

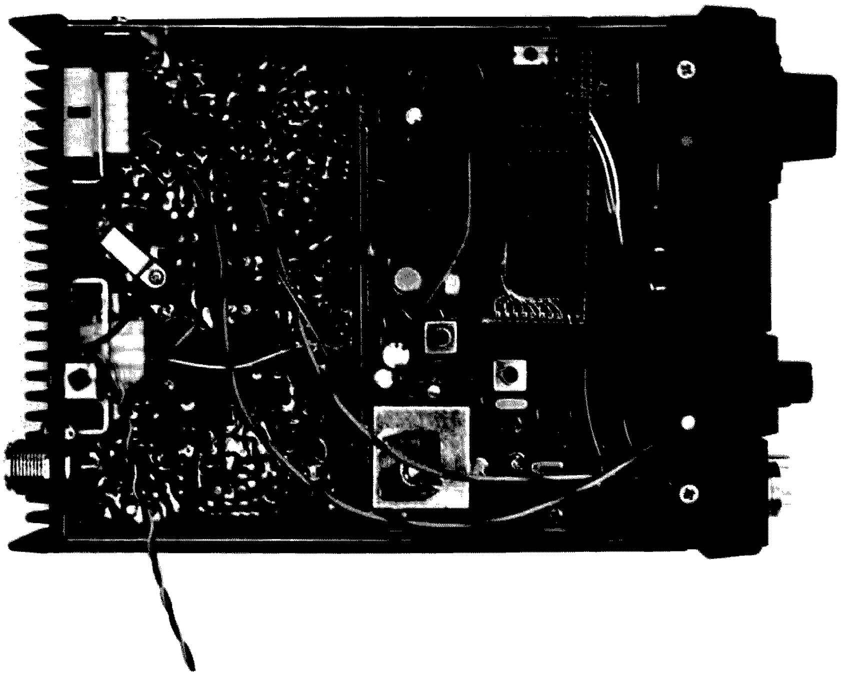

Photo B. IC-22S with interface board plugged into old diode programming board location. Molex connector on back carries all the signals.

Synthesizer Hardware Interface

The pitch of the speech output normally is determined by the board's RC oscillator circuit. By removing the resistor and capacitor, an external clock signal can be used to eliminate the possibility of frequency drift with time or temperature and to precisely match the pitch of the two boards. The clock signal is generated by a programmable counter/timer on the Pragmatic Designs CPU-1A microcomputer board, dividing the CPU's crystal-controlled clock frequency to 24 kHz.

The six-bit word-select code for both boards is provided by the computer's DACPORT output port, and the individual start strobes are provided by two bits of XPORT output port. To guarantee logic level compatibility, pull-up resistors to +5 volts are included for each synthesizer input line.

The synthesizers' busy output lines require a simple interface circuit to drive 5-volt logic. The signals are brought into the 8085A's interrupt 5.5 and 6.5 inputs, used as an input port—not really as interrupt inputs.

The speech output is a high-impedance (10k) couple of volts peak to peak. Telesensory recommends a filter network to shape the audio response, but we found that it sounded far better through the repeater with virtually no filtering. The audio from the two boards goes to the repeater's audio mixer circuits.

Synthesizer Software

Messages to be spoken are generally stored as strings in the microcomputer's ROM. Other messages

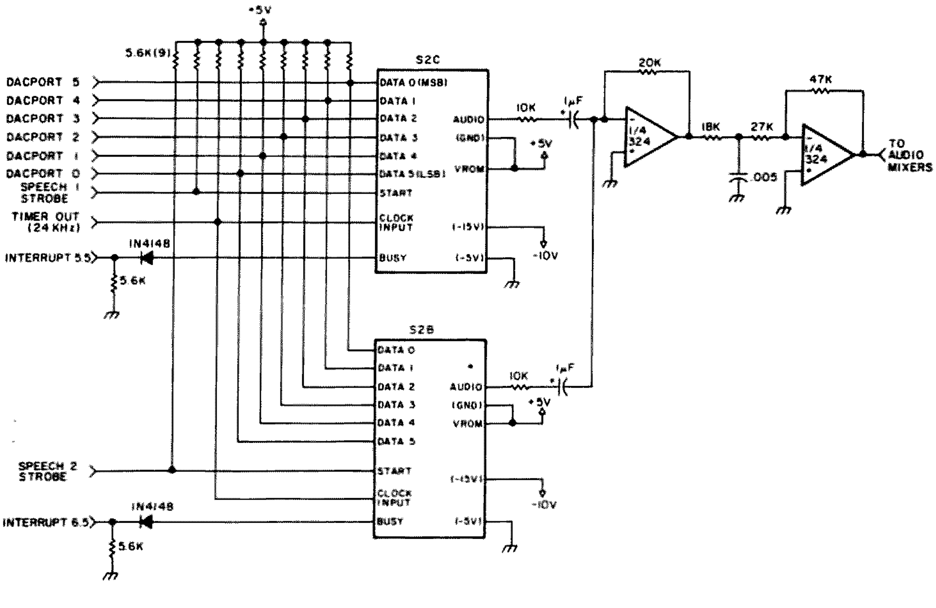

Fig. 1. Speech synthesizer hardware interface to microcomputer.

Table 1. Speech synthesizer control subroutine.

```
                ;SPEECH SYNTHESIZER CONTROL ROUTINE.  (HL)-> CHARACTER STRING.
                ;CHARACTER STRING TERMINATED BY OFFH.
                ;CODES 20H TO 5FH ARE ASCII. CODES 60H TO 9FH
                ;ARE TELESENSORY "STANDARD" VOCABULARY.  CODES 00H TO 0CH
                ;ARE BCD AND STAR/POUND (0AH NOT USED).
                ;IF 220 SPEECH IS INTERRUPTED, ROUTINE RETURNS WITH CY=1.
                ;
1D4C =          SPDELAY EQU 7500        ;INTER CHARACTER DELAY
7530 =          SPWORDELAY EQU 30000    ;INTER WORD DELAY
0032 =          TSPTIM  EQU 50          ;SPEECH MALFUNCTION TIMER=1.3 SEC
                ;
325C =          TALK    EQU $
325C C5                 PUSH B
                ;
325D =          TALK1   EQU $
325D F3                 DI              ;PROTECT CRITICAL AREA
325E DB12               IN XPORT        ;TAKE BOTH STROBES HIGH
32A0 F60C               ORI SP1STB OR SP2STB
3262 D312               OUT XPORT
3264 CD4B31             CALL TTRCVRTEST ;TALKING TO RADIO OR PHONE?
3267 CA7032             JZ TALK1D       ;IF TO PHONE, DONT MUTE RB
326A DB1A               IN AUD1         ;XCON RB AUDIO TO 220 XMTR
326C EAFB               ANI CRBRTO220
326E D31A               OUT AUD1
                ;
3270 =          TALK1D  EQU $
3270 FB                 EI
3271 7E                 MOV A,M         ;GET CHARACTER
3272 23                 INX H
3273 FEF0               CPI 0F0H        ;CHAR FROM AUTODIAL MEM?
3275 DA7F32             JC TALK1C       ; (MS 4 BITS=1?)
3278 E60F               ANI 0FH         ;IF YES, THEN MASK OFF MS BITS SO BCD
327A FE0F               CPI 0FH         ;LAST CHAR? (CHARACTER FF?)
327C CA1533             JZ FINTALK      ;FINISHED IF YES
                ;
327F =          TALK1C  EQU $
327F FE20               CPI 20H         ;NOT FINISHED, SPACE?
3281 CA3533             JZ SPACETALK    ;IF YES, JUST DELAY
3284 FE0D               CPI 0DH         ;BCD OR STAR/POUND?
3286 D29932             JNC TALK1A
3289 C630               ADI 30H         ;YES, CONVERT TO ASCII
328B FE3B               CPI 3BH         ;IS IT STAR?
328D C29232             JNZ TALK1B
3290 3E2A               MVI A,2AH       ;IF YES, USE TELES CODE
                ;
3292 =          TALK1B  EQU $
3292 FE3C               CPI 3CH         ;IS IT POUND?
3294 C29932             JNZ TALK1A
3297 3E23               MVI A,23H       ;USE NUMBER (POUND)
                ;
3299 =          TALK1A  EQU $
3299 EE20               XRI 20H         ;REVERSE BIT 5 TO MATCH TELES CODE
329B FB                 EI
329C 76                 HLT             ;SYNCHRONIZE TO RST75 TO GUARANTEE SETUP
329D F3                 DI
329E D311               OUT DACPORT     ;AND HOLD TIMES, OUTPUT TO SYNTH DATA
32A0 0632               MVI B,50        ;DELAY TO OBSERVE SETUP REQUIREMENTS
32A2 05                 DCR B
32A3 C2A232             JNZ $-1
32A6 EE20               XRI 20H         ;FLIP BACK BIT 5
32A8 FE60               CPI A0H         ;ASCII OR STANDARD VOCABULARY?
32AA D2B232             JNC TALK2
32AD 06FB               MVI B,SP1UNSTB  ;ASCII, BOARD 1 UNSTROBE
32AF C3B432             JMP TALK3
                ;
32B2 =          TALK2   EQU $
32B2 06F7               MVI B,SP2UNSTB  ;STANDARD, BOARD 2 UNSTROBE
                ;
32B4 =          TALK3   EQU $
32B4 DB12               IN XPORT
32B6 A0                 ANA B
32B7 D312               OUT XPORT       ;UNSTROBE IT
32B9 FB                 EI
32BA 76                 HLT             ;AND ALLOW DELAY OF BUSY LINE
32BB FB                 EI
32BC 76                 HLT
32BD E5                 PUSH H
32BE 213200             LXI H,TSPTIM
32C1 222F10             SHLD LGPT       ;STORE MALFUNCTION TIMEOUT IN
                ;                       ; GENERAL PURPOSE TIMER
                ;
32C4 =          TALK4   EQU $
                        RIM             ;SPEECH FINISHED?
32C4+20                 DB 20H
32C5 EA30               ANI INT65
32C7 C22B33             JNZ TALK5       ;JMP IF DONE WORD
32CA 2A2D10             LHLD LTTBEEP    ;220 SQUELCH OPEN?
32CB 7D                 MOV A,L
32CE B4                 ORA H
32CF CAF532             JZ TALK4A       ;NO, CONTINUE
32D2 DB1A               IN AUD1         ;(YES), TALKING TO RADIO?
32D4 E608               ANI BSPTO220
32D6 CAF532             JZ TALK4A       ;NO, CONTINUE
32D9 3A4410             LDA MWARN       ;YES, MONOLOGUE WARN ANNC?
32DC 0F                 RRC
32DD DAF532             JC TALK4A       ;YES, CONTINUE
32E0 3A4510             LDA PPTWARN     ;PATCH TIMER WARNING?
32E3 0F                 RRC
32E4 DAF532             JC TALK4A       ;YES, CONTINUE
32E7 3A4B10             LDA PCOVER      ;NO, COVER TONE?
32EA 0F                 RRC
32EB DAF532             JC TALK4A
32EE 3A4E10             LDA TTCOVER     ;TT COVER TONE?
32F1 0F                 RRC
32F2 D2FD32             JNC TALKABORT
32F5 =          TALK4A  EQU $
32F5 2A2F10             LHLD LGPT       ;NO, MALF TIMER TIMED OUT?
32F8 7D                 MOV A,L
32F9 B4                 ORA H
32FA C2C432             JNZ TALK4
                ;
32FD =          TALKABORT EQU $
32FD F3                 DI              ;YES, ABORT
32FE DB1A               IN AUD1         ;XCON SPEECH AUDIO
3300 E6F7               ANI CSPTO220
3302 D31A               OUT AUD1
3304 FB                 EI
                ;
3305 =          TALKABORT1 EQU $
                        RIM
3305+20                 DB 20H
330A EA30               ANI INT65       ;WAIT FOR END OF SPEECH
330B C21333             JNZ TALKABORT2
330B 2A2F10             LHLD LGPT       ;CHECK MALF TIMER
330E 7D                 MOV A,L
330F B4                 ORA H
3310 C20533             JNZ TALKABORT1  ;LOOP UNTIL DONE
                ;
3313 =          TALKABORT2 EQU $
3313 37                 STC             ;SET CY FOR INTERRUPTED RETURN
3314 E1                 POP H
                ;
3315 =          FINTALK EQU $
3315 F3                 DI
331A C1                 POP B
3317 F5                 PUSH PSW        ;RECONNECT RB AUDIO IF NECESSARY
3318 3A0110             LDA RBOR
331B E62R               ANI SRBEN OR SRBRON
331D FE28               CPI SRBEN OR SRBRON
331F C22B33             JNZ FINTALK1
3322 DB1A               IN AUD1         ;RECONNECT
3324 FA02               ORI SRBRTO220
3326 D31A               OUT AUD1
                ;
3328 =          FINTALK1 EQU $
3328 F1                 POP PSW
3329 FB                 EI
332A C9                 RET
                ;
332B =          TALK5   EQU $
332B E1                 POP H
332C 014C1B             LXI B,SPDELAY   ;INTER CHAR DELAY
                ;
332F =          TALK5A  EQU $
332F CD9934             CALL DEL2
3332 C35D32             JMP TALK1
                ;
                ;
                ;DELAY WORD SPACE TIME
                ;
3335 =          SPACETALK EQU $
3335 013075             LXI B,SPWORDELAY
3338 C32F33             JMP TALK5A
```

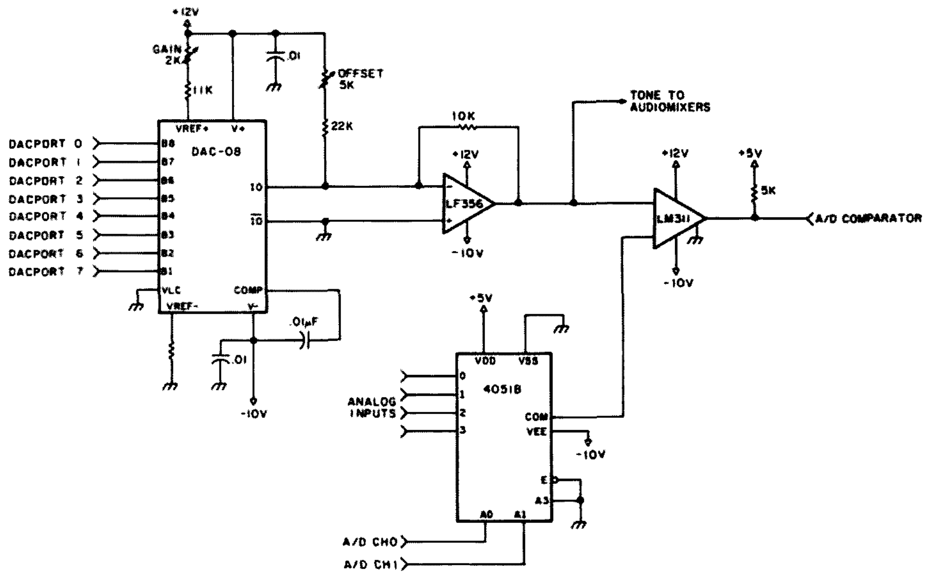

Fig. 2. A/D converter hardware for reading the meters.

are generated by computations made by the computer and are stored as strings in RAM. Prior to generating speech, the computer enables the synthesizer's audio mixer to the transmitter and/or phone line. The TALK subroutine expects the HL register pair to point to the character string in memory, and the string is terminated by a OFFH code. If speech to the transmitter is interrupted by a receiver squelch open, speech aborts and the subroutine returns with the carry flag set. There are certain exceptions to this rule, including timeout announcements and cover tone generation.

The TALK subroutine is

Table 2. Meter-read program extracted from the background module, TRAP interrupt module, and foreground module.

```
                ;
                ; *** BACKGROUND METER READ ***
                ;DATA ACQUISITION.  TICK COUNTER DETERMINES A CHANNEL TO BE
                ;MEASURED BY A/D CONVERTER.  VALUE ENTERED INTO PROPER
                ;LOCATION OF A/D TABLE.  TABLE CONTAINS LAST 16 MEASUREMENTS
                ;OF 4 CHANNELS.
                ;
01D3 =          DATAACQ EQU $
                ;
01D3 DB13               IN CHPORT        ;SELECT A/D CHANNEL
01D5 E6FC               ANI NOT ADMASK   ;CURRENT PORT VALUE
01D7 47                 MOV B,A
01D8 7E                 MOV A,M          ;TICK COUNTER
01D9 E603               ANI ADMASK       ;LS 2 BITS
01DB B0                 ORA B            ; OR IN A/D CHANNEL BITS
01DC D313               OUT CHPORT       ;AND SELECT
                ;
01DE 0600               MVI B,0          ;SUCCESSIVE APPROXIMATION A/D CONVERSION
01E0 0E80               MVI C,80H        ;B=CURRENT VALUE, C=MASK BIT
                ;
01E2 =          DATA1   EQU $
01E2 78                 MOV A,B          ;SET NEXT BIT
01E3 A9                 XRA C
01E4 47                 MOV B,A
01E5 D311               OUT DACPORT      ;AND SEND CURRENT VALUE TO DAC
01E7 00                 NOP              ;ALLOW OP AMP TO SLEW
01E8 00                 NOP
01E9 00                 NOP
01EA 00                 NOP
01EB DB19               IN RPORT         ;LOOK AT COMPARATOR
01ED E680               ANI ADCOMPB
01EF C2F501             JNZ DATA2        ;IF HIGH, LEAVE SET
01F2 78                 MOV A,B          ;IF LOW, CLEAR IT
01F3 A9                 XRA C
01F4 47                 MOV B,A
                ;
01F5 =          DATA2   EQU $
01F5 79                 MOV A,C          ;NEXT MASK
01F6 0F                 RRC
01F7 4F                 MOV C,A
01F8 D2E201             JNC DATA1        ;CONTINUE FOR 8 POSITIONS
                ;
01FB =          DATA3   EQU $
01FB 2A0610             LHLD CURRENTVALUE  ;A/D TABLE POINTER
01FE 70                 MOV M,B          ;PUT VALUE INTO TABLE
01FF 23                 INX H
0200 220610             SHLD CURRENTVALUE
0203 7D                 MOV A,L          ;WRAPAROUND?
0204 FE8A               CPI LOW FINADTABLE
0206 C2D900             JNZ FIN75        ;NO, DONE
0209 217610             LXI H,ADTABLE    ;YES, WRAP AROUND TO BEGINNING
020C 220610             SHLD CURRENTVALUE
020F C3D900             JMP FIN75        ;NOW DONE
                ;
                ; *** TRAP ROUTINE, AVERAGE READINGS AND STORE ***
                ;
                ;
04E4 =          TRAPSMET EQU $
04E4 017A10             LXI B,ADTABLE    ;CHANNEL 0 (TICK 4) IS SMETER
04E7 C3ED04             JMP AVGIT        ;(BC)-> START OF SMETER RAM VALUES
                ;
                ;
04EA =          TRAPDMET EQU $
04EA 017B10             LXI B,ADTABLE+1  ;CHANNEL 3 (TICK 3) IS DMETER
                ;
04ED =          AVGIT   EQU $
04ED D5                 PUSH D           ;AVERAGE PREVIOUS 16 READINGS
04EE E5                 PUSH H
04EF 210000             LXI H,0          ;CUMULATIVE SUM
04F2 110000             LXI D,0          ;DE=NEXT VALUE
                ;
04F5 =          AVGIT1  EQU $
04F5 0A                 LDAX B           ;GET VALUE
04F6 5F                 MOV E,A          ;DE=VALUE
04F7 19                 DAD D            ;NEW SUM IN HL
04F8 03                 INX B
04F9 03                 INX B
04FA 03                 INX B
04FB 03                 INX B            ;NEXT VALUE
04FC 79                 MOV A,C
04FD FE8A               CPI LOW FINADTABLE ;DONE?
04FF DAF504             JC AVGIT1
0502 29                 DAD H            ;YES, NOW GET 8 MSB
0503 29                 DAD H
0504 29                 DAD H
0505 29                 DAD H            ;X 16 IN HL
0506 7C                 MOV A,H          ;MS BYTE IS AVERAGE
0507 320810             STA READING      ;STORE IT
050A 2A2510             LHLD LMT         ;STORE MONOLOGUE TIMER SO KNOW
050D 220910             SHLD READTIME    ; THAT MIKE HELD DWN LONG ENOUGH
0510 E1                 POP H
0511 D1                 POP D
0512 C9                 RET
                ;
                ; *** FOREGROUND SEQUENCE DECODE ROUTINE ***
                ;
                ; S-METER AND DISCRIMINATOR READ ANNOUNCEMENT.
                ;
0BD8 =          SSMETER EQU $
                ;
0BD8 21050C             LXI H,SMETABLE   ;POINT TO TABLE
0BDB 110600             LXI D,6          ;ADD CONSTANT
                ;
0BDE =          SSMETER1 EQU $
0BDE 3A0810             LDA READING      ;GET LAST AVERAGED VALUE
0BE1 47                 MOV B,A
                ;
0BE2 =          SSMETER2 EQU $
0BE2 7E                 MOV A,M          ;CORRECT VALUE?
0BE3 B8                 CMP B
0BE4 D2F40B             JNC METALK       ;IF YES, SAY VALUE
0BE7 19                 DAD D            ;IF NOT, TRY NEXT VALUE
0BE8 C3E20B             JMP SSMETER2
                ;
                ;D-METER ANNOUNCEMENT.
                ;
0BEB =          DDMETER EQU $
0BEB 21650C             LXI H,DMETABLE   ;POINT TO TABLE
0BEE 110800             LXI D,8          ;ADD CONSTANT
0BF1 C3DE0B             JMP SSMETER1     ;CONTINUE
                ;
0BF4 =          METALK  EQU $
0BF4 23                 INX H            ;POINT TO FIRST CHARACTER
0BF5 E5                 PUSH H           ;SAVE POINTER
0BF6 2A0910             LHLD READTIME    ;WAS MIKE HELD DOWN FOR
0BF9 11B6E5             LXI D,-(TMT-20)  ; AT LEAST 1/2 SECOND
0BFC 19                 DAD D            ; SO HAVE VALID AVERAGE?
0BFD E1                 POP H            ;RESTORE POINTER
0BFE DA4F0B             JC FINSEQ        ;ABORT IF NO
0C01 CD3B33             CALL TALKR       ;SAY IT
                        JMPFINSEQ        ;DONE
0C04+E7                 RST 4
                ;
                ;S-METER TABLE OF VALUE AND SPEECH
                ;
0C05 =          SMETABLE EQU $
0C05 825330FF00         DB 82H,'S0',0FFH,0,0
0C0B 845331FF00         DB 84H,'S1',0FFH,0,0
0C11 885332FF00         DB 88H,'S2',0FFH,0,0
0C17 905333FF00         DB 90H,'S3',0FFH,0,0
0C1D 985334FF00         DB 98H,'S4',0FFH,0,0
0C23 A05335FF00         DB 0A0H,'S5',0FFH,0,0
0C29 A85336FF00         DB 0A8H,'S6',0FFH,0,0
0C2F B05337FF00         DB 0B0H,'S7',0FFH,0,0
0C35 B85338FF00         DB 0B8H,'S8',0FFH,0,0
0C3B C05339FF00         DB 0C0H,'S9',0FFH,0,0
0C41 C853392B6A         DB 0C8H,'S9',PLUS,TEN,0FFH
0C47 D053392B74         DB 0D0H,'S9',PLUS,TWENTY,0FFH
0C4D D853392B75         DB 0D8H,'S9',PLUS,THIRTY,0FFH
0C53 E053392B76         DB 0E0H,'S9',PLUS,FORTY,0FFH
0C59 E853392B77         DB 0E8H,'S9',PLUS,FIFTY,0FFH
0C5F FF53392B78         DB 0FFH,'S9',PLUS,SIXTY,0FFH
0C65 =          FINSMETABLE EQU $
                ;
                ;DISCRIMINATOR METER TABLE OF VALUE AND SPEECH
                ;
0C65 =          DMETABLE EQU $
0C65 1F2D3E354B         DB 1FH,MINUS,GREATERTHAN,'5K',HERTZ,0FFH,0
0C6D 2C2D354B96         DB 2CH,MINUS,'5K',HERTZ,0FFH,0,0
0C75 442D334B96         DB 44H,MINUS,'3K',HERTZ,0FFH,0,0
0C7D 582D324B96         DB 58H,MINUS,'2K',HERTZ,0FFH,0,0
0C85 622D318335         DB 62H,MINUS,'1',POINT,'5K',HERTZ,0FFH
0C8D 6C2D314B96         DB 6CH,MINUS,'1K',HERTZ,0FFH,0,0
0C95 702D387C96         DB 70H,MINUS,'8',HUNDRED,HERTZ,0FFH,0,0
0C9D 742D367C96         DB 74H,MINUS,'6',HUNDRED,HERTZ,0FFH,0,0
0CA5 782D347C96         DB 78H,MINUS,'4',HUNDRED,HERTZ,0FFH,0,0
0CAD 7C2D327C96         DB 7CH,MINUS,'2',HUNDRED,HERTZ,0FFH,0,0
0CB5 843C327C96         DB 84H,LESSTHAN,'2',HUNDRED,HERTZ,0FFH,0,0
0CBD 882B327C96         DB 88H,PLUS,'2',HUNDRED,HERTZ,0FFH,0,0
0CC5 8C2B347C96         DB 8CH,PLUS,'4',HUNDRED,HERTZ,0FFH,0,0
0CCD 902B367C96         DB 90H,PLUS,'6',HUNDRED,HERTZ,0FFH,0,0
0CD5 942B387C96         DB 94H,PLUS,'8',HUNDRED,HERTZ,0FFH,0,0
0CDD 9B2B314B96         DB 9DH,PLUS,'1K',HERTZ,0FFH,0,0
0CE5 A82B31E335         DB 0A8H,PLUS,'1',POINT,'5K',HERTZ,0FFH
0CED BC2B324B96         DB 0BCH,PLUS,'2K',HERTZ,0FFH,0,0
0CF5 D42B334B96         DB 0D4H,PLUS,'3K',HERTZ,0FFH,0,0
0CFD E12B354B96         DB 0E1H,PLUS,'5K',HERTZ,0FFH,0,0
0D05 FF2B3E354B         DB 0FFH,PLUS,GREATERTHAN,'5K',HERTZ,0FFH,0
0D0D =          FINDMETABLE EQU $
                ;
```

listed in Table 1. Optimum selection of the synthesizer's pitch and inter-character delay is essential to achieving the best intelligibility.

Meter Read

The repeater's meter-read capability allows users to request S-meter and discriminator meter readings to check signal strength and frequency error. Analog voltages from the receiver are buffered and brought to the A/D converter on the CPU-1A microcomputer board. Provisions are made for four analog channels, although only two are used presently. The background module measures each channel every 26.6 ms, and the reading is stored with the 15 previous readings for that channel in RAM. When the proper touchtone™ key sequence is detected by the TRAP interrupt module, the 16 readings for the appropriate channel are averaged and stored, to be retrieved by the foreground sequence-detect branch routine which speaks the meter value over the air. When a meter-read command is entered, therefore, the average reading over the last half second is read, reducing the effect of noise and flutter.

The A/D converter consists of a DAC-08 8-bit digital-to-analog converter with a current-to-voltage converter, analog multiplexer, and comparator. The DAC is driven by DACPORT output port, the multiplexer by CHPORT output port, and the comparator is read through RPORT input port. A 300-μs total conversion time successive approximation algorithm is used.

The meter-read software consists of three routines in the background, TRAP interrupt, and foreground modules. The listings of each are shown in Table 2.

Remote Base

An Icom IC-22S two-meter synthesized transceiver serves as a remote base, commandable through the repeater. Command codes independently enable the remote-base receiver and transmitter, allowing monitoring only and talking over the two-meter signals. The IC-22S synthesizer is under control of the CPU-1A microcomputer, allowing users to pro-

Table 3. IC-22S remote-base frequency control routine. Touchtone command is decomposed and determines programming frequency.

```
                ;REMOTE BASE FREQUENCY LOAD SEQUENCE DECODE ROUTINE.
                ;POINTER TO START OF COMMAND STRING ON TOP OF STACK.
                ;INTERPRETS STRING OF FORMAT (1'S MHZ) (100'S KHZ)
                ;(10'S KHZ) (1'S KHZ) (1=-600KHZ,2=SIMPLEX,
                ;3=+600KHZ XMT OFFSET) AND PROGRAMS IC-22S.
                ;SAMPLE STRING FOR .34/.94 IS 69401.
                ;
0B7B =          RBLOADP EQU $
0B7B C1                 POP B           ;(BC)-> START OF STRING
0B7C 117108             LXI D,FINSEQ
0B7F D5                 PUSH D          ;PUT FINSEQ ON TOP OF STACK
0B80 3A0110             LDA RBOR        ;RB ENABLED AND ON?
0B83 E628               ANI SRBRON OR SRBEN
0B85 FE28               CPI SRBRON OR SRBEN
0B87 C0                 RNZ             ;RETURN (TO FINSEQ) IF NO
0B86 49                 MOV L,C         ;STRING START ADDRESS
0B89 60                 MOV H,B
0B8A 221310             SHLD TEMPAIR    ;SAVE ADDRESS
0B8D 0A                 LDAX B          ;TYP STRING=69401(FF)
0B8E FE08               CPI 8           ;CHECK FOR 145-147 MHZ
0B90 D0                 RNC
0B91 FE05               CPI 5
0B93 D8                 RC
0B94 D606               SUI 6           ;START FORMING VALUE
0B94 21E803             LXI H,1000
0B99 CAA50B             JZ RBLOAD1
0B9C 210000             LXI H,0
0B9F FAA50B             JM RBLOAD1
0BA2 21D007             LXI H,2000      ;5->0,6->1000,7->2000
                ;
0BA5 =          RBLOAD1 EQU $
0BA5 03                 INX B
0BA6 0A                 LDAX B          ;CONVERT BCD TO 0-2999 BINARY
0BA7 116400             LXI D,100       ;X100 (HUNDREDS)
                ;
0BAA =          RBLOAD2 EQU $
0BAA 3D                 DCR A
0BAB FAB20B             JM RBLOAD3
0BAE 19                 DAD D
0BAF C3AA0B             JMP RBLOAD2
                ;
0BB2 =          RBLOAD3 EQU $
0BB2 03                 INX B
0BB3 0A                 LDAX B
0BB4 110A00             LXI D,10        ;X10 (TENS)
                ;
0BB7 =          RBLOAD4 EQU $
0BB7 3D                 DCR A
0BB8 FABF0B             JM RBLOAD5
0BBB 19                 DAD D
0BBC C3B70B             JMP RBLOAD4
                ;
0BBF =          RBLOAD5 EQU $
0BBF 03                 INX B
0BC0 0A                 LDAX B          ;X1 (ONES)
0BC1 B7                 ORA A           ;SHOULD BE 0 OR 5 KHZ
0BC2 C2CB0B             JNZ RBLOAD5A
0BC5 3E20               MVI A,SPACE     ;IS 0, INSERT SPEECH SPACE
0BC7 02                 STAX B
0BC8 C3D00B             JMP RBLOAD6
                ;
0BCB =          RBLOAD5A EQU $
0BCB FE05               CPI 5
0BCD C0                 RNZ             ;INVALID FREQ
0BCE 5F                 MOV E,A         ;ADD ONES
0BCF 19                 DAD D
                ;
0BD0 =          RBLOAD6 EQU $
0BD0 116202             LXI D,610       ;ADJUST
0BD3 19                 DAD D
0BD4 11F1FF             LXI D,-15       ;HL=0-2999, MULTIPLE OF 5
0BD7 C5                 PUSH B          ;NOW DIVIDE BY 15
0BD8 0600               MVI B,0
                ;
0BDA =          RBLOAD7 EQU $
0BDA 19                 DAD D           ;KEEP SUBTRACTING UNTIL DONE
0BDB 04                 INR B
0BDC 7C                 MOV A,H         ;NEGATIVE? IF YES ERROR
0BDD 07                 RLC             ; (NOT MULTIPLE OF 15 KHZ)
0BDE DAE50B             JC RBLOAD8
0BE1 B5                 ORA L           ;ZERO? IF YES DONE!!!
0BE2 C2DA0B             JNZ RBLOAD7
                ;
0BE5 =          RBLOAD8 EQU $
0BE5 58                 MOV E,B         ;VALUE TO GO TO IC22 IN E
0BE6 C1                 POP B
0BE7 D8                 RC              ;RETURN IF NEG (ERROR-NOT MULT OF 15)
0BE8 03                 INX B
0BE9 0A                 LDAX B          ;GET OFFSET, 1=-600,2=SIMPLEX,3=+600
0BEA FE01               CPI 1           ;-600 KHZ?
0BEC C2FB0B             JNZ RBLOAD9
0BEF 3E2D               MVI A,MINUS     ;SAY 'MINUS'
0BF1 02                 STAX B
0BF2 7B                 MOV A,E         ;AND PROGRMAM 600 KHZ LOWER
0BF3 D628               SUI 40
0BF5 5F                 MOV E,A
0BF6 16DF               MVI D,NOT RBDUPA ;SET DUPLEX A
0BF8 C3100C             JMP RBTALK
                ;
0BFB =          RBLOAD9 EQU $
0BFB FE02               CPI 2           ;SIMPLEX?
0BFD C2080C             JNZ RBLOAD10
0C00 3E53               MVI A,'S'       ;SAY 'S', SIMPLEX
0C02 02                 STAX B
0C03 16FF               MVI D,NOT 0
0C05 C3100C             JMP RBTALK
                ;
0C08 =          RBLOAD10 EQU $
0C08 FE03               CPI 3           ;+600 KHZ?
0C0A C0                 RNZ             ;INVALID IF NOT
0C0B 3E2B               MVI A,PLUS      ;SAY 'PLUS', DUPLEX B
0C0D 02                 STAX B
0C0E 16EF               MVI D,NOT RBDUPB
                ;
0C10 =          RBTALK  EQU $
0C10 DB1B               IN AUD2
0C12 F630               ORI RBDUPA OR RBDUPB
0C14 A2                 ANA D           ;SET DUPLEX/SIMPLEX MODE OF IC22
0C15 D31B               OUT AUD2
0C17 7B                 MOV A,E
0C18 2F                 CMA
0C19 320028             STA IC22FREQ    ;WRITE FREQ TO IC22
0C1C 2A1310             LHLD TEMPAIR    ;ORIG (HL) POINTER
0C1F C33B33             JMP TALKR       ;SAY NEW FREQUENCY ON RADIO
```

gram the frequency and transmitter offset.

The interface signals to the IC-22S include transmit and receive audio, push-to-talk, receive carrier-operated switch, eight synthesizer frequency control lines, plus DUPLEX A and DUPLEX B control lines. The interface circuits simply convert the 5-volt logic levels of the microcomputer to the CMOS logic levels of the IC-22S. The pull-down resistors in the IC-22S are made pull-up resistors so that the open collector buffers can function properly. The IC-22S simplex/duplex switch must be kept in the simplex position. The circuit was built on a small board which plugs in directly, replacing the diode matrix board. Icom's molex® connector option mounts on the back to carry the signals.

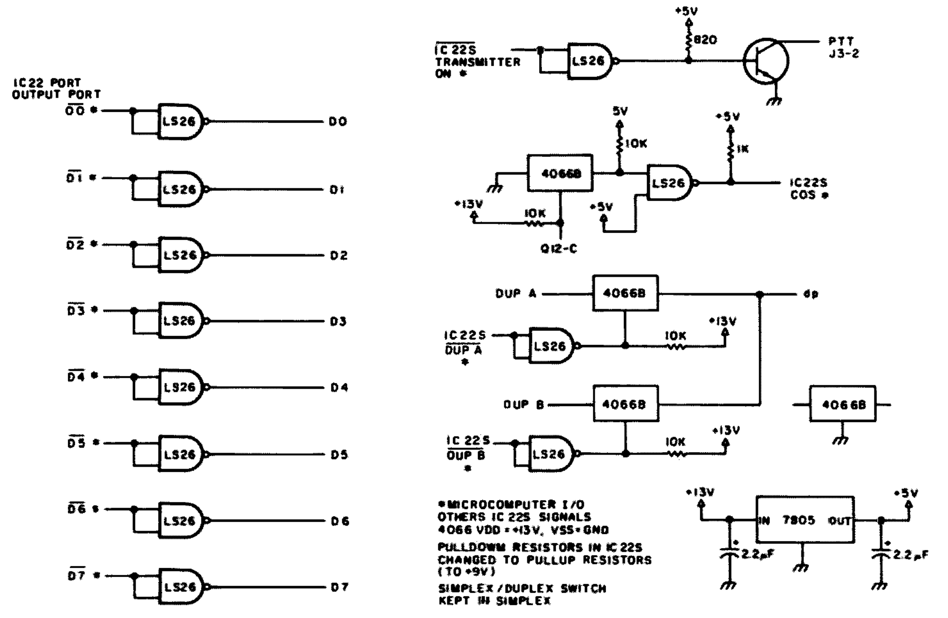

Fig. 3. IC-22S remote-base hardware interface to microcomputer. This hardware replaces the diode programming board. Note: R37 common taken to +5 V, R36 taken to +5 V, and dp resistor restored to pull-down.

The software listing is provided of the routine which programs the synthesizer's frequency and offset. The routine is executed by the foreground in response to detection of a remote-base frequency-programming command when the remote base is on. The command code consists of: (least significant MHz), (100s kHz), (10s kHz), (0 or 5 kHz), and (1 for −600-kHz offset, 2 for simplex, 3 for +600-kHz offset). For example, the 146.34/.94 pair may be selected by keying

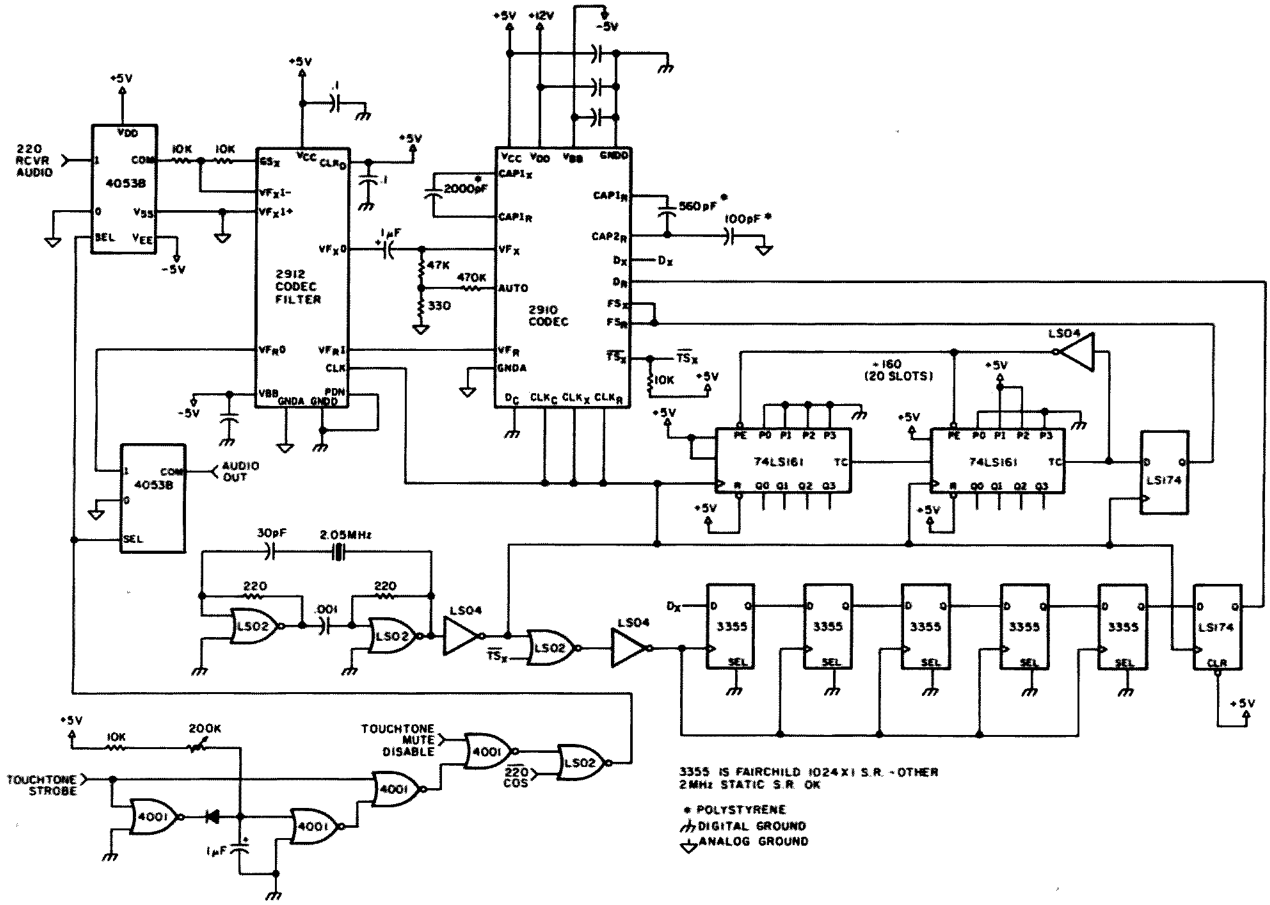

Fig. 4. Audio delay line schematic. Audio output is delayed 50 ms from the input, with squelch tails and touchtone chopped off.

in touchtone command 69401. The routine listed decomposes the command stored in the key buffer in RAM and programs the frequency synthesizer. The frequency then is read back by the speech synthesizer.

Sequence Detector

The sequence detector is a foreground task routine. Its task-pending bit is set by the timeout of the "220 only beep timer," so the task routine executes after every 220 transmission. Usually, the sequence detector finds an empty buffer and simply cleans up and returns to the foreground nucleus. If touchtone data keys have been placed in the key buffer by the TRAP input routine, meaning that commands have been sent, the sequence detector analyzes the command and, if valid, branches the program to the appropriate command routine.

A listing of a stripped-down sequence detector program is shown in Table 4. Since the # key can be used as a "clear" to cancel previous keys during a transmission, the routine scans down from the top of the used part of the buffer to either the bottom of the buffer or to a # key—whichever is found first. That point is the start of the command to be recognized.

The sequence detector is table driven—command routine addresses are stored in tables and are retrieved by the sequence detector to determine the branch location.

The first branch is based on the number of keys in the sequence—much information on the meaning of the command is provided by its length. For example, the remote-base frequency-change command may be the only valid five-digit command. The program can branch immediately to the remote-base frequency change routine to evaluate and act upon the command.

When the number of keys in the command does not uniquely identify the command, further processing occurs. If single-digit commands are used, the key value can be used to find its routine address in the ONETAB address table. For multiple-digit commands, a routine (COMPSEQ) compares each digit of the command up to the last digit to a valid string stored in the program. If the command sequence is valid, one of ten command routines is branched to based on the last digit of the command.

This approach to sequence detection is extremely flexible, easily changed, and is expandable. Special cases also can be handled easily outside the table-driven structure.

Audio Delay Line

The loudness and duration of the squelch tail in FM receivers varies, but some "chunk" exists in virtually all of them. Circuitry was built which eliminates the squelch tail and also allows total muting of touchtone command signals. By delaying the received audio on the way to the transmitter, squelch tails and touchtone can be headed off at the pass, before they go out the transmitter. The delay im-

Table 4. Sequence detector foreground task. Stripped down skeleton of version used in repeater controller.

```
                ;SEQUENCE DETECTOR FOREGROUND ROUTINE.  DECODES SEQUENCE
                ;IN KEY BUFFER AND BRANCHES PROGRAM EXECUTION APPROPRIATELY.
                ;$ EFFECTIVELY CLEARS PREVIOUS KEYS FROM BUFFER WHEN
                ;SENDING A SEQUENCE.
                ;
0800 =          FPTTSEQ EQU $
                ;
0800 210000             LXI H,0         ;CLEAN INTERDIGIT TIMER
0803 222710             SHLD LSEQDET    ; TO INHIBIT TIMEOUT ROUTINE
0806 3E01               MVI A,1         ;HARD CLOSE KEY BUFFER
0808 325010             STA KBHC
080B 3A0410             LDA KBPOINT     ;IS BUFFER EMPTY? (KEY BUFFER POINTER)
080E 47                 MOV B,A         ;SAVE
080F B7                 ORA A
0810 CA4F08             JZ FINSEQ       ;IF YES QUIT
0813 3A3D10             LDA PTTSEQ      ;PHONE OR RADIO COMMAND?
0816 0F                 RRC
0817 0F                 RRC
0818 DA2208             JC FPTTSEQ1
081B DB19               IN RPORT        ;PHONE COMMAND
081D E640               ANI TTSTBB      ;TOUCH TONE STILL PRESENT?
081F C21B08             JNZ $-4         ;LOOP UNTIL END OF TONE
                ;
0822 =          FPTTSEQ1 EQU $
0822 215910             LXI H,KEYBUF
0825 58                 MOV E,B
0826 1600               MVI D,0
0828 19                 DAD D           ;(HL)-> TOP OF FILLED BUFFER +1
0829 36FF               MVI M,0FFH      ;STUFF IN TALK/DIAL TERMINATOR
082B 45                 MOV B,L         ;END OF BUFFER
                ;
082C =          SEQ1    EQU $
082C 2B                 DCX H           ;SCAN DOWN FROM TOP TO #
082D 7D                 MOV A,L         ;    OR BOTTOM OF BUFFER
082E FE58               CPI LOW KEYBUF-1
0830 CA3908             JZ SEQ2
0833 7E                 MOV A,M
0834 FE0C               CPI KPOUND
0836 C22C08             JNZ SEQ1
                ;
0839 =          SEQ2    EQU $
0839 23                 INX H           ;(HL)->FIRST VALID CHAR
083A FEFF               CPI 0FFH        ;WAS ONLY KEY A #?
083C C24008             JNZ SEQ3
083F 2B                 DCX H           ;POINT TO # IF YES
                ;
0840 =          SEQ3    EQU $
0840 78                 MOV A,B
0841 95                 SUB L           ;A=NUMBER OF KEYS
0842 FE0B               CPI 11          ;CHECK FOR OVERFLOW
0844 D24F08             JNC FINSEQ
0847 E5                 PUSH H          ;JUMP TO BRANCH TABLE ENTRY LOCATION
0848 21A408             LXI H,KBLTAB    ;   BASED ON NUMBER OF KEYS
084B C34131             JMP JMPTAB      ;(POP RP)->FIRST VALID CHAR, B=KBPOINT
                ;
084E =          FINSEQP EQU $
084E E1                 POP H
                ;
084F =          FINSEQ  EQU $
084F CD6131             CALL TTOPEN     ;OPEN TOUCHTONE KEY BUFFER, ETC.
0852 AF                 XRA A
0853 323D10             STA PTTSEQ      ;CLEAR PENDING BIT
0856 37                 STC             ;RESYNC FOREGROUND TO BKGND
                ;
0857 =          FINCOMPSEQ EQU $
0857 E1                 POP H
0858 C9                 RET
                ;
0859 =          VALIDSEQP EQU $
0859 E1                 POP H
                ;
085A =          VALIDSEQ EQU $
085A 217C33             LXI H,VMARK     ;ACKNOWLEDGE VALID SEQUENCE
085D 3A3D10             LDA PTTSEQ      ;  WITH SPEECH (SAY "MARK")
0860 0F                 RRC             ;PHONE OR RADIO COMMAND?
0861 0F                 RRC
0862 DA6908             JC VALIDSEQR
0865 CD4733             CALL TALKP      ;TALK ON PHONE
                        JMPFINSEQ
0868+E7                 RST 4
                ;
0869 =          VALIDSEQR EQU $
0869 CD3B33             CALL TALKR      ;  ON RADIO
                        JMPFINSEQ
086C+E7                 RST 4
                ;
                ;DECIDE ON TYPE OF SEQUENCE BASED ON NUMBER OF CHARS
                ;
                ;ONE KEY COMMAND
                ;
086D =          ONEDEC  EQU $
086D E1                 POP H           ;(HL)->FIRST VALID CHAR
086E 7E                 MOV A,M         ;GET KEY VALUE
086F 21BA08             LXI H,ONETAB    ;TABLE OF ROUTINE ADDRESSES
0872 C34131             JMP JMPTAB      ;COMPUTE ADDRESS AND GO THERE
                ;
                ;
                ;EIGHT KEY COMMAND
                ;
0875 =          EIGHTDEC EQU $
0875 E1                 POP H           ;(HL)->FIRST VALID CHAR
087A 111009             LXI D,LSEQ1     ;TEST FOR FIRST POSSIBLE SEQUENCE
0879 CD8B08             CALL COMPSEQ    ;DONT RETURN IF VALID
087C 111A09             LXI D,LSEQ2     ;TRY SECOND, ETC
087F CD8B08             CALL COMPSEQ
0882 112409             LXI B,LSEQ3
0885 CD8B08             CALL COMPSEQ
0888 C34F08             JMP FINSEQ      ;MUST BE INVALID
                ;
088B =          COMPSEQ EQU $
088B E5                 PUSH H          ;SAVE STRING LOCATION
                ;
088C =          COMPSEQ1 EQU $
088C 1A                 LDAX D          ;GET EXPECTED VALUE
088D BE                 CMP M           ;COMPARE TO VALUE IN BUFFER
088E C25708             JNZ FINCOMPSEQ  ;RETURN IF DIFFERENT
0891 23                 INX H           ;OTHERWISE NEXT
0892 13                 INX D
0893 1A                 LDAX B          ;LAST CHAR IN SEQUENCE?
0894 B7                 ORA A
0895 F28C08             JP COMPSEQ1
0898 EB                 XCHG            ;YES, NOW GET BRANCH TABLE ADDRESS
0899 1A                 LDAX D          ;A=LAST DIGIT OF SEQ
089A 23                 INX H
089B 5E                 MOV E,M
089C 23                 INX H
089D 56                 MOV D,M         ;GET ADDRESS FROM TABLE
089E EB                 XCHG            ;INTO HL
089F D1                 POP D
08A0 D1                 POP D           ;RESTORE STACK POINTER
08A1 C34131             JMP JMPTAB      ;COMPUTE ROUTINE ADDRESS AND JUMP THERE
                ;
                ;BRANCH TABLE BASED ON NUMBER OF KEYS IN BUFFER
08A4 =          KBLTAB  EQU $           ;AT ROUTINE, (POP RP)->FIRST CHAR
08A4 4E08               DW FINSEQP      ;0 KEYS, INVALID ENTRY
08A6 6D08               DW ONEDEC       ;1 KEY, DECIDE
08A8 4E08               DW FINSEQP      ;2 KEYS, INVALID
08AA 4E08               DW FINSEQP      ;3 KEYS, INVALID
08AC 4E08               DW FINSEQP      ;4 KEYS, INVALID
08AE 3108               DW RBLOADP      ;5 KEYS, MAY BE REMOTE BASE FREQ LOAD
08B0 4E08               DW FINSEQP      ;6, INVALID
08B2 4E08               DW FINSEQP      ;7, INVALID
08B4 7508               DW EIGHTDEC     ;8, DECIDE
08B6 4E08               DW FINSEQP      ;9, INVALID
08B8 4E08               DW FINSEQP      ;10, INVALID
                ;
                ;BRANCH TABLE FOR ONE ENTRY BUFFER
08BA =          ONETAB  EQU $
U08BA 0000              DW KEY0         ;0
U08BC 0000              DW KEY1         ;1
U08BE 0000              DW KEY2         ;2
U08C0 0000              DW KEY3         ;3
U08C2 0000              DW KEY4         ;4
U08C4 0000              DW KEY5         ;5
U08C6 0000              DW KEY6         ;6
U08C8 0000              DW KEY7         ;7
U08CA 0000              DW KEY8         ;8
U08CC 0000              DW KEY9         ;9
08CE 4F08               DW FINSEQ       ;(BLANK)
U08D0 0000              DW KEYSTAR      ;*
U08D2 0000              DW KEYPOUND     ;#
                ;
                ;
                ;1234567X BRANCH TABLE
08D4 =          T123TAB EQU $
08D4 4F08               DW FINSEQ       ;0
08D6 4F08               DW FINSEQ       ;1
08D8 4F08               DW FINSEQ       ;2
08DA 4F08               DW FINSEQ       ;3
08DC 7409               DW CWID         ;4
08DE 5C09               DW VOICEID      ;5
08E0 1031               DW AUTOPATCHON  ;6
08E2 4F0D               DW RBRCVRON     ;7
08E4 7F0D               DW RBRCVROFF    ;8
08E6 4F08               DW FINSEQ       ;9
                ;
                ;LONG SEQUENCES - FIRST 7 OF 8 OF COMMAND CODE
                ;  AND BRANCH TABLE ADDRESS
                ;
0910 0102030405LSEQ1:   DB 1,2,3,4,5,6,7,0FFH
0918 D408               DW T123TAB
091A 0706050403LSEQ2:   DB 7,6,5,4,3,2,1,0FFH
U0922 0000              DW T765TAB
0924 0203040506LSEQ3:   DB 2,3,4,5,6,7,8,0FFH
U092C 0000              DW T234TAB
```

plemented was 50 ms, allowing the audio to be muted gently just prior to the squelch tail or touchtone reaching the transmitter.

Audio delays can be implemented with bucket-brigade devices—particularly short delays—but the approach used here for the relatively long delay was an Intel Codec chip plus digital shift registers. The Codec is a complete two-way data acquisition system, primarily intended for use in telephone equipment. It converts an incoming audio signal to a digital bit stream, and an incoming bit stream to an audio output signal, for a two-way pulse code modulation system. As used here, however, the digital bit stream is simply delayed through the shift registers and returned to the Codec. The audio output is therefore a delayed version of the audio input. Any delay length can be accomplished by selection of the size of the shift register, but five 1024-by-1 shift registers used here provide the desired 50-ms delay.

Audio Mixers

The various audio sources in the repeater are connected to the 220 transmitter and to the phone line under computer control. AUD1 and AUD2 output ports select one or more audio sources to be enabled into the two mixers. The audio switching is solid state and is quite simple considering that there is no detectable click or pop when switched and no detectable feedthrough in an open switch. 4053B single-pole, double-throw CMOS analog switches are used. When the audio switch is open, the output is shunted to ground to eliminate any signal feedthrough. Good grounding and isolation of the CMOS switch power supply from the computer logic are important to keep out noise. The low-power Schottky control line buffers ensure clean logic levels to the CMOS, even in the presence of possible crosstalk on an interconnect cable.

Repeater Performance

No significant problems were encountered in bring-

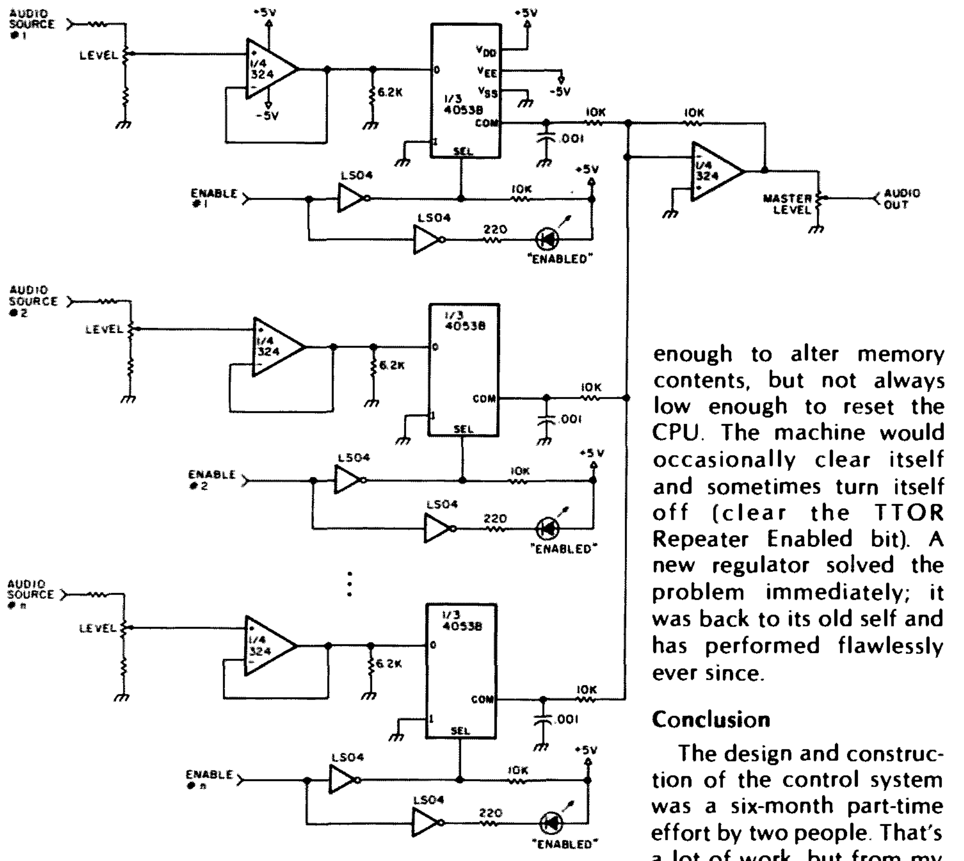

Fig. 5. Audio mixer schematic. Repeater contains one eight-input and one four-input mixer.

ing up the control system. We were concerned about rf interference from the computer's high-speed digital logic, but since the 220 receiver is very well shielded, there were no problems. The IC-22S remote base required feedthrough capacitors to be placed on all control lines leaving the repeater cabinet to keep rf off certain two-meter frequencies. RFI is something to be concerned about, but it isn't necessarily a serious problem.

When the repeater went back on the hilltop with the new controller, it worked very well. Some minor software changes were made after eight weeks—the ROMs were simply changed.

There was one failure in the system, occurring after eleven weeks. The three-terminal regulator on the computer board became intermittent—probably a high resistance internal bond, definitely not thermal shutdown. The computer's supply voltage occasionally dropped low enough to alter memory contents, but not always low enough to reset the CPU. The machine would occasionally clear itself and sometimes turn itself off (clear the TTOR Repeater Enabled bit). A new regulator solved the problem immediately; it was back to its old self and has performed flawlessly ever since.

Conclusion

The design and construction of the control system was a six-month part-time effort by two people. That's a lot of work, but from my viewpoint it was well worth it. Use of the computer in the controller allowed building in really useful features that would not have been possible without it. The software intensive approach was extremely educational and is the only practical approach for a system of this complexity. The project was the most satisfying microcomputer project I've been involved in.

Sincerest thanks go to Bruce Martin WA6EQS who shared half the work of this project. Bruce is the father of the three-year old repeater and had many of the ideas for features and their implementation in the new control system.

Don Pezzolo K6OZH contributed to the project as a resource for bouncing ideas back and forth throughout the development. His continuing encouragement throughout the project was a big factor in its successful completion. Don also manages the repeater site and keeps the machine happy in its home.

Behind the repeater is the rf expert Werner Vavken WB6RAW, who, with WA6EQS and Ray Maxfield WA6VAB, is responsible for the rf portion of the machine. Bill Melody WA6YBD installed and maintains the antenna systems.

Parts and equipment were contributed by WA6EQS, W6LVY, W6YJL, WA6VAB, and WB6WDP.■

Standard			ASCII		
zero	forty	dollars	space	six	J
one	fifty	cents	x-point	seven	K
two	sixty	pounds	quote	eight	L
three	seventy	ounces	number	nine	M
four	eighty	total	dollars	colon	N
five	ninety	please	percent	semicolon	O
six	hundred	feet	and	less than	P
seven	thousand	meters	apostrophe	equals	Q
eight	plus	centimeters	left paren	greater than	R
nine	minus	volts	right paren	mark	S
ten	times	ohms	star	at	T
eleven	over	amps	plus	A	U
twelve	equals	hertz	comma	B	V
thirteen	point	DC	minus	C	W
fourteen	overflow	AC	point	D	X
fifteen	clear	down	slash	E	Y
sixteen	percent	up	zero	F	Z
seventeen	and	go	one	G	lowercase
eighteen	seconds	stop	two	H	tone
nineteen	degrees	tone (low)	three	I	uppercase
twenty		tone (high)	four		up arrow
thirty		oh	five		control

Table 5. Telesensory Systems Mini Speech Synthesis PC boards vocabulary.

Make a Microcomputerist Smile

—build him this EPROM eraser

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One of my friends, who is deep into the home-computer hobby, had a difficult time locating an eraser for his 2716 EPROM. He finally located one that was built into a plastic tape-cartridge storage box and it worked fine. A quick look inside the box revealed that the manufacturer simply epoxied a pair of sockets to the edges of the box, bolted a small fluorescent ballast to it, drilled a hole for the line cord, and included the usual 4-wire fluorescent starter switch. El Cheapo at its best, but we wondered about the safety of the device as we had heard of the potential injury to eyes and skin from exposure to ultraviolet (UV) rays. The tube used in the device was a Sylvania G8T5—remember this, as it's important.

The next EPROM eraser we saw was built by someone with a much better concept. It had an all-metal case with a drawer that held the EPROM in conductive foam. The drawer had to be in place before a switch was operated to complete the circuit. No UV leakage, no unintentional viewing of UV. This one also had a 60-minute timer built in. It appears that the bulb used by the latter device has a much stronger output, for the suggested erasing times were in the area of 20-30 minutes. The bulb has a house number and no doubt is made by or for that company and thus would not readily be available to the home constructor.

The next chapter in this story comes from a 14-page General Electric manual, "Germicidal Lamps," TP-122, from their Large Lamp Department. I obtained a copy of this from the local industrial dealer for these lamps. An inquiry to them on the Sylvania number revealed that GE and others (Norelco) also make this lamp for air irradiation and other germicidal devices. We joked about the UV bulb in the electric razor at the airport (ten minutes, two bits)... all along my friend could have erased the EPROM while he was shaving! (Also used at the bowling alley to sterilize the rental shoes.)

But something good did come of this pursuit. Whereas the electric dealer would order the bulbs only in quantities of 24 or more, we found that the local barber and beauty supply house had them in stock and would sell them at retail for about ten dollars. Click. A small 6- to 8-Watt fluorescent tube ballast and switch are another six or seven dollars; everyone has a microswitch in his junk box for the absolutely mandatory interlock switch. Click. LMB and others make metal boxes; plywood is cheap; the tube is nominally 12" long, and the EPROM should end up *under* the lamp, about 1" from it, centered along the bulb, and impressed in the black conductive foam it came in. *Under* the bulb is specified so that the UV rays and not the heat from the bulb work on the EPROM. The effective length of the UV radiation is 8½", so cluster the EPROMs from the center of

Tube: G8T5
Nominal Watts: 8
Nominal length: 12"
Tube diameter: 5/8"
Approx. lamp Amps: 0.160
Approx. hours of life: 7500
Effective UV length: 8½"
UV output @ 2537 angstroms at 100 hours, Watts: 1.3
Average UV output through life: 0.98 Watts
Max. intensity perpendicular to bare tube:
Watts/Square Foot at:
1 ft—0.14
8"—0.315
4"—0.86
2"—0.75
These are averages at 100 hours life; initial ratings about 20% higher, decreasing to an average of 0.75 ratings above, through life.

Fig. 1. Useful data if you "roll your own." Source: General Electric TP-122, Large Lamp Department.

the bulb.

Back to the GE manual. To allay any fears about the use of UV at all, I quote, ". . . Prolonged exposures or exposures to high intensities of ultraviolet energy can cause conjunctivitis (inflammation of the outer membrane of the eyes) and a reddening, or burns, of the skin. The glass used in conventional eyeglasses affords adequate protection. However, care should be taken that the UV energy does not enter the eyes from the side, nor is reflected into the eyes from the back side of the glass. To protect the face, clear plastic face shields are available . . . General practice is to consider 0.5 microwatts per square centimeter of 2537-angstrom energy in a 7-hour period to be the maximum safe exposure without protection. An equivalent amount of exposure will be obtained from a bare 30-Watt lamp in one minute at 18 inches or in one hour at 12 feet."

Most of the rest of the manual describes the use of the family of germicidal lamps—from a 2¼" length to the largest, which is 64"; the lamps are used in everything from air cleaners to meat-cooling rooms to pharmaceutical manufacturing. But what should interest us the most is that the spectral response of these mercury vapor lamps peaks at 2537 angstroms, the exact wavelength called out for *all* EPROM erasures.

Fig. 1 is a compilation of data that will be of use to you if you choose to "roll your own." Fig. 2 shows typical wiring for a unit. Note in this latter drawing that the fluorescent switch, a 4-wire unit, performs the function of on-off and start, without a starter. If this switch is not available, one could use two separate ones, an SPST on-off switch and an SPST normally-open push-button for the momentary depress-to-start.

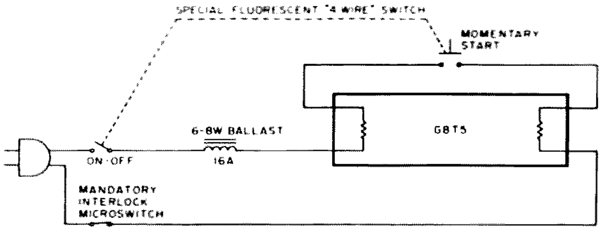

Fig. 2. Typical wiring.

It probably wouldn't hurt to fabricate a reflector from soft cardboard and then cover it with shiny aluminum cooking foil. Place this a couple inches above the lamp; it can only increase the UV intensity to the EPROM. Provide a small hole (¼" will do) covered with milky white plastic to act as a pilot lamp. Try a one-hour exposure as a beginning point.

In summary, you *can* have an ultra EPROM eraser, violet, for about $20, some ingenuity, and a lot of fun . . . but only if you promise to observe the strict cautions from the GE manual, which suggests that all products using germicidal lamps bear a prominent, highly legible CAUTION warning that no one should look directly at a lighted lamp or work near it without adequate eye (and skin) protection. Don't forget that interlock switch, be it on a tray or door! ■

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Build a Talking Digital IDer

—K2OAW redesigns his IDer at last

When my CW identifier and repeater control circuit article appeared in the February and March, 1973, issues of *73 Magazine*, I thought that those circuits were about as modern and simple as they could get. Over the years, I've heard of printed circuit boards and kits being sold at hamfests, and several ham repeater manufacturers have used the CW identifier circuit in their systems. The identifier also has been used in RTTY stations to provide Morse code identification.

But times do change; several articles have appeared in *73 Magazine* giving circuits which modified or expanded the original design. I finally decided that it was time for a new identifier design.

Here is an identifier circuit which should renew interest in identifiers for a while. It uses six ICs, the same as the 1973 version, but this identifier talks.

Yes, you read it right. It doesn't whistle or hum your call—it says it right out loud, in plain English, for the whole world to hear. A little muffled, perhaps (after all, what can you expect from six commonly-available ICs?), but clear enough to understand.

I'm having some fun with mine right now. It's sitting on my office desk (with a little IC timer setting it off about once a minute) quietly mumbling "Bah, humbug!" to anyone within earshot!

Although it makes a great conversation piece, that is not its main purpose. I started designing this identifier while driving on a long vacation trip last summer. Every half hour or so, I would remember to key up my 2-meter rig on .52, hoping that somebody would come back. In the meantime, a hundred hams could have passed me by going in the opposite direction. But unless I picked up the mike and gave my call every minute or two, the chances of either one of us knowing about the other were slim. Wouldn't it be nice (I thought) to have an automatic IDer which would key up the rig every minute or so and announce itself? If there were anybody around, they surely would

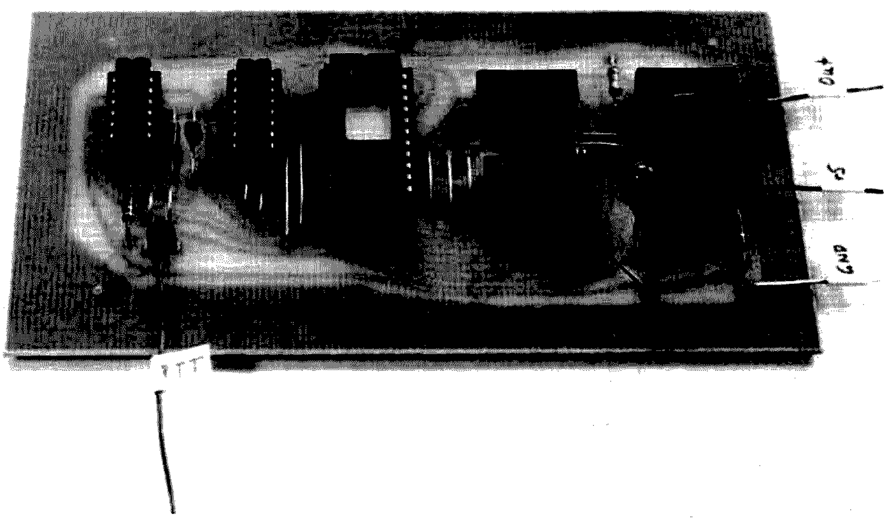


Photo A. Talking identifier.

hear me. And voilà—necessity was the mother of invention.

The identifier uses an EPROM (Erasable Programmable Read Only Memory) to store the voice data to be spoken. The secret, of course, is in knowing how to program this EPROM. I do the programming on my SWTP 6800 computer system, but it could be done on another computer just as well. This article includes the programs and a PC board layout to make your job easier. (Etched and drilled PC boards as well as preprogrammed EPROMs are available from Star-Kits, PO Box 209, Mt. Kisco NY 10549.)

How It Works

There are many ways either to store a real sound recording in a digital memory or to synthesize a fake voice. Quite a few voice synthesizers are available today, ranging from the Texas Instruments Speak and Spell™ to the Computalker synthesizer available for S-100 computers and the Radio Shack synthesizer for the TRS-80. Unfortunately, most of these are fairly complex, require some custom-integrated (and often secret) circuits, and are difficult to program.

Simply storing a digital image of a real voice and playing it back from memory turns out to be much easier and cheaper. That is how this identifier works. Its EPROM contains a digitized "recording" of a voice (which had been digitized previously on a computer), and a fairly simple circuit then scans the memory and "plays" it back. The only problem is to store the voice recording in such a way that it doesn't exceed the capacity of the EPROM.

If memory capacity were not a problem, then the voice pattern could be stored with voice fidelity better than any commercial hi-fi recording. In fact, digital stereo recording is the latest technique on the hi-fi scene because it can provide frequency response and distortion figures beyond anyone's wildest dreams of just a few years ago. But there is a price to be paid—very large amounts of digital data are involved. Digital recording often is done with videotape recorders which can record and play back millions of bits per second. Squeezing two seconds worth of voice into an EPROM which contains just 16,384 bits obviously requires some compromises, and it results in audio quality which is far from hi-fi. But it works.

To see how voice can be digitized, look at Fig. 1(a). Here we see a typical sound waveform such as might be picked up by a microphone. In order to digitize that waveform, we sample it at fixed, periodic intervals, and digitize the voltage that that waveform has at those instants of time.

For instance, suppose we measure the waveform voltage at the points marked with a dot, convert the value of that voltage to a binary number, and store it. If that is later "played" back, we get the waveform shown in Fig. 1(b). The result is a square waveform which changes to a new value at each of the sampling points.

Although the square wave doesn't look anything like the original audio signal, if it is fed through a low-pass filter the sharp corners will be chopped off and the signal will look a bit better.

If, on the other hand, we were to sample the audio signal more often—not only at the dots but also at the intermediate points marked with an X—and digitize that, the resulting waveform, shown in Fig. 1(c), would be a better approximation.

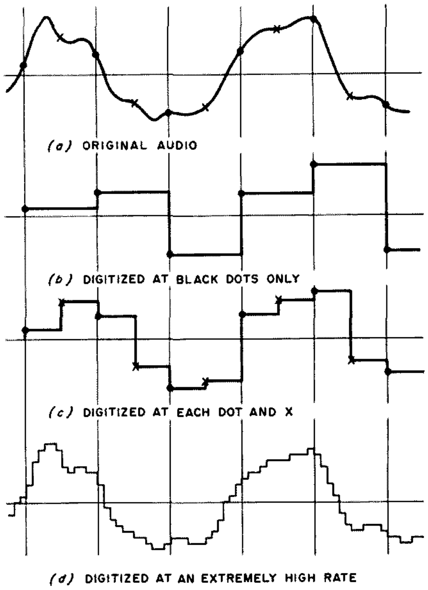


Fig. 1. Digitizing audio at various sampling rates.

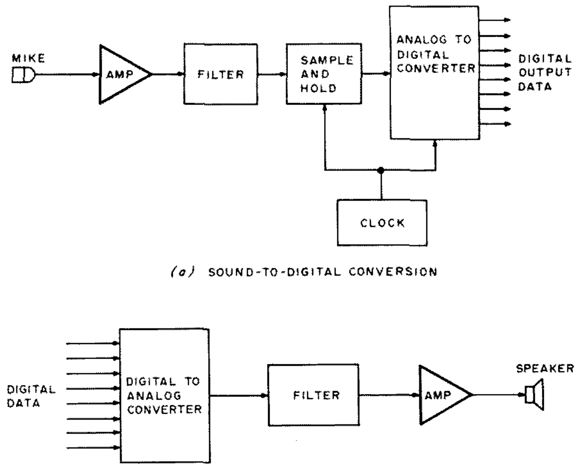
Fig. 1(d) shows that when we digitize very often, we get the best waveform yet. Although this waveform does have some sharp corners, they occur at a very high frequency and would be removed very easily with a filter.

How often must we digitize to get an acceptable digitized waveform? There is a rule called the "sampling theorem" which says that the sampling rate must be at least twice the frequency of the highest frequency component in the audio signal. In other words, a hi-fi signal with a frequency response to 20,000 Hz would have to be sampled at least 40,000 times per second. A communications-quality voice signal with a response to 4000 Hz would require sampling at least 8000 times per second.

We can get an idea of this from Fig. 1(b). Sampling at the black dots is enough to get a waveform which follows the large swings of the audio waveform which have a low frequency but cannot capture the small squiggles that have a high-frequency component. To get those, we need a high sampling rate.

Fig. 2 shows a block diagram of the circuitry which would be needed to do the digitizing. Starting with the audio signal, the signal is amplified and sent through a low-pass filter. The purpose of the filter is to remove those frequencies which are too high to be digitized (that is, more than half the frequency of sampling). These components have to be removed to avoid further distortion during the digitizing.

The filtered signal is now sent to a sample-and-hold circuit. This circuit takes a sample of the waveform and holds it in a capacitor while the analog-to-digital (A/D) converter converts the resulting voltage to a binary number. This is necessary because most A/D converters require a steady input voltage while they are converting; if the voltage is changing, then they will probably convert the voltage to the wrong value. Both the sample-and-hold circuit as well as the A/D converter are driven by a



(a) SOUND-TO-DIGITAL CONVERSION

(b) DIGITAL-TO-SOUND CONVERSION

Fig. 2. Circuitry needed to digitize audio.

clock oscillator which sets the rate at which the input signal is sampled.

The output of the A/D converter is now a binary number which can be stored in memory or recorded on tape. When the digitized data is played back, as shown in Fig. 2(b), the binary data is converted back to an analog signal with a digital-to-analog (D/A) converter, passed through a low-pass filter to remove the sharp corners from the wave, amplified, and fed to a speaker.

Now that we know how often a sample should be taken of the input wave, we have another question: How accurately must it be digitized in the A/D converter? This is related to the number of bits produced by the converter for each sample.

A binary number consisting of just one bit can take on only one of two values—either 0 or 1. A binary number consisting of two bits can have values of 00, 01, 10, or 11, a total of four different values. In general, a number which consists of n bits can take on 2^n different values. For instance, ten bits allow 1024 different numbers.

Suppose the converter produces a binary number consisting of just one bit. That one bit is not enough to indicate the precise voltage of the input. With one bit, we can tell only whether the input was positive or negative. This obviously will lead to a very distorted wave, since we cannot hope to keep all the little squiggles in the audio signal.

On the other hand, a ten-bit number can represent 1024 different numbers. Thus, we could measure and encode 512 different positive voltage levels and 512 different negative voltage levels. Thus, the more precise we want our measurements of the sample voltages to be, the more bits we need for each measurement.

In a hi-fi system, we often try to get a signal-to-noise ratio (S/N) of 60 dB or more. 60 dB is a voltage ratio of 1000 to 1, so that we must be able to reproduce two signals even if one is 1000 times larger than the other. This requires being able to measure at least 1000 different positive voltage levels and 1000 different negative voltage levels, for a total of 2000 different voltage levels. Since $2^{11} = 2048$, we need at least 11 bits for this. By the time you add a few more bits to allow these signals to be reproduced with low distortion and to give a little "headroom" so that an occasional burst of extra volume can get through, you are close to 14 bits per sample.

The digital systems being proposed in the hi-fi industry use between 14 and 18 bits per sample; 14 bits are used in consumer products and up to 18 bits are used in the studio-quality recorders which produce the master tapes.

How many bits per second (bps) does this add up to? For pure hi-fi, we need at least 40,000 samples per second, each with at least 14 bits, for a minimum of 560,000 bps (and up to 2 MHz in studio-quality systems). At a rate of 560,000 bps, a 16,384-bit EPROM would provide hi-fi for about 0.03 second. Not enough for a grunt, let alone a ham call.

So we must limit the number of bits per second. This is done by drastically reducing the sampling rate and also reducing the number of bits from the A/D converter.

To squeeze a two-second call into this ROM, we can store 8192 bps. At a sampling rate of 8000 Hz or so (to cover the communications audio range to 4000 Hz), that gives us about one bit per sample. This means that we don't need a complex sample-and-hold circuit, an A/D converter, or even a D/A converter. All we need is some circuit which can tell whether the input audio is positive or negative at the sampling intervals, and which produces a one-bit output—1 if positive, 0 if negative. That turns out to be very simple to do.

The disadvantage is that our voice recording will be very distorted. But by heavily filtering the output with a low-pass filter, we can remove some of that distortion and make the result quite understandable.

The Talking Identifier

Let's leave for a moment the question of how you "record" the voice and store it in the ROM, and look at the circuit of the talking IDer itself, Fig. 3.

The voice pattern is stored in a 2716 EPROM. This is a memory IC currently selling for about \$10-\$15. It is organized as 2K × 8, meaning that it has 2K storage locations (which is 2048), each holding an 8-bit number.

Each of those 2K locations has an address, a binary number which ranges from 00000000000 to 11111111111. This 11-bit address is fed to the EPROM via the A10 through A0 address pins shown at the bottom of the IC. Each time we give the EPROM an address, it outputs the contents of the addressed location on the eight data lines, D7 through D0, shown on the right side of the EPROM.

The eight bits in the location come out in parallel, meaning all at the same time. But we want the bits one at a time, roughly 1/8000 of a second apart, since each bit represents one sample of the recorded voice pattern. (Over a space of two seconds there is a total of 16,384 samples or bits, which are stored in consecutive locations on the EPROM. The first eight bits are in memory location 00000000000, the next eight bits are in location 00000000001, and so on, up to the last eight bits, which are in location 11111111111.)

The job of splitting up the eight bits in one location into individual bits is handled by the 74LS151 multiplexer. This IC behaves like an SP8T switch which is continuously rotating, scanning the eight bits coming in from the EPROM

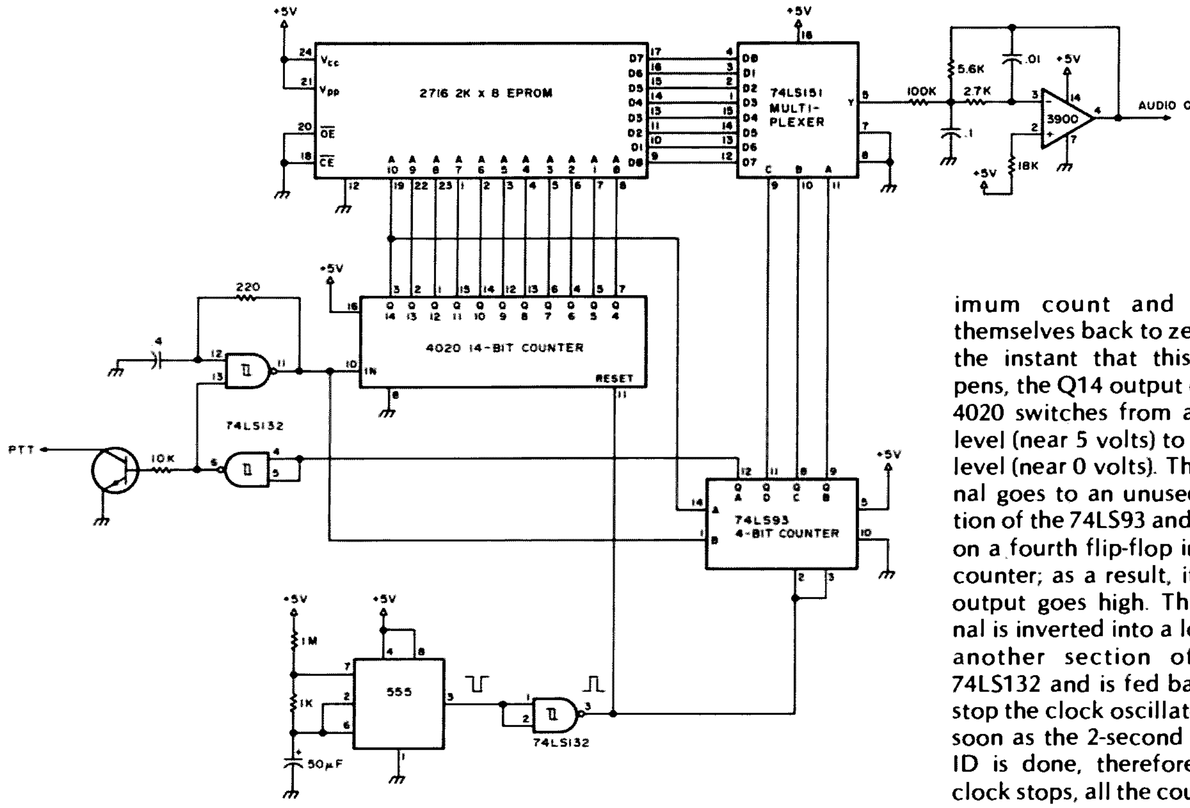


Fig. 3. Talking identifier diagram.

much like the distributor in a V8 car engine. It changes the parallel data coming into the multiplexer into serial data. The result, on pin 5 of the multiplexer, is a square wave which carries the frequency components of the voice but, of course, doesn't have any amplitude information because amplitude was never digitized. This signal is fed into an active low-pass filter which uses an LM3900 Norton op amp, and which cuts off at just under 4000 Hz. This provides the audio output.

The rest of the circuit simply provides different addresses to the EPROM to scan through its memory and also drives the multiplexer.

This part of the circuit starts with one section of a 74LS132 quad, two-input NAND, Schmitt-trigger IC which, along with a 220-Ohm resistor and 0.4-uF capacitor, forms an oscillator which oscillates at about 8 kHz. The output of this oscillator is sent to pin 10 of a 4020 CMOS counter.

The 4020 is a 14-stage ripple counter which contains fourteen flip-flops. Since $2^{14} = 16{,}384$, this counter can count off 16,384 clock pulses. Since the clock frequency is about 8 kHz, if we start this counter at a count of 0, it will take approximately two seconds to count up to its maximum count. As it does so, it's counting off the 16,384 data bits which are being converted into an audio signal.

We really need 14 outputs from that counter to drive the EPROM address lines and the multiplexer. Unfortunately, to save on pins the 4020 provides only the 11 outputs from the 4th flip-flop (Q4) through the 14th flip-flop (Q14); the outputs of the first three flip-flops are not accessible. So, we have a second counter, which is a 74LS93 binary counter. The oscillator signal which goes to the 4020 goes also to the B input, pin 1, of the 74LS93. Three of the flip-flops in this IC (called B, C, and D) count in parallel with the first three flip-flops of the 4020, and give us the missing signals.

These three signals, on pins 11, 8, and 9 of the 74LS93, change very rapidly and continuously drive the multiplexer which, therefore, scans the output of the EPROM at a high speed (one bit every 1/8000 second).

The eleven bits from the 4020 have a lower frequency and, therefore, drive the address lines of the EPROM at a slower rate (one address every 1/1000 second). Thus, the EPROM feeds out a new group of eight bits every 1/1000 second. Since there are 2K such groups, this again takes about two seconds.

When the two seconds are up, the 4020 and 74LS93 counters reach their maximum count and reset themselves back to zero. At the instant that this happens, the Q14 output of the 4020 switches from a high level (near 5 volts) to a low level (near 0 volts). This signal goes to an unused section of the 74LS93 and turns on a fourth flip-flop in that counter; as a result, its QA output goes high. This signal is inverted into a low by another section of the 74LS132 and is fed back to stop the clock oscillator. As soon as the 2-second voice ID is done, therefore, the clock stops, all the counters (except the A flip-flop in the 74LS93) freeze at zero, and the IDer stops.

The IDer is restarted by resetting all counters to zero with a positive pulse coming out of pin 3 of still another section of the Schmitt trigger NAND. This start signal could be generated externally, but for use with a 2-meter FM rig on 146.52 we have a 555 timer which automatically generates a very short reset pulse every 30 seconds or so. This pulse resets the A flip-flop in the 74LS93, which releases the clock and starts the ID process all over again.

Connected to the clock control line is an NPN transistor. When the clock is running (that is, when the IDer is identifying), that transistor is turned on; when the IDer is off, so is the transistor. By connecting the collector to the push-to-talk (PTT) line of the rig, the IDer automatically keys the transmitter while it is identifying. This circuit is suitable only for

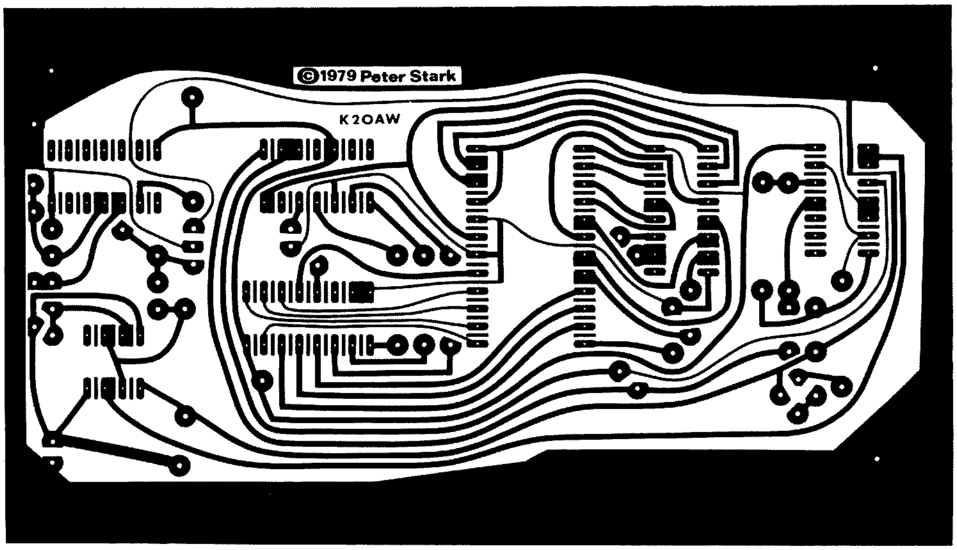


Fig. 4. PC board, copper side.

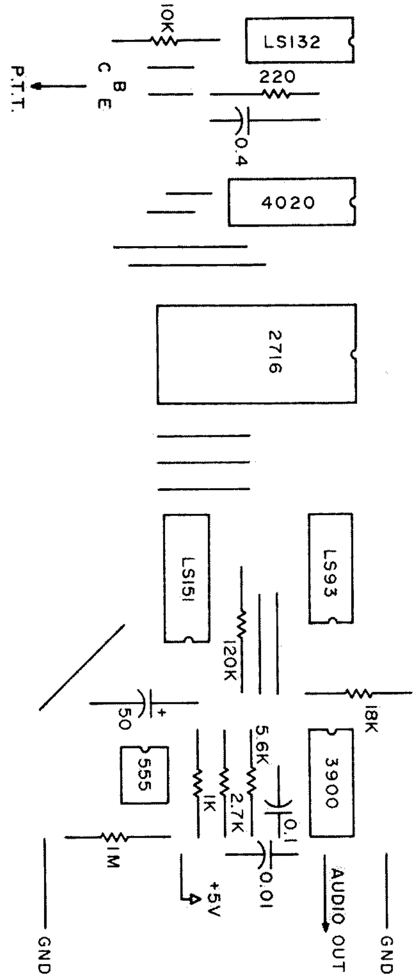


Fig. 5. Parts layout.

driving the PTT line in small, transistorized transceivers. Those rigs which require large currents to drive a PTT relay may require an additional buffer transistor.

Although there are no potentiometers in the circuit, there are several components which may require adjustment. The 100k resistor in the active filter is chosen to provide a fairly small output audio level; if more audio signal is needed, it can be reduced to as low as 5k. Incidentally, do not use disc capacitors in the active filter circuit. Use good quality polystyrene or dipped mica caps.

The oscillation frequency of both the 74LS132 oscillator and the 555 timer depends on the tolerance of the resistors and capacitors used. Since capacitors, especially, tend to have very wide variations, some trimming may be needed to get the right results. To vary the spacing between IDs, you may want to increase or decrease the capacitor value in the 555 timer circuit.

If the 74LS132 oscillator runs too fast or too slow, the voice pattern in the EPROM will be scanned too fast or too slowly, with the same result as when a record is played too fast or too slow. You may like the Donald Duck quality this gives, but for best results you should trim the RC values in this oscillator for the most natural speech sound.

The circuit layout is not critical, and almost any construction method will work, including wire-wrap and temporary prototype socket hookup. If desired, you can use the printed circuit board shown in Fig. 4. Fig. 5 shows the parts layout for the PC board.

The identifier needs approximately 100 mA of +5 volt power. This is provided easily by a three-terminal regulator. If you use the IDer in your mobile, simply include the regulator circuit of Fig. 6. Assuming a load current of 100 mA and a worst-case auto battery voltage of 16 volts, the regulator must drop 11 volts for a power dissipation of 1.1 Watts. With a good heat sink, all this can be dropped in the three-terminal regulator itself; by adding a 39-Ohm, 2-Watt resistor as shown in the circuit, however, we drop 3.9 volts across the resistor. This removes almost .4 Watts of heat from the regulator and dissipates it in the resistor instead.

For applications that require even lower power (such as for battery-powered applications), total circuit power can be reduced even more by lifting the chip enable pin (pin 18) of the 2716 from ground and connecting it instead to pin 12 of the 74LS93. This disables the 2716 when the circuit is not identifying. The circuit still draws around 100 mA when identification is in progress, but cuts it down to less than half during other times.

"Recording" the EPROM

To digitize the audio signal, we need a filter to remove high-frequency components above 4000 Hz and a comparator circuit to

sense the polarity of the input audio. This circuit uses another LM3900 quad Norton op amp and is shown in Fig. 7.

One op-amp in the LM3900 is used as an active low-pass filter with a cutoff frequency of just under 4000 Hz. This amplifier/filter has a small amount of gain but not enough to accept the weak signal from a microphone. It is designed for use with an external mike preamp or with the higher-level output of a tape recorder. I generally record the desired message on tape first and then feed the speaker output of the recorder to the audio input of this circuit.

A battery-operated recorder is best in this case, since with a high gain it is possible for hum to be digitized between words. Hum gets swamped out during speech, but when there is silence, the circuit works much like a volume compressor by boosting low-level sounds. Thus, a good S/N ratio is essential. The 10k volume control on the input helps to cut down excessive signal; its correct adjustment is important.

The output of the filter is sent to another op-amp section of the LM3900, which is used as a slicer or comparator. The signal coming from the filter is sent to one input of this op amp while a reference current from the 10k zero-set pot is fed to the other. As the filtered audio output goes above or below the reference signal, the digital output from pin 9 switches between 0 and +5 volts.

The 10k zero-set pot should be adjusted so that with the audio input shorted to ground, the output is just on the verge of switching between 0 and +5 volts. With proper adjustment, positive audio peaks will clip the digital output one way while negative peaks flip it the other way.

For testing purposes, an audio amplifier/speaker combination can be connected to the digital output to monitor the signal after it has been digitized; I use an inexpensive Radio Shack signal tracer for this purpose. The digitized signal is supposed to be filtered before being heard, so this signal will sound excessively harsh, but it is good enough to give you an idea of whether the circuit is working.

Once we have the one-bit digital output, we *must* sample it at intervals of about 1/8000 second, convert the samples into 8-bit bytes, and store them. Before burning them into the EPROM, however, it is very convenient to be able to "play" them back to make sure that the volume controls have been set right and that we have the right voice segment. It also would be very convenient if in some way we could edit the digital code to eliminate any noise just before and after the call. In other words, it would be very convenient if we could store the message in RAM and read or modify it before it is permanently stored in EPROM.

Building a special piece of hardware for just this purpose is difficult and expensive. Fortunately, most home or personal computers have an input and output port which could be used to input or output this one-bit digital signal and also have RAM which could be used to store the code temporarily. This makes the job almost trivial.

To do this, you need a program which will input data, group bits together in sets of 8, and store them. In most cases, this program has to be written in machine or assembly language since most BASIC systems are not fast enough to take 8000 samples per second and process them.

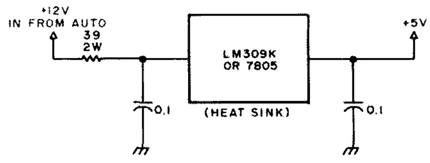


Fig. 6. Voltage regulator for mobile use.

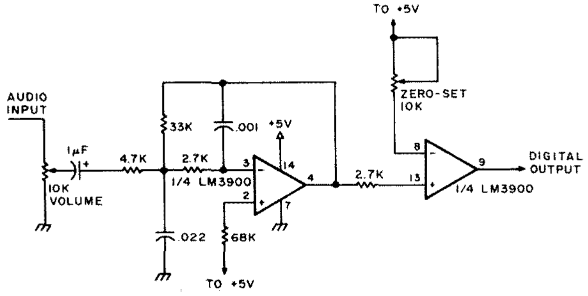


Fig. 7. Audio-to-digital conversion circuit.

Obviously, the program will depend on the particular computer used, but as a starter, I'm including here three programs written for an SWTP 6800 system which are very useful.

Parallel input/output on 6800 systems is usually handled by an IC called a PIA or Peripheral Interface Adapter. Although this IC has twenty input/output pins, only two are used in this application—bit 0 of port A gets the input from the circuit of Fig. 7, while bit 1 of the same port feeds an audio amplifier/speaker combination which is used to listen to the recorded sound.

Program 1 is an echo program which is used only for testing. It inputs via bit 0, outputs the bit right back to bit 1 of the input/output port, and then waits for a short while to simulate the delay between samples. When everything is running correctly, the audio coming out of the computer will sound very similar to the audio you could hear directly at the output of the circuit of Fig. 7. (It, too, will sound harsh because of the lack of filtering.)

The program starts by initializing the PIA to set up the correct bits for input and output. The main part of the program (starting at

```
                ********************************************
                *                                          *
                * THIS PROGRAM INPUTS DATA FROM PORT A BIT 0 *
                * OF A PIA IN PORT 7, AND ECHOES IT TO BIT 1 *
                *                                          *
                ********************************************

  (801C)        PIADAT EQU   $801C      PORT A DATA/DIRECTION REG
  (801D)        PIACTL EQU   PIABAT+1   PORT A CONTROL REGISTER

  (0100)               ORG   $0100
0100 7F 801D  START    CLR   PIACTL     RESET PIA
0103 86 02             LDA A #$2        SET BIT 0=INPUT, BIT 1=OUTPUT
0105 B7 801C           STA A PIADAT
0108 86 04             LDA A #$4        RESET BACK TO DATA
010A B7 801D           STA A PIACTL
010D B6 801C  LOOP     LDA A PIADAT     LOAD DATA FROM PORT A BIT 0
0110 4B                ASL A            SHIFT LEFT INTO BIT 1
0111 B7 801C           STA A PIADAT     OUTPUT TO PORT A BIT 1
0114 8D 02             BSR   WAIT
0116 20 F5             BRA   LOOP       GO BACK AND REPEAT

                * FOLLOWING WAIT ROUTINE INTRODUCES A DELAY
                * WHICH PERMITS SAMPLING RATE TO BE CHANGED

0118 CE 0010  WAIT     LDX   #$0010     INITIALIZE INDEX REGISTER
011B 09       WAIT1    DEX              DECREMENT INDEX
011C 26 FD             BNE   WAIT1      REPEAT IF NOT YET ZERO
011E 39                RTS              OTHERWISE RETURN
```

Program 1. Echo test.

```
**********************************************
*                                            *
* THIS PROGRAM INPUTS DATA FROM PORT A BIT 0 *
* OF A PIA IN PORT 7, PACKS 8 BITS PER BYTE, *
* AND STORES THE DATA IN MEMORY LOCATIONS 1000 *
* TO 7FFF.                                   *
*                                            *
**********************************************

 (801C)        PIADAT EOU   $801C      PORT A DATA/DIRECTION REG
 (801D)        PIACTL EQU   PIABAT+1   PORT A CONTROL REGISTER

 (0100)               ORG   $0100
0100 7F 801D  START   CLR   PIACTL     RESET PIA
0103 86 02            LBA A #$2        SET BIT 0=INPUT, BIT 1=OUTPUT
0105 B7 801C          STA A PIADAT
0108 86 04            LBA A #$4        RESET BACK TO BATA
010A B7 801D          STA A PIACTL
010D CE 1000          LDX   #$1000     POINT TO MEMORY BUFFER ABBRESS
0110 C6 08    LOOP1   LDA B #$08
0112 F7 0132          STA B BITCTR     COUNT 8 BITS PER BYTE
0115 4F               CLR A            ERASE A ACCUMULATOR
0116 F6 801C  LOOP2   LDA B PIABAT     READ BATA INTO B ACCUMULATOR
0119 C4 01            ANB B #$01       MASK OFF EVERYTHING EXCEPT BIT 0
011B 48               ASL A            SHIFT A ACCUM LEFT
011C 1B               ABA              ADD NEW BIT FROM B TO A
011D C6 10            LDA B #$10       SET UP COUNTER FOR SAMPLING DELAY
011F 5A       WAIT    DEC B            DECREMENT B
0120 26 FD            BNE   WAIT       REPEAT IF NOT YET ZERO
0122 7A 0132          DEC   BITCTR     DO FOR 8 BITS
0125 26 EF            BNE   LOOP2      GET NEXT BIT
0127 A7 00            STA A 0,X        STORE BYTE WHEN COMPLETED
0129 08               INX              INCREMENT INDEX REGISTER POINTER
012A 8C 7FFF          CPX   #$7FFF     CHECK FOR END OF MEMORY
012D 26 E1            BNE   LOOP1      REPEAT IF OK
012F 7E E0D0          JMP   $E0D0      RETURN TO MONITOR WHEN DONE

0132          BITCTR RMB    1          BIT COUNTER TO COUNT 8 BITS
```

Program 2. Input.

```
*****************************************
*                                       *
* THIS PROGRAM GETS BATA FROM MEMORY    *
* LOCATIONS 1000-7FFF, UNPACKS IT INTO  *
* INDIVIDUAL BITS, AND OUTPUTS TO PORT A *
* BIT 1 OF A PIA IN PORT 7.             *
*                                       *
*****************************************

 (801C)        PIADAT EQU   $801C      PORT A DATA/DIR REGISTER
 (801D)        PIACTL EQU   PIADAT+1   PORT A CONTROL REGISTER

 (0180)               ORG   $0180
0180 7F 801B  START   CLR   PIACTL     RESET PIA
0183 86 02            LDA A #$2        SET BIT 0=INPUT, BIT 1=OUTPUT
0185 B7 801C          STA A PIADAT
0188 86 04            LDA A #$4        RESET BACK TO DATA
018A B7 801D          STA A PIACTL
018D CE 1000          LDX   #$1000     POINT TO MEMORY DUFFER ADDRESS
0190 C6 08    LOOP1   LBA B #$08
0192 F7 01B4          STA B BITCTR     COUNT 8 BITS PER BYTE
0195 A6 00            LDA A 0,X        GET NEXT BYTE FROM MEMORY
0197 16       LOOP2   TAB              TRANSFER IT TO B REGISTER
0198 48               ASL A            SHIFT A ACCUM LEFT 1 BIT
0199 59               ROL B            ROTATE B LEFT 3 BITS TO MOVE THE CURRENT
019A 59               ROL B            BIT FROM BIT 7 (LEFT-MOST) INTO
019B 59               ROL B            BIT 1 (SECOND FROM RIGHT)
019C C4 02            AND B #$02       MASK OFF EVERYTHING EXCEPT BIT 1
019E F7 801C          STA B PIADAT     OUTPUT TO PIA
01A1 C6 08            LDA B #$08       SET UP COUNTER FOR SAMPLING DELAY
01A3 5A       WAIT    BEC B            BECRENENT B
01A4 26 FD            BNE   WAIT       REPEAT IF NOT YET ZERO
01A6 7A 01B4          DEC   BITCTR     DO FOR 8 BITS
01A9 26 EC            BNE   LOOP2      IF BIT COUNTER NOT ZERO
01AB 08               INX              INCREMENT INBEX WHEN BYTE IS DONE
01AC 8C 7FFF          CPX   #$7FFF     CHECK FOR END OF MEMORY
01AF 26 DF            BNE   LOOP1      REPEAT IF OK
01B1 7E E0D0          JNP   $E0D0      RETURN TO MONITOR UHEN DONE

01B4          BITCTR RNB    1          BIT COUNTER TO COUNT 8 BITS
```

Program 3. Output.

the statement labeled LOOP) loads a bit from the PIA, shifts it left from bit 0 into bit 1, and outputs it. Then it branches to a WAIT subroutine for a short delay, after which it branches back to LOOP.

For experimental purposes, it's important to be able to calculate how many samples are taken per second. This is done by computing how many computer clock cycles are required for each instruction in the loop. In Program 1, the main loop takes 31 clock cycles plus 8 cycles for each repetition of the WAIT1 loop. With the WAIT1 loop initialized (with the LDX instruction) to run 16 times (0010 hexadecimal), the total time between samples is 31 + (16) × (8) = 159 clock cycles.

In a typical SWTP computer running with a 900-kHz clock, each clock cycle takes 1.11 microseconds, so that the total delay between samples is 177 microseconds; this translates into a sampling rate of about 5600 samples per second, which is about the minimum that can be used for acceptable results. For 8000 samples per second, the LDX instruction should be changed to run the WAIT1 loop 10 times.

Once the echo test program reveals that the A/D conversion and the computer input/output circuitry is working correctly, Program 2 can be used to input data into the computer's memory, while Program 3 is used to output it back to the speaker. Both of these programs have a WAIT loop which provides some control over the delay between samples. There is some leeway here in adjusting this delay. If the number of samples taken per second is changed above or below 8000 (to increase playing time, for instance), the clock oscillator frequency in the identifier circuit of Fig. 3 also has to be changed to a similar value or the final output will have a pitch which is too high (like Donald Duck) or too low.

Both programs are located in low memory, with the input program starting at location 0100 (hex) and the output program at 0180. They do not overlap and, therefore, can be in memory at the same time. Thus, we can input audio, store it in memory, and then output it right back.

The programs are written for a 32K computer and use locations 1000 (hex) through 7FFF to store the resultant digital data. This is a total of 28K of memory; at the rate of 1K per second, this can store a total of 28 seconds of sound. When Program 2 is finished, it returns to the monitor. Rather than calculate the sampling rate by computing the number of cycles per loop, etc., an easier way to adjust the WAIT loop is to note how long the overall program runs. If it runs exactly 1 second per K of memory used, then it is running at 8192 samples per second.

By changing the starting address (1000 hex) or the ending address (7FFF) in Program 3, we can "play" back just selected portions of the input. In this way, we can pick one of several versions of the same call, choosing the one that sounds best. This allows us to edit the data before it is stored into EPROM. Once you find the portion which sounds best, burn that portion into the EPROM and keep the rest of the EPROM data empty (an erased 2716 EPROM has a hex FF in every location). This will assure that no noise or sounds are in the EPROM other than the actual call.

Conclusions

While this talking identifier won't win any awards for hi-fi quality, it is perfectly understandable and fulfills its purpose well. It also gives you a chance to experiment with speech reproduction via digital means. In addition, it's a lot more satisfying to build such a device from commonly-available ICs than to go out and buy an expensive synthesizer chip or system. Why don't you try it?

So, if you ever hear something grumble "K2OAW" on 146.52 as I speed by your house on the nearby Interstate, maybe you'll be able to turn on your own IDer and have it come back to me.■

CORRECTIONS

May, 1980
"A 'Short-Yard' Antenna for 40/75—fits where others won't"

The spacing between the length of vertical copper or aluminum wire shown in Fig. 1, page 78, should be 8 inches, not 8 feet!

June, 1980
"Down with Interpolation—a digital display for the Triton and others"

On page 36, Fig. 1, the pin 6 of the 74196 shown going to +5 V should be pin number 10. On page 39, column 2, line 2, pins to check on the 7490 should be 8, 9, and 11.

If the readout displays changing random figures, the crystal is probably not oscillating. When ordering crystals, it is always a good idea to send along a schematic of the circuit, with values indicated, in which the crystal will be used.

As stated in the caption for Fig. 3, page 38, there are frequencies other than 409.6 kHz which can be used. If your readout works on all bands except 28 MHz, it is probably the 74C925 which is at fault. This chip is specified for a minimum response of 2 MHz—typically 4 MHz. Since the mixer frequency for the 10-meter band is 2.1 MHz, your 74C925 may have a response of less than this.

Brooks Carter W4FQ
Irmo SC

July, 1980
"ADDSCAN—now you can be two places at once"

In Fig. 2, page 52, the polarity of C1 should be reversed from what is shown. We apologize for the error in the author's call. It should be WB9SFC.

"The Sweet Sounding Probe"

The reference designators for the ICs shown in Fig. 1, page 84, were omitted. The 555 is U1; 741 is U2; and 78L12 is U3.

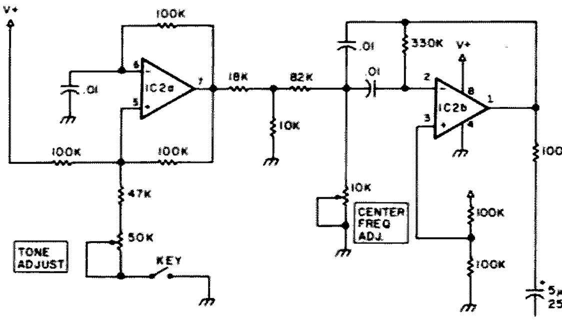
August, 1980
"On Ten FM—home of the free, land of the brave"

I'd like to add a few words of clarification to my article. The best source I've found for the CB circuit boards is Surplus Electronics (Miami, Florida) who advertise in *73*. Specify the PTBMO36AOX CB circuit board with 40-channel switch. These boards contain the easy-to-work-with PLL02A frequency synthesizer PLL chip, rather than some odd-ball chip for which there is no readily available data, and are of better quality than other boards I've seen. Sam's CB series of Photofacts, Nos. CB-129 (Midland 13-888B) and CB-131 (Hy-Gain IX), are the best sources of schematics and technical information for these boards.

John F. Sehring WB2EQG
Oradell NJ

September, 1980
"The Penultimate CPO—a non-discrete LSI device"

Pin numbers for IC2b were inadvertently left out in Fig. 2, page 62. The missing numbers are shown in the accompanying diagram.



Revised Fig. 2, "The Penultimate CPO."

October, 1980
"NASA Satellites You Can Use—with permission, of course"

In the math box on page 52, the calculations for Washington DC should have indicated that X, the difference between satellite longitude and site longitude, was obtained using Washington DC's west longitude of 77.2 degrees.

Joseph D. Novak K4OVK
Vienna VA

Map of States Worked

A calming note to our readers in British Columbia and Michigan: No, Vancouver Island has not been traded for the Upper Peninsula.

November, 1980
"Direct Conversion Lives—excitingly simple receiver project"

There are three corrections to this article—the easy ones first:

On page 66, Fig. 3, pin 6 on the LM380 is shown in two places. The pin 6 shown as being grounded should be pin 4.

On page 68, column 3, 8 lines from the bottom, mH should be uH.

Now for the big one! Also on page 68, insert the following just before Audio Filters in column 1.

The VFO and Buffer

I used separate vfos for 80m and 40m and after trying several circuits, I chose the series-tuned Clapp oscillator because of its good stability. The output part of the vfos and the buffer are exactly like that used by PA0SE. His was a good design and I find no need to change it. It has one weakness, though: Because it is a broadband buffer, the second harmonics of the vfos also appear at the mixer. This is especially true of the 80m vfo where the second harmonic of, for example, 3.6 MHz mixes with a very strong commercial station on 7.2 MHz. I tried a 40m series-tuned trap from the drain of the FET in the 80m vfo, but it cured the problem only partially. (This also was the case without rf amplification at the front end.) I solved this problem by changing the single-tuned input circuit as used by PA0SE to a double-tuned one as shown in Fig. 3. The capacitors of this double-tuned circuit are two gang-tuned 350-pF variable capacitors (700 pF total) and the inductances are so chosen such that the 3.5-MHz resonance occurs with the plates nearly fully closed. Resonance at 7.0 MHz then occurs with the plates nearly fully open.

Audio Amplification

After some trials with other circuits, I agree with PA0SE that an FET audio amplifier is about the best device for a first audio stage after the mixer. The audio transformer, T2, is a 1k:10k, which is far from ideal, but it was the only one available locally. Far better would be one with a 50 Ω: 10k impedance ratio, as the output impedance of the MD108 is 50 Ω. The final audio amplifier, the LM380, provides plenty of audio and is better than the LM386 which I used at first.

"Tune In the Wind—a do-it-yourself hot-wire anemometer"

On page 81, column 4, line 3 would make more sense if "about" were to be replaced with "above."

"The Odd Couple—CASEY/1 tackles OSCAR's telemetry"

In column 4, page 110, the last two lines of the article refer to the article listed in reference 2. The reference number was omitted from the last line. Also, please note my new address.

Rich Casey WA9LRI
1818 Hemlock
Garland TX 75041

"Be Prepared!—30 meters for the FT-101B"

Please note a change in my address.

Mark H. Monson EL5G/KB8NO
Box 1046
Monrovia, Liberia

"New Weather Eye in the Sky—a primer on NOAA's TIROS"

In Table 1(b) on page 177, subpoint latitude for 76 minutes after crossing should be −81.1, not −91.1.

On page 181, column 1, the first sentence of step 3(A) should read, "Break the connection between the vertical size pot and the input line of the vertical deflection amplifier."

1980 INDEX

NEW PRODUCT SECTION

OPERATING

HAM HELP

Help!!! I am having difficulty in locating a schematic or operating manual for the following piece of equipment. It looks like a modem but I want to be sure. It has a transmit and receive section. The model number on the receive section is 1CRCU-RS-1. The model number on the transmit section is 1CTCU-RS-1. It carries the Burroughs Trademark on the case but it was manufactured by Stelma, Inc. Burroughs and Stelma, Inc., have not been able to help. Any information would be greatly appreciated.

Terry Hazelett
2107 Capitol Dr.
Parkersburg WV 26101

I need a schematic and/or instruction manual for a Collins 310B-1 exciter. I will buy a copy or reproduce one and return it. I also need an ac power supply for a KWM-2A.

Herman F. Shnur K4CTG
115 Intercept Ave.
North Charleston SC 29405

I would like to correspond with people who have working models of computer-controlled or radio-controlled humanoid robots. Thank you.

Matt Beha N8BPI
3752 Lane Court
St. Joseph MI 49085

Our school amateur radio club is in need of the schematic and/or instructions for a Hammarlund four-20 transmitter. Payment for copies will be mailed or we will copy and send back if preferred.

Barringer High School
c/o F. Rice N2BVZ
90 Parker Street
Newark NJ 07105

FUN!

from page 26

17) Slow-scan television is permitted only on upper-sideband. ____ ____
18) Hertz rotation is an important factor in moonbounce communication. ____ ____
19) Amplitude-shift radioteletype is also called "make-and-break" keying. ____ ____
20) Color amateur television is permitted only above 1296 MHz. ____ ____

ELEMENT 4—SCRAMBLED WORDS

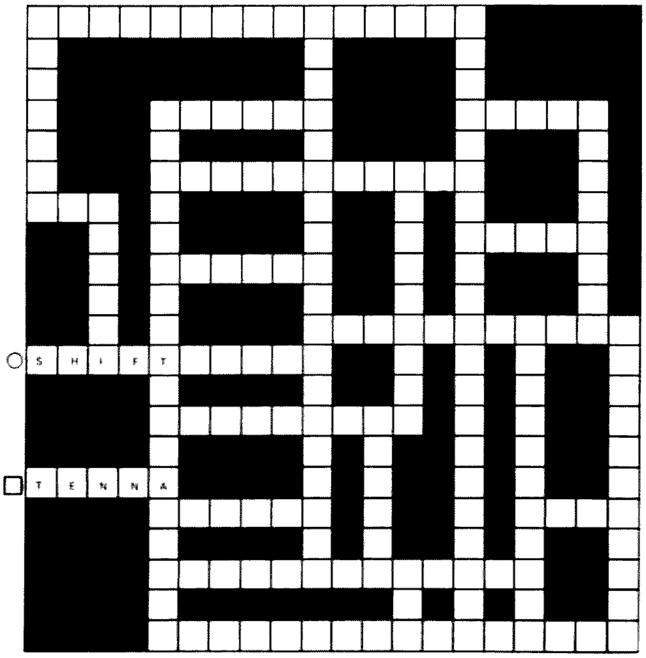
Unscramble these words dealing with specialized mode activities.

rswohe	hpcun	craos	cibsa
trenrip	ivode	anocbe	puknil
lebl	olop	ormci	xfa
iliadgt	lupes	cnsy	eramac
rtc	nisp	retmoe	nigp

ELEMENT 5—HAMAZE

Here's a new type of maze specifically geared to hams. The object is to start at the circle and trace your way to the square by filling in the answers to the clues given below. To help you on the way, we've already given you the first and last clue answers. All words read either vertically downward or from left to right. Each new word is on a *perpendicular* angle to the previous word. Words join on a common letter. Good luck.

1) Mark and space (given)
2) RTTY automatic monitoring
3) Phase III computer channel (abbr.)
4) Take antenna for a turn
5) Meteor and rain
6) Without pattern or a memory
7) Between short and long waves
8) Frequency above 1 GHz
9) Moonbouncer's reply
10) Thousand prefix
11) You type on one
12) CRT, digital, etc.
13) TV scale
14) Satellite protection band
15) WAS, DXCC, etc.
16) People who sank Phase III (abbr.)
17) Greek: at a distance
18) RTTY error
19) Highest point or radio company
20) OSCAR rotator: ______-el
21) Skyhook: an______ (given)



THE ANSWERS

Element 1:
See illustration.

Element 2:
1-I, 2-D, 3-E, 4-K, 5-C, 6-H, 7-G, 8-A, 9-J, 10-F.

Element 3:
1) True - Yes, but now there are many other funny noises to be heard on this band.
2) True - With Charles Krum he formed the Morkrum Company which was eventually bought out by AT&T. He got to keep the salt business, however.
3) False - No, F1 is. The only FCC designation AF2M has is his Extra ticket.
4) True - Like clockwork.
5) False - Only RTTY.
6) True - Many times.
7) True - With a little on 50 MHz and some activity above 432.
8) True - WB2IBE to K7OFT, November 20, 1979, on 50 MHz.
9) True - Still not quite television in the conventional sense, but an improvement beyond slow scan.
10) True - Write to Washington stating your reason.
11) False - Most awards require a real signature on them for credit.
12) False - That's really wideband! Kill the "k."
13) False - No, it stands for Narrow Band Voice Modulation. The meter, however, would probably be more useful.
14) False - Eighty and up.
15) False - All CW bands *but* Novice and 160.
16) False - Means "Earth-Moon-Earth."
17) False - Only by convention on 20 and up.
18) False - The polarization change of a signal passing through the Earth's ionosphere is known as *Faraday* rotation.
19) True - Old practice that was eliminated when FCC approved frequency-shift keying.
20) False - Color television, fast scan or slow scan, is allowed on any appropriate amateur TV frequency.

Element 4:
(Reading from left to right) shower, punch, oscar, basic; printer, video, beacon, uplink; bell, loop, micro, fax; digital, pulse, sync, camera; crt, spin, meteor, ping.

Element 5:
See illustration.

SCORING

Element 1:
See illustration. Twenty points for the complete puzzle, or 1/2 point for each question you got.

Element 2:
Two points for each mode you matched to its equipment.

Element 3:
One point for each correct answer.

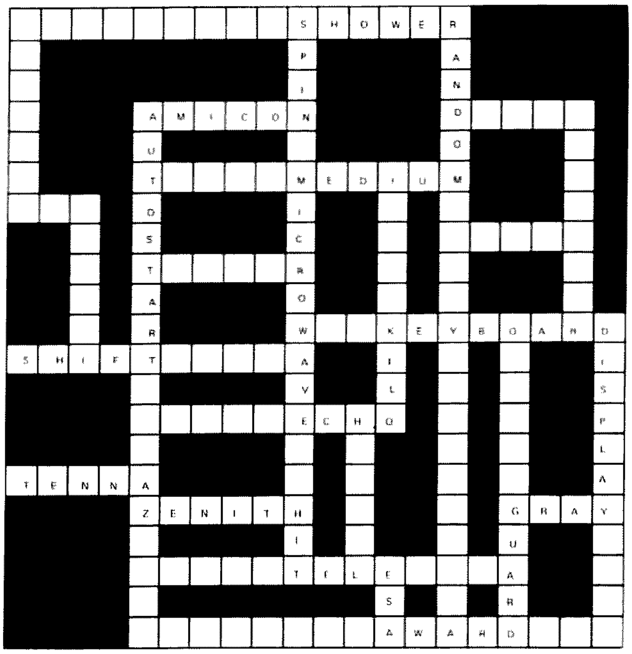
Element 4:
One point for each word successfully unscrambled.

Element 5:
Twenty points for complete puzzle, or one point for each word.

Total up your points and see the level of your technical expertise:

- 0-20 points - Lid
- 21-40 points - Physically-fit Conditional
- 41-60 points - KA
- 61-80 points - A pro
- 81 and up - A Technician in the full sense of the term

R	A	M		T	E	L	E	T	Y	P	E
O	P	S		D		O	X			R	G
	E		D		H		P		R	A	G
E	X	P	E	R	I	M	E	N	T		
Q		E		C		A	R		T	T	Y
U		R		A	P	R	T		Y		L
I	N	F	O			K	S	R		R	S
P				A	G	E		C	P	Y	
M	O	N	I	T	O	R		V		S	T
E	M	E		V	T		A	R	S		A
N		W	R			U				A	P
T	V		F	A	C	S	I	M	I	L	E



Next month: Ham History

REVIEW

RADIO EQUIPMENT AND SUPPLIES

It's been estimated that there are at least 8,000 collectors and enthusiasts of antique radio equipment in the United States. As is the case with all manner of antiquities, there's a great demand for literature on these old sets and the equipment that was used three generations back, when radio began to make itself known to the public.

Radio Equipment and Supplies is a 160-page catalog originally issued in 1922 by the Robertson-Cataract Company of Buffalo, New York, a major distributor in the field. It's full of pictures of receivers, transmitters, tubes, vario-couplers, tuning inductances, headphones, and all the apparatus that radio people of that day had to grapple with in order to "bring in the stations" or to "get on the air."

To serve the interests of the antique radio buffs of today, The Vestal Press has made a top-quality reprint of this 8½" × 11" book. With its contents including 30 pages of receivers, 74 pages of accessories for receivers, 30 pages on transmitting equipment, and 20 pages of basic "Radio Information and Data," there's something for every one of the present-day enthusiasts. It contains literally hundreds of photographs and drawings, and the 1922 prices would make anyone weep! It's certainly interesting, in the light of today's highly sophisticated electronics, to view the astounding changes that have occurred in the past 60 years.

Copies are available directly from The Vestal Press Ltd., Box 97, Vestal NY 13850, or through any bookstore, for $12.50 + 75¢ shipping (NY residents add sales tax).

CODING AND DECODING TELEVISION SIGNALS
Science Workshop

Everyone is talking about "those secret TV channels." If you have a fistful of money or a lot of technical expertise, you might build an earth satellite terminal. For a bit less cash an MDS microwave receiver capable of catching local pay TV signals can be had. A third source of limited access viewing is signals transmitted on conventional UHF TV channels but scrambled at least part of the time. As nonpaying "customers" become prevalent, more and more of these common carrier video signals will be encoded and, of course, more than a few hams will be busy trying to unscramble them. Now, much of the current scrambling technology is discussed in Science Workshop's book, *Coding and Decoding Television Signals.*

A video freak is likely to exclaim, "So that's how they do it!" after reading *Coding and Decoding* for the first time. Material for this book was gathered from a variety of public and private sources. Included in the contents is a word-for-word reproduction of a NASA report on the scrambling technique used for the Application Technology Satellite video signals. Later sections explain how some UHF signals are encoded with a 15-kHz pulse train and have special subcarrier audio. Block diagrams, oscillographs, and spectrum analyzer photographs supplement the descriptive text.

The editor of *Coding and Decoding Television Signals* states, "This is not a 'how-to' book. It does not contain any construction projects." However, an amateur knowledgeable about video and experienced in building rf circuits should be able to successfully reproduce the designs shown. You'll have to make your own parts lists and circuit board templates, though.

For some reason, beating the system at its own game has always been an attraction for electronics experimenters. As the issue of the freedom of the airways is discussed in high places, hundreds or even thousands of tinkerers will be using information from books like *Coding and Decoding Television Signals* to build their own units. Costing $9.95 ($1.00 postage), this 43-page softcover pay-TV primer for experimenters is available from Science Workshop, Box 393, Bethpage NY 11714.

Tim Daniel N8RK
73 Magazine Staff

DX

from page 14

point of view on the subject, but there should be no doubt just what its point of view is.

FOR SALE: QSLS

As long as we are rampaging, might as well take up one additional subject recently beaten nearly to death in the amateur press. Maybe we can breathe a little life into it. Some have complained about the practice of requiring payment of a dollar for a QSL for an expedition contact. Actually, this is not new. W9WNV (and others) were doing it fifteen or more years ago, only then you paid for the contact *before* the expedition was undertaken. Those who anted up found that the DXpeditioner was able to hear them without difficulty; those who held out were just not heard or worked.

Grousing when required to supply a buck for a QSL shows little appreciation for the sacrifices made by expeditioners. When they moan in print about it, that constitutes almost a personal affront to the DXer who has made it possible for many to work a new country. As plane tickets are not free, we see little wrong with QSLing *only* to those who help with the expenses. Most expeditioners are not independently wealthy and are only practicing economic horse sense. If they recoup some of the expenses from one trip, they are more likely to make another.

ISTANBUL REPORT

The accompanying letter from an amateur in Turkey is printed in full, except that all references to callsigns and names have been deleted. Anyone wishing to act as QSL manager for the writer of the letter can make arrangements by writing to me at the address given at the beginning of this column.

"Istanbul, Aug. 26, 1980

Dear OMs: I am a subscriber to *73*, and I am very glad to see a DX column in your excellent magazine. The purpose of my letter is to provide you with some material and information for the section, and possibly seek your help on a subject.

Here in Turkey, for a long time there has been on-and-off operating by courageous local and by temporarily resident foreigners (mainly from the US). I am sure some of your fellow hams and subscribers do not know that ham radio in Turkey is still illegal due to a law dated 1937! I say TA is activated by courageous people because possession and operation of transmitters has severe penalties, including imprisonment of up to five years!

"Terrorism all over the world is well known, and we too have a fair share of it in TA Land. I am sure there would be far less of it if we had worthwhile hobbies like amateur radio to keep the young people occupied. We have martial law in certain parts of the country (including Istanbul), during which the penalty for the above mentioned offense is ten years in jail! Big risks are taken in operating, but you know ham radio is a bug and...

"Therefore, operation from TA is sporadic; at present we must be at an all-time low. I have been QRT since March, 1980, and will be so for another few months.

"We have an amateur radio club, TRAC, which is listed in the *Callbook* for incoming QSLs. That is the only service provided by TRAC except for a magazine which gets published now and then. Since there is no outgoing QSL service, I suspect the QSL record of TA stations is not very good, as everyone is on his own for sending cards. Having a 100% QSLing record is very important to me.

"One question which is often asked is how and by whom we get our calls assigned. The answer is that we do not get them assigned, we just pick them ourselves. The country was divided into call areas by the club when it was founded in the 1960s. Most of us pick our initials and we all know each other so duplicates are prevented. We watch out for newcomers, too.

"As far as equipment is concerned, it simply is not available. Transmitters and transceivers are illegal, and even receivers are almost nonexistent. I personally would be willing to pay twice the list price for a good receiver. We make do with whatever we can find in surplus, and that, too, is something which may come once in a lifetime. Surplus and simple homemade rigs are what you hear from Turkey. If our signals are drifting and we cannot hear you S9, I think we can be excused if people know the conditions we work in.

"Attempts have been made to change the 1937 law but have failed for various reasons, mainly because the people concerned did not know what amateur radio was about. Lately, the final word has been that to ensure the national security, monitoring stations tied to a computer center where 'exact location of any transmission can be found' is the only way for amateur radio to be legal in Turkey. Estimated cost of this is twenty million dollars!

"I hope *73* can find a manager for my QSLs when I return to the air. I am sure you have a heavy workload, so if you cannot spare the time I shall understand.

73,
TA2— —."

This is a somewhat abbreviated column due to things backing up at the editor's shop. The column will be back to its usual size in January. Your input of letters and pictures is appreciated.

CONTESTS

from page 16

couver, BC Canada V6J 1E3, postmarked before January 15th. Results will be published in *TCA*, the Canadian amateur magazine. Non-subscribers may include an SASE for a copy of the results.

ZERO DISTRICT QSO PARTY
Starts: 2000 GMT January 3
Ends: 0200 GMT January 5

Organized by the Mississippi Valley Radio Club. Stations outside of Zero District will work Zero stations only; Zeros may work any station. The same station may be worked once on each band and each mode. However, stations in the special mobile class may be worked each time they change counties.

EXCHANGE:

RS(T) and ARRL section. Zero District stations also must send county.

FREQUENCIES:

3560, 7060, 14060, 21060, 28060, 3900, 7270, 14300, 21370, 28570, 3725, 7125, 21125, 28125.

SCORING:

Add the number of Zero District ARRL sections worked plus the number of Zero District counties, then multiply by the number of contacts. Zeros score by adding ARRL sections, Zero District counties, and DXCC countries worked, and then multiplying by total contacts.

ENTRIES & AWARDS:

Awards will be issued to the high scorer in each ARRL section and DXCC country. Also to top Novice/Technician and top in special mobile class. Mail logs by February 15th to: WØSI, 3518 W. Columbia, Davenport IA 52804. Include an SASE for log forms or results.

2nd ANNUAL INTERNATIONAL 160-METER PHONE CONTEST
Sponsored by 73 Magazine
Starts: 0000 GMT January 17
Ends: 2400 GMT January 18

This is the second annual 160-meter contest sponsored by our magazine. The object is to work as many stations as possible on 160-meter phone in a maximum of 30 hours allowable contest time. Multi-operator stations may operate the entire 48-hour contest period. Entry categories include single- and multi-operator, both with single transmitter on phone only.

EXCHANGE:

Stations within the Continental USA and Canada transmit RS report and state or province. All others transmit RS report and

DX country.

SCORING:

All valid two-way contacts score 5 points per QSO. A station may be worked only once for contest credit! Multipliers are as follows: 1 multiplier point for each of the Continental US states (48 max.); 1 multiplier point for each of the Canadian provinces (13 max.); 3 multiplier points for each DX country outside the Continental US and Canada.

The final score is the total QSO points times the total multiplier points.

DX WINDOW:

Stations are expected to observe the DX window from 1.825 to 1.830 MHz as mutually agreed by Top Band operators. Stations in the US and Canada are asked not to transmit in this 5-kHz segment of the band.

AWARDS:

Contest awards will be issued in each award category in each of the Continental US states, each Canadian province, and each DX country.

DISQUALIFICATIONS:

Disqualifications may result if contestant omits any required entry forms, operates in excess of legal power authorized for his given area, manipulates operating times to achieve a score advantage, or fails to omit duplicate contacts which reduce the overall score more than 2%.

ENTRIES:

Each entry must include log sheet, dupe sheet for 100 or more contacts, a contest summary sheet, and a multiplier checklist. All entries must be postmarked no later than February 21st. To request contest forms or submit your entry, write: Dan Murphy WA2GZB, PO Box 195, Andover NJ 07821 USA. Please include an SASE!

SPECIAL CHRISTMAS EXPEDITIONS

With the Christmas holidays fast upon us, there are two special operations planned for the holidays. The Delaware-Lehigh Amateur Radio Club (W3OK) will have a special events station on the air as part of Bethlehem PA's Christmas City Celebration. The station will be on the air from 2300 to 0300 GMT starting December 15th and will continue to operate through January 1st. The operating hours will increase during the period whenever possible. Operation will be on the Novice CW and General phone bands. Suggested frequencies are: 15 kHz down from the top of the Novice band, and 15 kHz up from the bottom of the General phone band. Special QSO certificates will be sent from the Christmas City Station. QSLs or requests should be mailed with a business-size SASE to: W3OK, DLARC, 1719 Callone Avenue, Bethlehem PA 18017. SWL requests will also be honored.

The Indian River Amateur Radio Club of Cocoa FL will be operating from Christmas FL from December 20 through 27. Operating times will generally be from 1400 to 2000 GMT daily. The town of Christmas, located on the east coast of Florida, welcomes many visitors each year from around the USA. Christmas is celebrated each and every day of the year. There are fully lighted Christmas trees, wreaths, and decorations along with Santa and his helpers. The Indian River Amateur Radio Club, as a celebration of its 26th year of organization, will use the club callsign W4NLX/4. A special handsome certificate will be awarded to all worked stations. This certificate depicts some of the aspects of Christmas in Florida. Arrangements have been made to have a special cancellation at the US Post Office for this award. Please send a large SASE for the certificate. Operating frequencies on SSB will be 7280, 14280, 21380, and 28680. On CW, the club will operate 60 kHz up from the bottom edge of the 40-, 20-, 15-, and 10-meter bands. The 146.34/.94 repeater will also be operational for local contacts. QSL to Indian River Amateur Radio Club, W4NLX, PO Box 105, Christmas FL 32709.

AWARDS

from page 20

bands the same day (6 × 3 = 18) or work him on twenty meters three individual days (6 × 3 = 18), you will have qualified very easily for the Gold Sardinian Award. Sounds easy, doesn't it?

To be valid, all signal reports must be a minimum of 338 for CW and 43 for phone.

To apply, have your claimed contacts verified by at least two amateurs or a local radio club official. Enclose your application with an award fee of 15 IRCs or $4.00 US to: URS Club, via Sardegna 16, 07100 Sassari, Sardinia.

While in Europe, let's visit the United Kingdom, where last time I failed to include two very interesting awards.

HAMPSHIRE COUNTY AWARD

The Hampshire County Award is made available to amateurs worldwide who have established two-way contact with amateur operators of Hampshire County in England. The award is issued on a point basis in which all contacts count 1 point, with the exception that contacts with G3BZU, GB3RN, or any other special-event station count 2 points.

There are three award classes: Class I–UK/50 points; EU/20 points; DX/15 points. Class II–UK/30 points; EU/15 points; DX/10 points. Class III–UK/20 points; EU/10 points; DX/5 points.

To be valid, all contacts must be made after October 1, 1960. There is no mode or band restriction, but special band or mode recognition will be made if requested at the time of application.

To apply, have your list of claimed contacts verified by at least two amateurs or a local radio club official. Forward this application and an award fee of 50 pence or 6 IRCs to: F. D. Cawley G2GM, Award Manager, Bay Sound, Freshwater Bay, Freshwater, Isle of Wight, England, United Kingdom.

THE MERCURY AWARD

While in England, it is my honor to feature to our readers the very respectable Mercury Award, sponsored by the Royal Naval Amateur Radio Society. This award was initiated to encourage contact with the many members of the Royal Naval Society. The award is issued to any amateur who can meet the requirements of the program which are tabulated on a point basis. Contacts with RNARS members on the HF bands earn 1 point each, while two-way contacts established 30 MHz and above constitute 2 points apiece. In addition, any special-event station, such as GB3RN or G3BZU, counts double the normal point value.

To attain the award, stations within the United Kingdom must accumulate a total of 20 points, other European stations must total a minimum of 10 points, and stations outside Europe must gather a total of at least 5 points. Once an applicant earns 10 points (for US) or 20 points (for Europeans), stickers will be issued for each multiple of 10 points earned thereafter.

Contact must be made October 1, 1960, and after to be valid. There are no band or mode restrictions, but recognition will be given if special band or mode accomplishments are attained.

The Mercury Award also is made available to shortwave listeners who must meet the same criteria on a "heard-only" basis.

Do not send QSLs! Have your list of claimed contacts verified by at least two fellow amateurs or a radio club official. Enclose this application along with the award fee of 6 IRCs to: Awards Manager G3HZL, 153 Worple Road, Isleworth, Middlesex TW7 7HT, England, United Kingdom.

To be successful in confirming contacts with members of the Royal Naval Amateur Radio Society, it is advisable that you obtain a list of their members before attempting the challenge of this award. It is unfortunate that the list is so lengthy, as space does not permit the list to be printed at this time. As an alternative, however, the Mercury Award is featured in the *DX Awards Guide* published by Chuck Ellis W0YBV. The entire list of RNARS members is contained within this publication. This DXer's award guide, fea-

tured in last month's column in detail, is available for a very modest price of $14.95 (plus 1-lb. postage for DX shipment) by enclosing payment to Chuck Ellis, PO Box 1136 Welch Station, Ames IA 50010. Be sure, if that is the reference you plan to use, that you tell Chuck you read about it here in the *73 Magazine* Awards column.

If you are like many of us on the west coast and are looking for a real toughie, try your hand at working toward the Worked All Gozo Award.

WORKED ALL GOZO AWARD

The WAG Award, as it is called, is open to amateurs and SWL stations and has no band or mode restrictions. To be valid, all contacts for this award must be made on or after August 1, 1972.

To qualify, European stations must confirm 8 individual stations from Gozo Island (9H4). Now, if you are considered a DX station like we are in the USA, you only have to work 5 different Gozo Island stations. And, of course, if you are like me, you'll be happy to settle for just an SWL Heard Only Award which also is available under the same requirements.

Do not send QSL cards, please! Have your list of claimed Gozo Island contacts verified by at least two amateurs or a radio club official. Forward this verified application and an award fee of $3.00 or 12 IRCs to: Joe Cauchi 9H4L, 20 P. P. Hili Street, Victoria, Gozo Island, Malta. All award fees are contributed to aid the blind and handicapped operators; we all should apply for this award if for no other reason than to aid this cause.

OUR AWARDS PROGRAM

By the time this magazine reaches your hands, the hundreds of certificates already earned via the *73* Awards Program will be on their way to amateurs around the world. Now, if you are one of the many who qualified for an award months and months ago, you're no doubt saying, "It's about time!" Right you are.

What caused the incredible delays? First of all, some of us underestimated the work involved in getting the certificates designed and produced. But more than that, we too often allowed the Awards Program to take a back seat to other projects which, at the time, seemed more important. Few of us at *73* wear only one hat, and it was all too easy to stop working on the awards when article titles needed to be written or when manuscripts needed to be read. After all, we had magazine deadlines to meet each and every month, and it always seemed that the awards could wait . . . and wait . . . and wait. In short, we blew it.

In retrospect, it's easy to see what we should have done. For starters, we should have had the awards printed and on the shelf before the Awards Program was even announced. Then, we should have assigned one person to stay on top of the program and keep it moving. The good news is that we have, at last, recognized these failings, and the Awards Program is finally up to speed. The debacle of the past 14 months is over, and the awards are going out.

Before proceeding any further, a note of commendation is in order. The man who writes this column each month and serves as manager of our Awards Program is Bill Gosney WB7BFK. Bill has been with the program from the beginning, and he has done an outstanding job under very difficult circumstances. He's done everything we have asked of him and more. If you've been waiting for an award, the delay was at our end, not his. Thank you, Bill.

To those of you who have earned awards through our program goes a special note of thanks for getting involved in our new and untried venture. Now that we're back on track, we hope you enjoy your awards and that you'll apply for others in the future. If you have never applied for a *73* award, please do so; the system is working, and it's our goal to handle all future applications quickly and efficiently.

As we move into the third decade of *73 Magazine*, we're looking forward, not back. There are exciting times ahead for amateur radio, and we want the *73* Awards Program to be a part of it.

Jeff DeTray WB8BTH
Assistant Publisher/Editor

73 AWARD WINNERS

NORTH AMERICAN CONTINENT AWARD

1 WA2GUM
2 WB8VPA
3 K4HRG
4 KE4E
5 N6TK
6 AA8TK
7 WA1SMI
8 WA9BBX
9 K8ZIP
10 WB9YMR
11 WB6VVI/9
12 WB3BAP
13 WD8MGO
14 WB7BFK
15 WB1DQC
16 K4BOZ
17 K8JSY
18 KA5COJ
19 K1TH
20 W7ULC
21 WB3ICM
22 K8WD
23 W9NAX
24 VE1BVD
25 WD9HRH
26 WD8MOV
27 K9PSN
28 AD1S
29 DA1MV
30 WB8LXM
31 KA9ACM
32 WB7TXY
33 WB3CIW
34 N6PV
35 F2YS/W2
36 W8CHV
37 AJ8L
38 WA2YEX
39 SM5AKT
40 AC3O
41 WA2SRM
42 K9TI
43 WDØEPE
44 K4JYD
45 N8AC
46 JH1VRO
47 WB3BVL
48 WD4DVZ
49 W8YBV
50 WB2FFY
51 W5TJO
52 WD8DZO
53 KB4JA
54 WB4SXX
55 DJ2UU
56 WD4KRK
57 KA2EAO
58 K9MD
59 N7BZ
60 W2ODA
61 WB2MVC
62 K4BYK
63 KB8JF
64 WA2PIP
65 KB2DE
66 N9ADL
67 WB7PKO
68 S8AAT
69 HK4DUM
70 WDØAVG
71 WD9IIC
72 W1AGA
73 WB3JUK
74 WA2RVF
75 KA2K
76 PY8ZLC
77 K4LQ
78 DA1UO
79 IC8OGS
80 DA1OR
81 WD4IIU
82 AG5X
83 K9BIL
84 N4BQD
85 WA2LYF
86 WD9HWY
87 N4BOD
88 AI1Y
89 WB5SND
90 NØAMI
91 WD8QEO
92 VE3JGT
93 KA5CTZ
94 WD8DEL
95 WB8CDM
96 KB8LT
97 N8GP
98 AI6I
99 N4AKO
100 KB8DB
101 N8BJQ
102 K5BLV
103 DF9ZP
104 KB5OU
105 K8GAK
106 N1BCV
107 S8AAP
108 WB7RUV

SOUTH AMERICAN CONTINENT AWARD

1 WB8VPA
2 KE4E
3 N8TK
4 AA6TK
5 WA1SMI
6 VE1BVD
7 WD8EEO
8 WB8YMR
9 WB6VVI/9
10 WB2BAP
11 WD8MGQ
12 WB7BFK
13 WB1DQC
14 K9JSY
15 KA5CQJ
16 K1TH
17 W7ULC
18 K8WD
19 K4HRG
20 WD9HRH
21 WD8MOV
22 AD1S
23 WBØLXM
24 WB3ICM
25 KA9ACM
26 WB7TXY
27 WB3CIW
28 K9PSN
29 F2YS/W2
30 K8ZIP
31 WA2SRM
32 AJBL
33 WA2YEX
34 AC3Q
35 SM5AKT
36 WDØEPE
37 JH1VRQ
38 WB3BVL
39 WD4DVZ
40 W5TJQ
41 WD8DZO
42 WB4SXX
43 WD4KRK
44 K9MD
45 KB4JA
46 N7BZ
47 DJ2UU
48 W8CHV
49 K9TI
50 W2ODA
51 WB2MVC
52 KA2EAO
53 K4BYK
54 KB8JF
55 KB2BE
56 WA2PIP
57 WB7PKD
58 S8AAT
59 DA1MV
60 HK4DUM
61 WD9IIC
62 W9YBV
63 WB3JUK
64 W1AGA
65 PY8ZLC
66 KA2K
67 WA2RVF
68 K4LQ
69 DA1UO
70 N8AC
71 IC6OGS
72 DA1OR
73 AQ5X
74 K9BIL
75 N4BOD
76 WA2LYF
77 WD9HWY
78 WB5SND
79 KBØOE
80 NØAMI
81 WD8QEO
82 VE3JGT
83 KA5CTZ
84 WD8DEL
85 WB6CDM
86 KB8LT
87 N9GP
88 N4AKO
89 KB8DB
90 N8BJQ
91 K5BLV
92 DF9ZP
93 KB5OU
94 N1BCV
95 WB7RUV
96 S8AAP
97 WD4LYA

Q-5 AWARD OF EXCELLENCE

1 WB8ZJL
2 WD8ONV
3 KA8HNR
4 K8IU
5 WB7OEP
6 KAØFPG
7 WL7ADX
8 WD5EHI
9 KA3DBN
10 KA3COP
11 KA3CGM
12 WD2AKK
13 WD8IDD
14 SM2COR
15 KØTBB
16 WD5ICQ/1
17 KA4KJI
18 N3ADF
19 K6TMB
20 WØCJG
21 KA8IGM
22 WD8NHN
23 WB3GSO
24 KA8HTU
25 KA8GXN
26 KAØCDR
27 KA1ESG
28 WD8OHN
29 WD4BLU
30 KA3ENO
31 KA4JOS

SPECIALTY COMMUNICATIONS AWARD CLASS A-1

1 W2ODA (RTTY)
2 WB8OCD (SSTV)
3 WB7BFK (RTTY)
4 WBØOCD (RTTY)
5 WD9GRI (RTTY)
6 WB6CDM (RTTY)
7 N3AKO (RTTY)

DISTRICT ENDURANCE AWARD

1 AJ8L
2 WL7ACY
3 WB6CDM/7

EUROPEAN CONTINENT AWARD

1 WB8VPA
2 K4HRG
3 KE4E
4 N6TK
5 WA1SMI
6 WB3ICM
7 VE1BVD
8 WA9BBX
9 WBØYMR
10 WB6VVI/9
11 WØHMA
12 WB3BAP
13 WD8MGO
14 WB7BFK
15 WB1DQC
16 WA2GUM
17 N9ND
18 K4BQZ
18 K8JSY
20 N6PV
21 KA5CQJ
22 W8CHV
23 K1TH
24 W7ULC
25 N9ADL
26 K8WD
27 WØYBV
28 W9NAX
29 WA2SRM
30 WD9HRH
31 WD8MOV
32 K9PSN
33 AD1S
34 DA1MV
35 KA3DBN
36 WB8LXM
37 WB7TXY
38 WB3CIW
39 F2YS/W2
40 K8ZIP
41 DK5WJ
42 WA2YEX
43 AJ8L
44 AC3Q
45 SM5AKT
46 WD8EPE
47 W4JYD
48 JH1VRQ
49 WB3BVL
50 K9TI
51 WD4DVZ
52 WB2FFY
53 W5TJO
54 WD8DZO
55 KB4JA
58 WB4SXX
57 DJ2UU
58 WD4KRK
59 K9MD
80 N7BZ
81 JA1VDJ
82 K1KOB
83 W2ODA
84 WB2MVC
65 K4BYK
68 KB8JF
67 WA2PIP
68 KB2DE
69 WB7PKD
70 N8AC
71 S8AAT
72 WD4IIU
73 WD4IIU
74 KA1CBD
75 WDØAVG
76 WD9IIC
77 W1AGA
78 WB3JUK
79 WA2RVF
80 KA2K
81 PY8ZLC
82 K4LQ
83 DA1UO
84 IC8OGS
85 DA1OR
88 AG5X
87 K9BIL
88 N4BOD
89 WA2LYF
90 WD9HWY
91 WB6CDM
92 WD8DEL
93 KA5CTZ
94 VE3JGT
95 WD8QEO
96 N8AMI
97 W8EVH
98 WDØEPV
99 AI1Y
100 WB5SND
101 KA4KST
102 KB7O
103 WD4BLU
104 KB8LT
105 NØGP
106 KB9OO
107 AI8I
108 N4AKO
109 N3AKO
110 KB8DB
111 N8BJQ
112 K5BLV
113 DF9ZP
114 KB6OU
115 K8GAK
116 K8QAK
117 N7AHQ
118 KA4ITQ
119 W8OLL
120 N1BCV
121 WB7RUV
122 WD4LYA
123 DA2AL
124 S8AAP

ASIAN CONTINENT AWARD

1 WB8VPA
2 K4HRG
3 KE4E
4 WB3ICM
5 WB6VVI/9
6 WD8MGG
7 WB7BFK
8 WB1DOC
9 K8JSY
10 W7ULC
11 K8WD
12 WD9HRH
13 WD8MOV
14 AD1S
15 DA1MV
16 WBØLXM
17 WB7TXY
18 WB3CIW
19 K1TH
20 F2YS/W2
21 K8ZIP
22 WB8YMR
23 WA2YEX
24 AJ8L
25 AC3O
26 SM5AKT
27 WDØEPE
26 JH1VRQ
29 K9PSN
30 WD9DVZ
31 W5TJQ
32 WDBDZO
33 WB4SXX
34 DJ2UU
35 WD4KRK
38 K9MD
37 N7BZ
38 JA1VDJ
39 WB3BAP
40 W8CHV
41 K4BYK
42 KB8JF
43 KB2DE
44 WA1SMI
45 S8AAT
46 N8AC
47 HK4DUM
48 K9TI
49 WA2SRM
50 WD9IIC
51 W1AGA
52 WB3JUK
53 WA2RVF
54 KA2K
55 K4LO
56 DA1UO
57 IC8OGS
58 DA1QR
59 WDØAVG
60 AG5X
61 KB4JA
62 K9BIL
63 N4BOD
64 WD9HWY
65 WB7PKD
66 N9AMI
87 WD8QEO
68 VE3JGT
69 WD8DEL
70 WB6CDM
71 KB8LT
72 N8GP
73 KB8DB
74 N8BJO
75 K5BLV
78 DF9ZP
77 S8AAP
78 WB7RUV

AFRICAN CONTINENT AWARD

1 WB8VPA
2 K4HRG
3 KE4E
4 WA1SMI
5 WB3ICM
6 WB6VVI/9
7 WB3BAP
8 WD8MGQ
9 WB7BFK
10 WB1DQC
11 KØJSY
12 KA5CQJ
13 K1TH
14 W7ULC
15 K8WD
16 WD9HRH
17 WD8MOV
18 AD1S
19 DA1MV
20 WB9LXM
21 WB7TXY
22 WB3CIW
23 K9PSN
24 F2YS/W2
25 K8ZIP
28 WA2YEX
27 AJ8L
28 WB9YMR
29 AC3Q
30 WA2SRM
31 SM5AKT
32 W8CHV
33 WDØEPE
34 K4JYD
35 N8AC
36 JH1VRQ
37 WD4DVZ
38 WB2FFY
39 W5TJQ
40 WD8DZO
41 KB4JA
42 WB4SXX
43 DJ2UU
44 WD4KRK
45 K9MD
48 N7BZ
47 W2ODA
48 K4BYK
49 KB8JF
50 KB2DE
51 N9ADL
52 S8AAT
53 K9TI
54 HK4DUM
55 WD9IIC
56 W1AGA
57 WB3JUK
58 WA2RVF
59 PY8ZLC
60 K4LQ
61 DA1UO
62 IC8OGS
63 DA1GR
64 AG5X
65 K9BIL
66 N4BOD
67 WD9HWY
88 WB7PKD
89 WB6CDM
70 WD8DEL
71 KA5CTZ
72 VE3JGT
73 WD8QEO
74 N8AMI
75 KB8LT
76 NØGP
77 N4AKO
78 KB8DB
79 N8BJQ
80 K5BLV
81 DF9ZP
82 S8AAP
83 WB7RUV

OCEANIC CONTINENT AWARD

1 WB8VPA
2 K4HRG
3 KE4E
4 N8TK
5 AA6TK
6 WB3ICM
7 WD6EEQ
8 WB6VVI/9
9 WD8MGO
10 WB7BFK
11 WB1DOC
12 KØJSY
13 N6PV
14 KA5CQJ
15 W8CHV
16 K1TH
17 W7ULC
18 K8WD
19 WD9HRH
20 WD8MOV
21 AD1S
22 WBØLXM
23 WB8YMR
24 WB7TXY
25 WB3CIW
26 K9PSN
27 F2YS/W2
28 K8ZIP
29 AJ8L
30 AC3Q
31 SM5AKT
32 WDØEPE
33 K4JYD
34 N8AC
35 JH1VRQ
36 WD4OVZ
37 W5TJQ
38 WD8DZO
39 KB4JA
40 WB4SXX
41 WD4KRK
42 K9MO
43 N7BZ
44 JA1VDJ
45 WB3BAP
46 K4BYK
47 KB8JF
48 KB2DE
49 WA1SMI
50 WB7PKD
51 DA1MV
52 HK4DUM
53 WD9IIC
54 W1AGA
55 WB2JUK
56 K9TI
57 KA2K
58 K4LQ
59 IC8OGS
60 DA1GR
61 S8AAT
62 AG5X
63 K9BIL
64 WD9HWY
65 N4BQO
66 N9AMI
67 WD8QEO
88 VE3JGT
69 KA5CTZ
70 WD8DEL
71 WB8CDM
72 KB8LT
73 NØGP
74 KB8DB
75 N8BJQ
76 N7AHG
77 K5BLV
78 DJ2UU
79 WB7RUV
80 S8AAP

WORK THE WORLD AWARD

1 WB8VPA
2 KE4E
3 WB6VVI/9
4 WD8MGQ
5 WB7BFK
6 WB1DQC
7 KØJSY
8 W7ULC
9 K8WD
10 K4HRG
11 WD9HRH
12 WD8MOV
13 AD1S
14 WBØLXM
15 WB3ICM
16 WB7TXY
17 WB3CIW
18 K1TH/9
19 F2YS/W2
20 K8ZIP
21 AJ8L
22 WBØYMR
23 AC3O
24 SM5AKT
25 WDØEPE
26 JH1VRQ
27 K9PSN
28 WD4DVZ
29 W5TJQ
30 WD8DZO
31 WB4SXX
32 WD4KRK
33 K9MD
34 N7BZ
35 WB3BAP
38 W8CHV
37 K4BYK
38 KB8JF
39 KB2DE
40 WA1SMI
41 DA1MV
42 HK4DUM
43 WD9IIC
44 W1AGA
45 WB3JUK
46 KA2K
47 K9TI
48 K4LQ
49 N8AC
50 IC8OGS
51 DA1QR
52 AG5X
53 S8AAT
54 KB4JA
55 K9BIL
56 WD9HWY
57 WB7PKD
58 WB6CDM
59 WD8DEL
60 VE3JGT
61 WD8OEO
62 NØAMI
63 N4BQD
64 KB8LT
65 NØGP
66 KB8DB
67 N8BJQ
68 K5BLV
69 DJ2UU
70 WB7RUV
71 S8AAP

WORKED ALL USA AWARD MIXED BAND

1 KA1CBD
2 WD8QMS
3 WD4RAF
4 KA3CBC
5 KA9DLI
8 KA4HEP
7 KL7EO
8 KA4DNW
9 N4ACS
10 N7AGD
11 KA3DBN
12 KB5NE
13 K2EQU
14 KA6FYQ
15 K4JYD
16 K6ARE
17 N8BKB
18 WL7AHL
19 WN5MBS
20 KA4GML
21 WB7RBH
22 WD8LCE
23 WB3BVL
24 WD6EQP
25 KB4NJ
26 WAØCED
27 WD9GFL
28 KA3CGM
29 KB7EY
30 AF8D

CENTURY CITIES AWARD

1 K2MF
2 WA2SRM
3 WD4RAF
4 KAØAZQ
5 K1TH
8 K4JYD
7 WA9WGJ
8 KA4HEP
9 JH8DSC
10 N8BKB
11 KB8JF
12 WDØEPE
13 W1AGA
14 KA2CLQ
15 KA8FOQ
16 KA4BNQ
17 WB6CDM
18 AK2H

10 METER DX DECADE AWARD

1 WB4WRE/M
2 AC3O
3 W5TJQ
4 WDØAVG
5 DA2AL

TEN METER "10-40" AWARD

1 W6OLA/7
2 K4JSI/6

DX CAPITALS OF THE WORLD

1 WB1DQC
2 WB7BFK
3 K1TH
4 WD4KRK
5 DJ2UU
6 KB8JF
7 WD4DVZ
8 W1AGA
9 N9GP

73 DX COUNTRY CLUB AWARD 2X SSB

1 WB8VPA
2 WB3ICM
3 WB1DQC
4 N6TK
5 WA1SMI
6 WB6VVI/9
7 WD8MGQ
8 WB7BFK
9 WB9JBH
10 KØJSY
11 K8WD
12 WA2JCX
13 K1TH
14 K9PSN
15 W5TJO
16 WD8MOV
17 DA1MV
18 WD4DVZ
19 WB3CIW
20 KB9IS
21 KL7EO
22 EA6ET
23 WA2YEX
24 N4AOJ
25 WA2SRM
26 W5ZKJ
27 WB7TXY
28 F2YS/W2
29 WA2GUM
30 KB4NJ
31 KB4JA
32 DJ2UU
33 K9MD
34 K4BYK
35 KB8JF
36 HK4DUM
37 S8AAT
38 IC8OGS
39 K9TI
40 SV1IW
41 WB3JUK
42 WA2RVF
43 KA2K
44 9G1LL
45 DA1OR
46 DA5CTZ
47 VE3JGT
48 WB8CDM
49 N4AKO
50 DF9ZP

73 DX COUNTRY CLUB AWARD MIXED MODE

1 WØANZ
2 K4HRG
3 WD8DNG
4 K8ZIP
5 AA8Z
6 KA5CQJ
7 K1VKO
8 WD8DZO
9 AC3Q
10 WB9YMR
11 K4JYD
12 JH1VRO
13 WB4SXX
14 N7BZ
15 W8CHV
16 WDØEPE
17 WA1GTQ
18 WD9IIC
19 PY8ZLC
20 K4LQ
21 W2XQ

73 DX COUNTRY CLUB AWARD 2X CW

1 AA8Z
2 W7ULC
3 SM5AKT
4 WD8MAS
5 WB7PKD
6 WØYBV
7 WB2FFY
8 WB3BVL

WORKED ALL USA AWARD

6 METERS

1 WB8ZKG
2 K6PHE

10 METERS

1 KL7IEN
2 W5ZKJ
3 VE1BVD
4 JH8DSC
5 VK7NBT

15 METERS

1 WD5DRB
2 WAØCEL
3 KA6ACO
4 WB6CDM

20 METERS

1 WA9BBX
2 WA9WGJ
3 K1TH
4 KB8JF
5 WDØEPE

40 METERS

1 WA2SRM
2 N8AZD
3 WD4DBJ
4 WDØBOS

75/80 METERS

1 KA9AZQ
2 WDØBOS
3 KA5AOP
4 KS4B
5 WB9UKS

NEW PRODUCTS

from page 32

sizes: Model DTE-8 (8" wide), Model DTE-11 (10.65" wide), and Model DTE-14 (14" wide). The overall height of the series is 3.15 inches and the depth is 8.25 inches.

For further information, contact *Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002; (415)-592-8097.* Reader Service number 479.

HEATH CONTINUING EDUCATION INTRODUCES NEW IC TIMERS SELF-INSTRUCTION PROGRAM

Heath Continuing Education has announced a new self-instruction program which covers integrated circuit timers. The new program, Model EE-103, includes an introduction to the common types of IC timers, how each works, what they do, and where they are used.

Among the types of IC timers covered are the popular 555 and 556 series general-purpose timers, the 322 and 3905 wide-range, precision, monostable timers, and programmable timer/counters—including the 2240 binary programmable timer/counter, the 2250 BCD programmable timer/counter, and the 8260 seconds/minutes/hours BCD programmable timer/counter.

The program's self-teaching text, with the assistance of review quiz questions and lab experiments, completely covers how each timer works and how each is used—in logic functions, output drive circuits, time-delay relay circuits, wide-range pulse generators, phase-locked loops, universal appliance timers, and as precise clock sources.

All of the electronic components required to perform the experiments are included with the program. The Heathkit ET-3300 laboratory breadboard is a recommended option.

The EE-103 IC timers course is one of four Electronic Technology Series self-instructional programs. They are designed to provide detailed knowledge for engineers, technicians, and other technical people. Other programs in the series include Operational Amplifiers (EE-101), Active Filters (EE-102), and Phase-Locked Loops (EE-104).

For further information, contact *Heath Company, Dept. 350-230, Benton Harbor MI 49022.* Reader Service number 481.

NEW HAMTRONICS® VHF FM EXCITER KIT

Hamtronics has announced a new single channel VHF FM exciter called the model T51. Patterned after the popular T50 exciter, the new unit is rated at 2 Watts continuous output and is contained on a 3- × 5-inch PC board. It is available for the 28-, 50-, 144-, and 220-MHz bands and may be modified for use on adjacent commercial bands. It is ideal for control links, repeater service, telemetry, and other applications for which a small unit is required. A multichannel adapter is also available to extend operation up to 5 channels.

Features include low-impedance dynamic mike and high level audio inputs; crisp, clear modulation; low spurious output; pre-wound coils; adjustable output level; and built-in test points for easy alignment. A commercial grade frequency stability option is available.

For further information, contact *Hamtronics, Inc., 65F Moul Rd., Hilton NY 14468; (716)-392-9430.* Reader Service number 476.

CENTURION ANTENNAS

Centurion International has introduced a new line of heavy-duty telescoping replacement antennas. These antennas are full-length ¼-wave radiators providing increased efficiency for radios that are not normally available with a telescoping-type antenna.

Three models are offered, each fitted with one of the five connector configurations: a straight telescoping antenna, a flex-spring model, and right-angle mounting model. The right-angle model is suitable for radios with front- or rear-mounted connectors or test equipment applications.

The flex-spring model has a shock absorbing spring fitted to its base to provide the popular flexible feature. The spring is protected with a tight-fitting neoprene sleeve. The sleeve retains its flexibility from −55° C to 100° C.

All models are available with a choice of five different con-

Centurion's telescoping antennas.

nectors: BNC, TNC, PL-259, F, and 5/16-32 threaded stud.

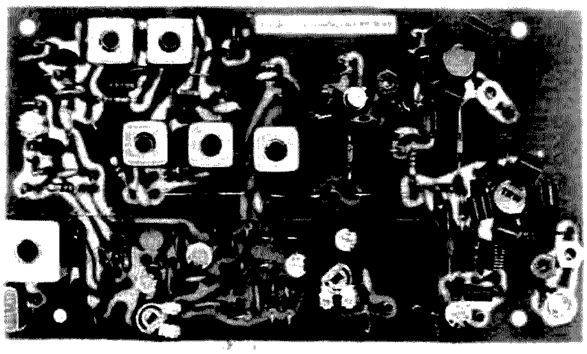
For further information, contact *Centurion International, PO Box 82846, Lincoln NE 68501; (402)-467-4491.* Reader Service number 477.

GILFER'S ALLBAND RECEIVER WITH 24-CHANNEL MEMORY OPTION

Gilfer Associates has just introduced in the USA the Japan Radio Company's NRD-515 communications receiver. The NRD-515 continuously tunes from 100 kHz to 30 MHz using a 100-Hz "step" photo-type encoder. Received frequencies are read to 100 Hz and the PLL-synthesized circuit can be locked to any frequency with assurance that the drift will be less than 50 Hz/hour. The rf/i-f circuit is a double conversion upverter (70.455-MHz first i-f).

The "kHz" tuning knob moves

Heath's IC Timer self-instruction program.



Hamtronics' T51 VHF FM exciter board.

10 kHz per revolution and a momentary "UP/DOWN" switch permits rapid frequency changes at 200 kHz/sec. There are no mechanical tuning stops and the all-electrical bandswitching circuit automatically tracks from MHz to MHz. Also featured in the NRD-515 are passband tuning, AM broadcast preselection, noise blanker, 10- and 20-dB switchable attenuator, variable bfo, LSB/USB/RTTY offsets, and RIT. Four switchable selectivity options are available (two supplied).

The optional 24-channel memory unit eliminates manually re-tuning your favorite frequencies—just turn the channel selector switch and the receiver is automatically and completely re-tuned. The memory is nonvolatile and the input/output data base is a 22-bit BCD code. Other optional extras include a matching loudspeaker and CW filters of 600- and 300-Hz selectivity.

For further information, contact *Gilfer Shortwave, Box 239, Park Ridge NJ 07656.* Reader Service number 478.

SONY ICF-2001 PROGRAMMABLE GENERAL-COVERAGE RECEIVER

In most cases a portable radio would be only casually interesting. But most cases aren't like the new ICF-2001 from Sony.

It is evident that frequency synthesis and scanning techniques are gradually winding their ways into the manufacture of reliable, inexpensive, consumer-oriented radio equipment. The little Sony package is an excellent example.

Approximately the physical dimensions of a cassette recorder (12" × 7" × 2"), the ICF-2001 features a liquid crystal display frequency readout. Coverage is 150 kHz through 30 MHz AM/SSB/CW, and 76-108 MHz FM. Frequency entries are made via a standard keyboard, registered to the nearest kilohertz (nearest 100 kHz on FM). Fine tuning of CW/SSB in the 150 kHz-30 MHz range is provided by an accurately-calibrated thumbwheel.

Frequency readout accuracy is excellent, fully reliable to a few hundred Hertz. Frequency stability is outstanding; CW and SSB signals are readily copyable from power-on until you get tired of listening! A series of slaps at the cabinet caused no shift in frequency.

A built-in four-foot telescoping whip antenna is adequate for casual worldwide reception. Relative signal strength is indicated by a light bar graph composed of 5 LEDs. Signals may be peaked by the use of an antenna-resonating thumbwheel.

A series of six push-button memory channels may be used to store and recall any six frequencies between 150 kHz-30 MHz, or 76-108 MHz, depending upon which band is switched in. The low-frequency FM band allows monitoring of channels 5 and 6 of TV audio as well. And for the paranoids among us, the common bugging frequencies between 86 and 92 MHz may be searched!

For the hunt-and-peck frequency hopper, the microprocessor is a dream come true. Merely load *suspected* channels into the six memory positions and punch up any one of them at any time. The non-volatile memory retains the frequency entries even with power disconnected.

The ICF-2001 also features a scanning function. Any limits within the passband being received may be programmed, and the receiver may be automatically or manually scanned. A slide switch may be activated for automatic stop when a signal is discovered.

Tuning is also accomplished by the push-button scanning method; any frequency displayed serves as a starting point from which up or down search begins.

Tuning or scanning speeds may be increased by another key, raising the rate from 1 kHz per increment to 10 kHz (approximately 4 or 40 kHz per second). On FM, the rate is either 400 kHz or 800 kHz per second, corresponding to 4 or 8 FM channels.

Power for the little Sony may be chosen from 3 internal D cells, 4.5 V dc (accessible from an automotive cigarette lighter using a Sony power plug accessory), or 120 V ac (power supply included). If you are tempted to use the receiver on batteries, use alkaline cells...current drain is a bone-crushing 400 milliamps! Yes, microprocessors still use a great deal of power!

But How About Specs?

The promotional and owner's literature give us little meaningful insight into the electrical specifications for the ICF-2001. A call to the factory was of little help, as even the product manager did not know. However, private measurements give us a little more information.

Image rejection averages −35 dB throughout the shortwave spectrum. The 6 dB/60 dB selectivity points are at 6 kHz and 17.5 kHz, making the 2001 a little broad for serious communications work. But it's about what could be expected from the custom 2-pole ceramic filter.

As far as intermodulation and spurious signals go, we found them no problem. In fact, we couldn't find them! Sure, they're there, but with an antenna connected and strong or weak signals being received, intermod and spurs were virtually absent.

A second i-f of 10.7 MHz (first and only i-f on FM) is used on both frequency ranges, with a first conversion i-f of 66.35 MHz on 150 kHz-30 MHz. Up-conversion is a standard technique in frequency synthesis to avoid in-band i-f images.

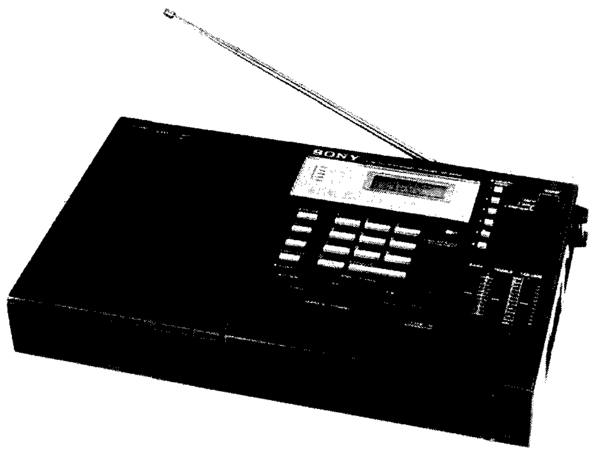
The 2001 sports 9 ICs, 11 FETs, 42 bipolar transistors, 24 diodes, 5 LEDs, and 1 large-scale IC microprocessor chip.

Swell, But Does It Work?

You bet! The ICF-2001 is an extraordinary performer for a portable. Our first experience with the little unit was with the self-contained whip antenna extended. Punching up 6 known SAC SSB channels into the memory banks, airborne and ground stations worldwide were received, solid copy. Step-tuning through the ham bands, single-sideband and CW stations were easily copied with excellent quality. No frequency drift was detectable over several minutes of portable handling, carrying the unit from room to room.

Attaching the 135-foot windom antenna, we fully expected that the receiver would come apart at the seams from signal overload. Surprisingly, although signals were much louder, the receiver behaved very respectively. Some signal bleed-through was detectable at night, but it was easily removed with the attenuator switch.

Gilfer's NRD-515 communications receiver.



Sony's ICF-2001 general-coverage receiver.

We haven't even discussed some of the other features... sleep switch, accessory jacks, LCD function displays.

In Conclusion

The new Sony ICF-2001 is meticulously designed, extremely functional, compact and flexible, and an outstanding performer. While it was never intended to compete with a Collins receiver, it makes one potent backup receiver and a fine vacation portable!

The Sony ICF-2001 lists for $329. For further information, contact *Sony Corporation, 4747 Van Damm St., Long Island City NY 11101.* Reader Service number 484.

Robert Grove WA4PYQ
Brasstown NC

B&W BROADBAND FOLDED DIPOLE ANTENNA

It would seem that after a century of experimentation with radiating wires, every possible configuration of single-wire antennas would have been explored and exploited. But new antennas keep popping up, proving that experimentation still is wide open in this aspect of communications.

During the 1950s, a series of articles by G. L. Countryman W3HH discussed the possibilities of the "tilted terminated folded dipole." The T2FD, as it was popularly called, was a cross between a resistively-terminated rhombic and a sloping folded dipole.

It seems that B&W is impressed enough with the commercial feasibility of such a contrivance to produce a similar antenna for both its military and its consumer market. The model 370-15 broadband folded dipole is the result.

The antenna comes fully assembled, wrapped around two cardboard tubes for shipping. It is designed for continuous frequency coverage, 3.5-30 MHz. The antenna dipole is constructed of #14 stranded 40% copperweld wire, the upper and lower dipole sections held apart by six spacers of rigid PVC pipe.

The antenna system is rated at 2.5 kW (5 kW PEP), enough to take the full power of any amateur-rated linear amplifier. All-weather construction ensures years of maintenance-free operation.

The antenna is coupled to a balun transformer and fed by approximately fifty feet of permanently-attached RG-8/U coaxial cable. A special impedance terminating network maintains the constant characteristics of the antenna throughout its usable frequency range.

Installation

All large dipole antennas are somewhat unwieldy to install. The 370-15 is no exception. It is recommended, although not mandatory, that two people cooperate in erecting the antenna. It is not particularly heavy, but it is ninety feet long, consisting of two wires, fifty feet of cable, and other accessory accoutrements along the way! Merely keeping the copperweld wire from kinking is important and requires attention while unrolling the dipole.

B&W recommends using the allband dipole in one of three configurations: a sloper, a flattop, or an inverted V. Among the three, the sloper is the best all-around antenna. It requires only one high and one low support and it is essentially omnidirectional. The manufacturer recommends an upper height of 24 to 40 feet, allowing six feet of clearance for the lower support.

Our Experience

The ninety-foot dipole posed no particular problem in installation even when erected by one individual. By anchoring the center of the antenna, the remaining lengths are easily unfurled, ready for elevation.

Although fifty feet of coax may seem like a lot, keep in mind that a ninety-foot antenna is an imposing length to permit the coax to come close to the shack. Add to that the fact that the antenna must be removed from metallic influences (siding, electrical and power line wiring, metal roofing, air-conditioning ductwork, automobiles, etc.), and you may very well need an additional length of feedline; I did.

Additional feedline at frequencies below 30 MHz is no liability. Even the smaller RG-58/U would be perfectly satisfactory for another fifty feet or more if power levels on the order of 200-300 Watts are all that will be used. Line loss is insignificant.

After erecting the folded dipole as a sloper, we loaded it with a Drake TR-7 for our field trials. Sure enough, the vswr curve on all bands was very close to that shown on a graph which accompanies the instructions. Curiously, there is a vswr hump on 40 meters, rising to nearly 3:1 at our location.

With one end of the dipole tied to a 35-foot tree, we moved the lower end around the yard, testing its response on all bands. Proximate metallic masses (a power line, a utility shed, the car) showed their deleterious effects on the antenna. Clearly, the antenna must be mounted as free from reactive materials as possible.

In the case of less-than-ideal environments, the use of an external matchbox is recommended. While the matchbox will not help the reflective and absorptive tribulations of nearby metal, it will keep the vswr at a respectable level.

Wind and ice characteristics of the antenna should prove adequate for most localities. With end supports only, 100-mph winds may be tolerated—150 mph with an additional center support pole. Ice accumulation of 40-50 pounds (80 pounds with center pole) is also endurable by the system.

While the antenna is designed to operate through 30 MHz, chances are that the ferrite materials in the balun would behave at frequencies somewhat higher. It would be interesting to find out how the antenna would perform on six meters. With ninety feet of dipole length, there are bound to be some directional lobes, as there are on ten meters.

The cost of the B&W antenna is substantial, but for allband performance with no external feedline tuning necessary, it is worth considering, especially with the advent of the new amateur band plan obsoleting many present-day antenna systems.

B&W's 370-15 allband folded dipole lists for $149.50. For further information, contact *Barker & Williamson, Inc., 10 Canal St., Bristol PA 19007.* Reader Service number 483.

Robert Grove WA4PYQ
Brasstown NC

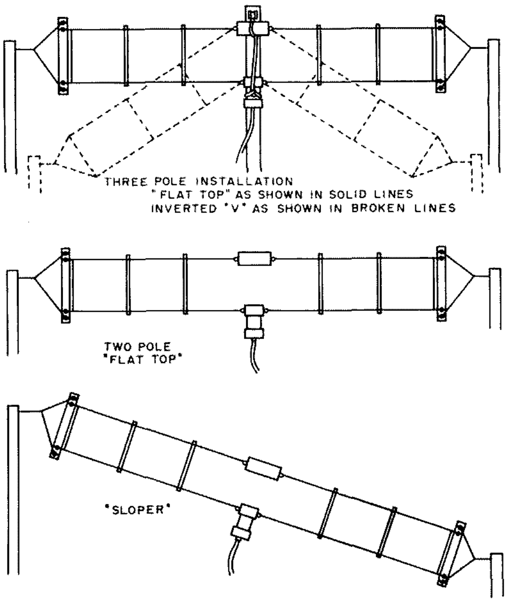


Fig. 1. Typical installations for B&W's 370-15 allband folded dipole.

SC-76 SCANNING MODULE

The SC-76 is a low-cost scanning module for the Kenwood 7600 and 7625. It installs in a matter of minutes, requires no soldering, and comes complete with detailed instructions. Once installed, it is placed in operation by turning the radio's mode switch to position "M". It then causes the radio to scan between the frequency in memory and the frequency on the dials. Either frequency becoming active will stop the scan. Normal operation is resumed by placing the mode switch to the simplex or offset positions.

For further information, contact *Karetron Engineering Co., PO Box 241, Middletown OH 45042.* Reader Service number 482.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

read guess-what magazine and talk mostly to other old-timers...all who have 20-year-old ham gear, factory made...all you have to do is take one look at the number of pages of ads in *73* for parts. Look here, if hams weren't building equipment, those firms wouldn't spend all that money to advertise parts.

One of the hottest microwave receivers on the market today was first designed by hams. It did so well they went into business making 'em...and these are the Cincinnati Microwave "Escort" radar detectors. The hams are a bunch of chaps who split from Drake and went into the detector business...and are cleaning up. Do you think they would be doing that if they hadn't been hams and learned about that through hamming?

KILL THE LAWYERS?

One of our readers (W2JTP) sent along a copy of *Industrial Communications*, a most interesting newsletter which covers the mobile radio field, among others. There was an article on the state of the art in spread spectrum (SS) communications such as was pioneered by John Costas in 1959, when I published an article by him on the subject in *CQ*. Much of the experimentation with these techniques is presently taking place in Japan.

Let me quote *Industrial Communications* on the subject of why the U.S. commercial sector has not pursued this: "It appears that the principle 'wet blanket' in this regard is the regulatory atmosphere that pervades the nation's capital. The present adversary structure and rigid rulemaking are so inconducive to innovative technologies that the prudent industrialist is obliged to shift his ground in miniscule steps or not at all.

Already this native American technology is being investigated more seriously in Japan than in the U.S. It would be sad indeed if a burgeoning new field were to become the patented reserve of another country. Perhaps as a first step in regaining world leadership in this area, we should look to Shakespeare's Henry VI: 'First we kill all the lawyers...' "

I see the fault lying not in the restrictions on the commercial field, but rather as a failure of amateur radio to provide the needed pioneering and inventing which is our responsibility ...and to hell with the FCC lawyers. I don't think it is necessary to kill them, just find honest work for them...fixing roads or something.

IT'S LOBBY TIME

A bill (HR-7747) has been entered into the legislative logjams which could cause amateur radio one hell of a headache if we don't muster our forces to beat it to death in committee. This is a matter which should involve every amateur...individually and via action through ham clubs. If any ham club does not take action on this, they need restructuring quickly.

The bill is designed to protect the interests of the pay-TV people, who seem to be utterly paranoiac about a handful of experimenters managing to see their shows without helping to pay for the corporate jets.

Historically, the FCC has had a strict policy of protecting the availability of all radio frequencies against corporate privilege. Despite local regulations in some cities against listening to some frequencies, the FCC has stuck by their manifesto that the airwaves are the property of the people of our country, not those wishing to use them for making money or governing us. Thus it is and has been legal to tune any receiver to anything you wish.

In order to give some degree of protection to the users of radio channels, there is a rule which prohibits a listener from using information heard over the air for commercial gain or other such financial benefit.

This freedom to listen to the radio is constantly being threatened by firms which want to use our frequencies for making money and are fearful that even a tiny body of people will tune in without paying in full. Rather than using sophisticated protective measures such as coding of the signals, they have tried to use their lawyers and their lobbying money to get around the FCC through Congress. Congress reacts positively to money, as we know, so it is a logical approach. Congress reacts even more positively to an outcry by the people they need even more than the lobbyists—voters—and in this case this means you, your family, and your friends.

One ham should, with some motivation, be able to make one hell of a stink about something which is not only bad for the country, but in particular has very ominous portents for amateur radio. You know as well as I that once we let them start setting up laws prohibiting the use of the radio spectrum, it will be no time until we are not allowed to have all-band receivers or to even build experimental circuits.

WHAT WAS PURAC?

This was an advisory committee set up to work with the FCC and help them to cope with the growing CB problems of the mid-70s. It was made up of volunteers who worked at no cost to the FCC to solve the CB problems. The committee was broken into eleven subcommittees, each reporting on one aspect of the interlocking problems. The committee included quite a few hams and brought forth a report which was published in three volumes...a most authoritative report. Unfortunately, due to a shortage of funds, only ten copies of the report were ever printed. The part on RFI solving is considered by many in the FCC as definitive. The PURAC committee functioned from 1976 to 1978 and was decommissioned by the FCC when the new administration came in and decided that there should be no further advisory committees.

In fairness, I gather that this demolishment of PURAC was a case of overkill, resulting from a desire to end the FCC practice of giving out contracts for reports...and paying dearly for them. This was a juicy little business in the 70s and attracted a number of firms which had figured out how to get the contracts and how to fulfill them, all with a minimum of actual work and value of the end reports. Having participated in one aspect of this and having gotten a good look at how the whole system worked, I'd say it was a good move to put a stop to that boondoggle.

REPEATERS CAN SAVE LIVES

Perhaps you've read about the emergency locator transmitters (ELT) which planes have aboard. They are small VHF transmitters which are triggered in a crash to help locate the downed plane. Obviously, the sooner a downed plane can be found, the more chance there is that survivors can be saved, so every minute helps.

VHF being what it is, and planes which have crashed being on the ground in most cases, it figures that the higher you are when listening for these little low-powered ELT rigs, the better chance you will have of hearing them. So what is up in the air as high as we can put it? Repeater stations, of course.

It makes a lot of sense to me for every repeater site to have a receiver tuned to the ELT frequency so that any transmissions on this channel can be picked up as soon as they start. You still want to be able to use the repeater, so the ELT would not want to take complete control, but you might want to have the repeater stay on the air once an ELT signal was coming in, perhaps with a low-level tone modulation so you can talk over it for search coordination.

Advanced tinkerers might set up an omnidirectional antenna for normal ELT listening, with a remote switching system to change to a directional antenna which can be rotated via the repeater...and the peak signal direction (or null) indicated in some way. I'll bet we can drum up some interesting articles on how to do that! We need 'em anyway for eventual remote controlling of low-band beams via repeaters.

Every service we can supply with our repeaters is another merit badge for amateur radio. All of us should be thinking in terms of putting our expertise and equipment to the public good as often as possible... and then making darned sure the public knows about it. That's

not being glory hungry or cynical about it, just being practical. If you want to attract more kids into hamming, you've got to be visible and make it seem like fun . . . which should not be much of a challenge.

All is not perfect with ELT transmitters either. Sometimes one will go off unintentionally due to being set wrong, bumped, or even jarred in a bad landing. If we have more people listening to the channel, we will put pressure on pilots and technicians to be sure that errant transmissions on the ELT channel are cut to a minimum and not just shrugged off.

You may be sure that I'd like to hear about any repeaters set up to help with the ELT situation . . . and so would the other readers.

RADAR JAMMING

During the time when Chuck Martin WA1KPS and I were making our tests of the 10-GHz ham gear . . . and running up our record of making contacts from here in New Hampshire to seven other nearby states . . . we did not entirely ignore the possibilities of using these little rigs to interfere with police radar.

The area out in front of our Elm Street building (with the *73 Magazine* ham shack) is a favorite haunt for both the local and state police. It is at the top of a hill rising from the center of town and just over the lip of the hill. The result is that cars come roaring up the wide highway and tend to ignore the 35-mile-per-hour speed limit . . . after all, it is a restricted entry road, so why drive that slowly? As they come over the top of the hill, there are the police, handing out speeding tickets.

On several occasions, I tried zapping these money makers with our 10-GHz ham rigs, but they never fazed them. After thinking about it, I realized that at 10 GHz the likelihood of being close enough in frequency to really interfere was remote. You have to get down to about 3 kHz and you just aren't going to be able to do that.

Upon reflection, I can see that those firms making radar-jamming rigs are just selling smoke. Sure, if you tuned one of them up exactly on the channel of a radar unit, you could get it to work. But as soon as another radar came along, you'd get into trouble if you expected to cause false readings on it.

Despite the come-on mph calibration of the bogus radar jammers, I suspect that the main value of these is for 10-GHz ham experimenting. I'm sure that many *73* readers would like to see more articles on 10-GHz equipment and tests, whether the stuff will jam radar or not.

THOSE SILLY EQUATIONS

One of the more serious wastes of my time in college was the time I spent learning enough to pass the courses on calculus. I've had a fundamental rule with *73* down through the years: Edit out the math equations unless they are absolutely necessary. They rarely are, so you've seen precious few equations in *73* during its twenty years of publication.

To give you an idea of how little calculus is really needed and what a waste of time it is in school, harken to my personal experience with it. I started in college in 1940 and went for two years, thus taking two damned years of calculus. Then, urged on by the government to cut out all this college nonsense and to get out there and fight, I joined the Navy (one lousy day before the Army was going to draft me . . . close call!).

After a year of schooling in the Navy, I was shipped out to the fleet and spent the rest of the war . . . or most of it . . . on a submarine, making five war patrols on the *USS Drum* (SS228). Managing to survive that, despite stubborn efforts by both the Japanese and our own Air Force to put me into the Silent Key columns, I eventually got discharged and went back to college.

Having finished all but one of the calculus courses during the first two years, all I had to do was breeze through that one remaining course. Easier said than done. I found myself with virtually a zero recollection of two years of calculus. It had never come up during the intensive Navy electronics school courses, so I'd managed to completely forget everything.

This put quite a strain on my first term back at school because I had to first go back over four terms of calculus so I could hack the fifth term. Boy, did I hate that!

Funny thing . . . I have a remarkable memory for songs, poetry, and operettas, being able to sing most of several Gilbert and Sullivan operettas, but I just had no recall on calculus.

In the over 30 years since college, I have had no occasion to use any calculus, despite a wide variety of work . . . and the editing of several thousand manuscripts. I remember enough of it now so I am not intimidated by the use of calculus and I know that I can just edit most of it out of articles without hurting them at all.

This came to a head recently when a reader sent in a copy of a letter he'd written to *Ham Radio* magazine complaining about their excessive use of math in a W2PV article series. The writer, who is quite familiar with the math involved, took the editor to task for letting the author snow the readers with the totally unnecessary math.

One of the reasons that the scientific calculators did not achieve more popularity was that there were no instruction books available for them to explain how to make use of the scientific calculations which they made possible. Few businessmen have the vaguest notion of what chi-squared represents . . . and none of the calculator instructions helped them. Most of these same people would have loved to have been able to use the calculator to find out statistical data, if there had been any simple instructions on the application.

The lack of such instructions has cost the calculator people dearly. I'll bet they could have made millions more in sales if such a book had been available.

The technical articles in *73* are the equal of any in ham magazines, but we do try to make them easier to understand by filtering out the math which some authors want to put in . . . mostly for ego purposes. We want to make it easy and fun to learn, not scare the hell out of you.

CROWD PLEASER

For a while it was beginning to look as if every newcomer to two-meter FM would eventually have his own repeater and sit there listening to it kerchunking every now and then with satisfaction. When the number of channels ran out in some areas, there were bitter fights . . . oddly enough, usually over the most active channels rather than those merely sitting there unused.

A recent report by Stanford University indicates that there are some new techniques which hams should be checking out . . . techniques which could provide us with three times as many two-meter channels as we already have. This would enable us to have three times as many unused repeaters as at present . . . and three times the number of happy repeater owners kerchunking away every now and then. And think of the joy in Japan when a whole new set of ham gear is needed!

The new technique, called Amplitude Compandored Sideband Radio (ACSB), has some similarities to the recently discredited Narrow Band Voice Modulation (NBVM) craze which the ARRL went through and then dropped. With this system, it is possible to have voice channels every 5 kHz on the VHF bands without interference. It also has a nice benefit in that it provides about a 10-dB improvement in reception over FM, which takes about 25 kHz or so . . . despite our attempts to contain it within 15 kHz.

The ACSB signal is a sideband type, but with some differences. It has a voice processor which boosts the low and high frequencies to bring up the average power of the voice . . . plus it has a pilot tone about 7 dB weaker than the peak voice which keeps the receiver on tune (AFC) and provides decoding of the compandoring, a standard signal for automatic gain control (AGC) to smooth out fading and the picket fence syndrome. The pilot also has a subaudible FM tone for selective calling. In some ways this system is quite similar to my proposed automatic identification system described recently.

Of course we would have to change over to sideband from FM, which would mean all new rigs. That should bring about $500,000,000 in joy to the manufacturers. It is not difficult to change present SSB rigs for the new system, but FM gear has receivers which are far too wide for the 5-kHz channels.

Needless to say, I would like to see some experimentation with this system by amateurs and some articles on it. The circuits necessary to do the pilot, the FM subcarrier, the AFC, the AGC, the compandoring, and all else involved are being integrated into an LSI chip, so our

work may not be difficult.

The 5-kHz channel spacing would mean that we could fit 80 channels between 146.00 and 146.40, where we now have 26, none of which can do well if anywhere near an adjacent channel repeater. This would give us 160 channels in the 146- and 147-MHz repeater segments of the band. With more channels, we would not need as many simplex channels and could take at least half of them for one-MHz split repeaters, giving us 200 channels in the 146-148 segment alone. That might even take care of Los Angeles for a year or two.

The pilot carrier system would fit right in with my proposed identification scheme, making it simple to locate any individual station desired. Each station would continuously send out identification, allowing you to see instantly the call of anyone using the repeater. Good-bye kerchunking and bad language.

The doubling of the range of reception for repeaters and the elimination of most of the fading problems by the system would greatly improve our repeater coverage and value. This would also help with hand transceivers, which could be made smaller due to the lower power which could be effective. Ten dB is equivalent to ten times the power, so a one-watt HT would be about the same as a 10-Watt mobile rig in effectiveness... unless we throw the power away with a rubber duckie.

Let's see what we can do to pioneer this idea.

INFECTING THE ACNE SET

Now that it is no longer unpopular to be successful, it may be possible to carry the message about amateur radio into the high schools and turn on the students to hamming instead of pot or the development of a lifelong dependency on tobacco or booze.

The fact is that we have one hell of a message for the kids, for not only is hamming fun, but it also is one of the best keys one can find these days to getting an edge on the future. Is there any question in your mind that the electronics field is not going to keep right on growing at a healthy rate for the next 50 years? Every sign is that electronics is going to be more mixed into everything we do in the future than it is now...and that includes computers, obviously.

We're heading into a world full of micro communications devices which will put us in touch with each other at will and be able to gather information on a magnitude not even realized today. The bottom line in all of this is electronics...and how better to learn and be ahead of the pack than to get sucked into amateur radio? It happened to me and it happened to you.

Surveys show us that currently almost 90% of the teenagers who get hooked on amateur radio are going into electronics in some form. We also know that about 50% of the newly licensed amateurs are either 14 or 15 years old, so it is obvious that the growth of amateur radio is tied closely to the growth in the number of electronics oriented people...who are or will become technicians and engineers.

The Japanese took clever advantage of us when they instituted a code-free ham ticket and thus laid the groundwork for the incredible amateur population they have today. Next they got their amateurs to talk up amateur radio in the high schools and get ham clubs going. The result is that today amateur radio in Japan is known to everyone In the country and they have nearly one million hams, virtually all active. That's almost six times our active hams, and we have twice their population. Is it any wonder Japan is ahead of us in technology?

As I see it, the future of amateur radio as well as the future of our country depends on how much enthusiasm our ham clubs and repeater groups can put into developing interest in amateur radio in the high schools. We need to expose these kids to hamming and get them involved with ham clubs.

One approach to this is for your club to set up a demonstration ham station in the local high school and pass out literature about hamming which will explain the fun involved, the practical long-range advantages, and give details on how to get started. If you keep after 'em, you'll have plenty of kids in your classes at the club...and we'll start seeing some significant growth in amateur radio again.

If you have someone in your club who has some experience in public speaking, you might get them to go around to the local schools and explain the advantages and fun of amateur radio. From a practical standpoint, the kids could hardly ask for a better hobby since hamming will aim them at the pot of gold ahead in electronics.

When it comes to being a success in life, it is a lot easier to make it in a field which is growing than in one where the field is dying...such as education. I give a lot of talks to groups on the fundamentals of success and I usually start out by explaining that there are several time-proven ways of investing your life so that you will never be a commercial success...never be able to make much money. One is to go into teaching. Now this may be very rewarding in spirit, but it sure results in very few yachts and planes...or security. Then there is working for the government, which does have security, but at one hell of a price in salary and opportunity. Another big loser is working for a large corporation. Again there is a tight lid on salaries, though a mere handful do manage to work up into the 90% income tax bracket. It's a tough way to go...and you can get canned at any time.

So if the direction that our colleges and all the media push on us aims us at losing, how can we aim kids at careers which will give them the probability for making real money? The secret to being successful is to plan for it and work at things which will have a good chance of resulting in getting rich. Certainly, considering the growth which has come about in electronics (and computers), this is a lot better field to go into than English, art, or law. Just what we really need is more lawyers.

Hamming is particularly good because it gets kids into the habit of thinking about their life's work more than the usual eight hours a day. Hams never really stop thinking about their interest. Hundreds of hams get ideas for new products and start up small firms to make them... and a few of these pan out well and we have big firms such as Drake resulting...Electro-Voice, etc. Others go for a while and then fade away, but the experience gained by the entrepreneur is invaluable and will surface later. When I meet the heads of medium-sized firms in electronics, it is rare that I don't find a ham heading things up.

So get out there and spread the contagion...let's get the ham virus going in high schools. You'll enjoy seeing your handiwork...the kids will certainly benefit...amateur radio will grow and perhaps we can even get the leadership in electronic technology back from Japan.

THE CODE-FREE HASSLE

Some years ago, in response to the pressures from the CB industry, I could see a concerted move afoot to grab the ham 220-MHz band. I thought we might be able to fight this off with some stratagems, but I wanted to make sure that we were as well covered as possible so I came up with a no-code ham ticket proposal for the 220-MHz band.

My strategy was to give the CB manufacturers an out which would sell equipment for them ...possibly as well as making 220 into a CB band, but which would still leave it a ham band and thus not force hams out of it. The growth of hamming, which this would bring about, was needed...and still is. By starting people in as hams instead of CBers, I felt that we could exert ham influence on them to upgrade much more than we could if they were just CBers.

The license that I proposed was not a sign-it-and-own-it CB ticket, but one which would be granted by ham clubs only after people interested graduated from ham training classes and passed exams in very simple theory, operating techniques, and rules. I felt this would, at the same time, put the new licensees in touch with clubs where they could continue on to higher classes of license and experience the ham spirit.

The proposal I made also specified that the no-code license part of the band would be bordered by parts of the band open only to higher classes of license such as Technicians. I had in mind the use primarily by repeaters which would have to be operated by higher class licensees and would thus give the newcomers a good introduction to amateur radio and make sure that they did not think of it as CB. That, plus the ham club license classes, I felt, would get these new people aimed in a

good direction.

If the band were set up with repeater inputs from, say, 220.5 to 222.0, and outputs from 223.0 to 224.5, this would provide a half meg on each end of the band for higher class operators (and repeaters) plus a full meg in the middle for higher class. . . or perhaps split with half of it for the new class simplex and half for higher class.

With 220 still not very much used in most areas of the country, this concept could still fly.

The plan did cause some weakening of the CB industry ranks and it helped us in that respect. I also got after my friends in Mexico and Canada to put on their pressures to stop the CB takeover of 220 and that had even more of an impact.

When I first proposed the no-code license, the ARRL was opposed to it. Then, as pressures from the industry mounted, they flopped over and were in favor of it. Now I understand that they are opposed again.

Seeing what a no-code ticket has done for Japan, with many benefits and no detectable drawbacks, I'm still very much in favor of the idea. I was more enthusiastic before Dick Bash started publishing his detailed cheat sheets on the FCC licenses, which essentially cancelled their effectiveness. Right now the only thing between anyone wanting a ticket and having it is the code or being too cheap to buy the Bash cheatos. Until we are able to resolve that mess, I'm not inclined to push for going to a purely written no-code ham test.

If we could set it up as I had proposed with ham clubs issuing the licenses to those people who had taken and passed their courses on being a ham, I would again favor a no-code situation. There are some problems to be resolved before clubs would be able to have the right to issue tickets. I would like to see amateur radio get more autonomous, having much more of a say in our regulations and the granting of licenses. We might be able to work out a system where we could get needed rule changes made in less than ten years, thus allowing amateur radio to keep up with technological developments instead of having to stay at least ten to twenty years behind.

If you have any well-thought-out ideas on a no-code license situation, please write in. None of us needs any emotional outburst or other red-neck responses. . . just good ideas.

LOOKING WEST

from page 12

Frankly, I have a feeling that this is where the problem in relation to this dismissal order comes from.

While I cannot speak for the Commission, I can surmise what transpired. Mr. Talley submitted his petitions under the assumption that the Commission understood amateur radio's internal interpretation regarding repeater categorization. He even told me that his opposition was toward repeaters that required one to become a member of some club or organization in order to use the repeating facilities. Again remember, we in amateur radio consider closed and private repeaters as those which restrict system access to club members. But the FCC did not read it that way. To the Commission, an open repeater is apparently one that offers no control over system operation, either technically or operationally. At least that's what seems to come to light when you read the dismissal order.

Therefore, if my guess is right, a system that has some form of control is looked upon as a closed or private repeater. It seems to have become a problem of semantics. They have never bothered to reseach what we in the amateur community accept on a day-to-day operational level. The Commission apparently looked upon Mr. Talley's request as one of removing all controls and guidance from repeater operation and reacted along those lines. Unfortunately, they may well have set an unwelcome precedent and started us on the road toward reregulation rather than continuing with deregulation.

Even more unfortunate is that in using the rationale they have, the Commission has overlooked the true intent and purpose of Mr. Talley's filings. In my view, Mr. Talley was actually raising a Constitutional issue. His contention is that amateur repeaters should be by law available to any qualified licensed amateur. I oppose this because it is my sincere belief that to force anyone operating a repeater to make it available to anyone is akin to forcing him to provide a service for another person that he may not wish to provide for that person. If you are going to open all repeaters to all qualified amateurs, then, by the same token, you also must make all individual amateur stations available to all qualified amateurs, regardless of where such stations are located.

The concept of forcing one amateur to provide a service for another is what I object to, and this has nothing to do with either amateur radio's or the Commission's interpretation of repeater categorization. In my opinion, the defeat of RM-2844 was justified, but not for the reasons noted in the dismissal order. Had it been stated that the reasons I have outlined were the basis of their decision to deny, then I could agree with it. Maybe it's time that we in amateur radio begin to educate those who regulate our service, get them to understand our terminology and definitions in regard to our day-to-day operations. If this can be achieved, then we can really get on with things.

There is nothing wrong with the system by which regulations governing our hobby are generated. For the most part, it is people like you and I who generate them, for better or worse. We are very lucky: In most other places, rules are simply by government decree. There is nothing that the amateur can do but abide by them without recourse.

Here, in America, we can help generate and guide the destiny of amateur radio through the public rulemaking procedure. This is a liberty we must cherish and utilize for the good of our hobby. But we also must find a way to overcome the semantics problem so that when we talk about open repeaters, the FCC understands our meaning and we theirs. When we speak of modes, power levels, or anything else, each must know the meaning of the other's words. This will go a long way in developing more positive lines of interaction between those of us who comprise the amateur community and the agency that regulates our operations.

SHOULD THERE BE PRIVATE REPEATERS DEPARTMENT

In any discussion, we must first set some ground rules for understanding. In this case, I feel it is best that we begin by reviewing the definitions of the three categories of repeater operation as accepted within the amateur community. Over the years, the following definitions have developed:

Open Repeater: An amateur relay device placed into operation by an individual or group to serve the needs of all licensed and qualified amateurs in a given area. In most cases, no form of tone access is necessary to access such a system.

Closed Repeater: An amateur relay device which requires that one become a member of the sponsoring organization to gain use of the relay system facilities. However, membership in such organizations is open to any interested amateur licensee.

Private Repeater: An amateur relay device which, like the closed repeater, requires membership in the sponsoring organization. However, the availability of such membership is at the discretion of the system licensee. Both closed and private repeaters are usually tone accessed, and such access tones are considered to be proprietary information.

If we accept these as our definitions of operational categorization, then a question arises. Should the latter two be permitted to exist in today's amateur society? It probably depends upon where you reside, conditions of crowding on various bands, and, most importantly, your own personal taste. I

cannot comment on the last, but in regard to the others, I have a number of words, some of which will not make the owners of closed and private repeaters too happy. What I have to say differs from earlier commentary that has appeared over the years in this column, but this is because of the ever-changing face of the amateur service itself.

If you live out in the boondocks where nobody cares, you can basically do your own thing and nobody will say boo. If there are only three or four repeaters in your area and a clear band, then I do not think anyone will really care what category of operation you choose. However, in crowded urban areas where one finds a repeater or two every 15 kHz between 146 and 148 MHz and the same condition every 20 kHz from 144.5 through 145.5 MHz, then the two-meter band is no place to start or continue a closed or private device. Two meters has become "the people's band" and, for the most part, "the people" want and demand access to the entire spectrum. While densely populated metro areas might have been able to tolerate a number of private repeaters on two meters only a few short years ago, with today's spectrum crunch it may be time for those wishing this category of operation to look toward greener, less occupied spectrum.

I have no qualms with closed and private repeaters. In fact, I freely admit to being a member of two such entities, but neither of these are on two meters. Over the past several years, I have been invited onto a number of private two-meter systems here in the Los Angeles area, but each time have declined such an invitation. Yes, there is a place in our society for those who want their privacy and there is nothing wrong with their wanting it. But the urban private repeater of today, operating within the crowded confines of the two-meter band, is somewhat akin to a case of the flu. Neither is very welcome anymore. As time progresses and the spectrum crunch tightens, they will probably become a definite liability within our amateur community.

On the other hand, there are bands with practically no utilization. This holds true even for areas where the two-meter band is saturated with 24-hour-a-day activity. Such spectrum would welcome any activity, private or otherwise. This is where such systems belong, out of the mainstream of today's amateur activity. Further, those wishing the luxury of operation on such a system should be prepared to spend the extra bucks for the necessary equipment, be it on 6 meters, 220 MHz, or 450 MHz. If you want the luxury, then be prepared to pay the price tag that comes with it. After all, the vast majority of those using the two-meter band are not that interested in getting on a private or closed system. For most, amateur radio is a recreation and not an avocation. I can see no reason to displace the masses in deference to the few. I do not condemn private or closed operations. They have their place within the structure of amateur radio society and as such serve a definite purpose. Many of the earliest systems had restricted access, and from them has come much of the open operation of today. However, in areas where the two-meter band is overflowing with activity, where the coordinator or coordination council has a waiting list a yard long for new open repeaters, the closed and private category system should take a back seat to the will of the majority.

SIX-METER BAND PLANNING, CONTINUED

The band plan outlined in the September issue on page 163 has begun to get some response. What I find very scary is that thus far I have not received any negative commentary. Some suggested changes, yes, but nothing that says "NO" emphatically. One important addition that I want to note concerns the existence of another Pacific DX corridor. It was not brought to my attention prior to the formulation of the band plan and therefore was not included.

A second Pacific DX corridor does exist from 51.0 through 51.1 MHz. It has been around for some time but never has been given very much publicity. So, if we were to obtain deregulation down to 51 MHz for FM relay operations, in some areas it might be wise to keep FM away from this small slot to protect weak-signal operations. Again, this would fall under a voluntary program and not be part of the amateur rules and regulations. It would be exactly the same as the Pacific DX corridor that exists from 52.0 through 52.1 MHz. I might suggest that you pencil this into the band plan for future reference.

For the moment, that's about it in regard to six meters. More on the subject will be included in future columns and as comments come in.

FINAL UPDATE ON STORY ONE

We opened this month's column by reporting on the dismissal order to RM-2844, an order that on the surface seems to eliminate open repeater operation. We also included a scenario on what we hypothesized as being the sequence of events leading up to it. Well, information we have gathered seems to point to this being similar to what really happened.

It appears as though the order was given to a member of staff to prepare the document. The person was not all that familiar with Part 97 as it governs repeater operation and wrote the document based upon his own understanding. After its release, a number of inquiries were made to its validity and it was brought to the attention of a senior member of the staff who agreed that its wordage was somewhat contradictory to the rules as written. A clarification has been promised. It should be forthcoming and we may have it for next month's column. I hope that it will clear the air.

LETTERS

from page 24

what about the other 99% of the time? Unfortunately, although they expect us to operate in the public interest, we really can't expect them to do likewise.

If the FCC doesn't resume testing in Germany, there is only one option left. That is to reinstate the Conditional class license which we had many moons ago. If this can't be done, then they should put the testing program in the hands of the Extras. The FCC would undoubtedly balk at a suggestion such as this because of past problems concerning "mail-order" Technicians. But I am sure that the Extra class hams can run an honest and sound testing system not only for amateurs, but also for the commercial applicants. I have already earned my Extra class ticket, but I am speaking for the hundreds of hams and those desiring their phone licenses. In closing, all I can add is that "the FCC giveth, the FCC taketh away."

Harry A. Schools KA3B/DA2AL
APO NY

Thanks for the letter, Harry; you are expressing what I heard everywhere I went in Europe a few months ago. Perhaps someone should petition the FCC to solve the problem with an overseas Conditional license arrangement? The major problem, both with lack of growth of the hobby and with the FCC problems, stems from our lack of a lobby to push for amateur radio in Washington... and in particular with the FCC. It is completely unfair to blame the FCC for acting like any other government bureau and reacting to lobbying pressures which are on them from all sides... except amateur.—Wayne.

IT'S A MESS

Every time I read an article or letters from readers regarding FCC decisions, which are usually negative, causing more government control of amateur radio and more restrictions, I wonder if the founders of the Federal Communications Commission were of this mind?

Amateur radio has been the victim of the Commission's inability to cope with their bum decisions on CBers. But the worst of all is the alphabet soup call letters of all descriptions. As I

see it, it is further degradation of amateur radio. We used to be able to tell where a particular callsign would originate from, but not now; it's a mess! Possibly, they want to fracture this sacred organization, i.e., to make it like CB. I surely hope not.

I have been a licensed ham since 1939 and I still enjoy ham radio. This brings to mind a recent overseas contact on 20 CW with a ham in northern Norway. My comment that I had been an amateur since 1939 brought this response: "I, too, am an old-timer, receiving my first ticket in '38, and I dearly love my hobby."

Henry S. Mitchell
Seattle WA

Henry, a lot of us grumble about the FCC, and certainly some of the rules they put through are for political reasons and not in the best interests of the hobby . . . but then we have virtually no lobby there to deal with the FCC and guide them in a positive way, so we can expect no more than we get. When you are dealing with government, you have to do things the government way, and this means lobbying for your hobby. It is useless to get mad at the FCC for acting perfectly normal and hold blameless the real villains . . . the people we are paying to represent us.—Wayne.

ANTENNA CHOKES

I've received an interesting letter from Al Stahler AD6G commenting on my article, "Check Chirp with a Choke," which appeared in the June issue. Al comments as follows: "I've used a similar device in all of my antennas—but for a slightly different reason. The idea is to remove rf from the feedlines. King, in his book *Transmission Lines, Antennas and Wave Guides* (Dover, 1965), page 151, states that common mode currents, i.e., antenna currents on the outside of a coax or antenna currents on both conductors of a parallel feedline, can be de-tuned or eliminated by placing a high impedance to these currents at a point on the line where the current would be maximum.

"For a dipole antenna, the optimum location for the high impedance would be at the feedpoint where the current is maximum, or at $\lambda/2$ intervals from the feedpoint. I have found that a choke coil like yours placed at the feedpoint of a dipole is *much* more effective at eliminating rf on the feedline than a conventional balun. I no longer use a balun, just a choke.

"Field strength measurements have shown that the radiation pattern of a dipole antenna is drastically altered when there is rf on the feedline, but the addition of a choke at the feedpoint corrects this problem.

"I first found that I had rf on the feedline when I noticed that the swr was different at different points along the feedline. With the choke installed, this problem goes away.

"P.S. If you resonate the choke with a variable capacitor the results are even better!"

Thanks for the interesting feedback, Al. Resonating with a capacitor had not occurred to me, but for single-band operation, an improvement could certainly be obtained by this expedient. For allband operation, it would be best to stick with the choke method. Another application for choke isolation of undesired antenna currents comes to mind. This is the suppression of rf energy from the shack when necessary to eliminate rf burns resulting from contact with "hot" equipment.

Stanford J. Solms WA2MEL
Sunnyvale CA

FUN-PEDITIONS

Caribbean vacation spots are certainly *not* DXpeditions—they are DX operations or are sometimes called fun-peditions. Let's start putting DXpeditions vs. DX operations in true perspective. True DXpeditions include, but are not limited to, for example, Malpelo, Bouvet, Okino Torishima, Spratly, et al. My *new* show is *all* of these plus many others. Hope you can catch my show on the circuit. It's a great show.

Hugh G. Vandegrift WA4WME
Killeen TX

We'll be looking for you, Hugh, and be sure to take a lot of good color pictures for the write-ups on your trip. One of the problems with some of the earlier DXpeditions to many of the places you mentioned was that they were fakes. At least when someone says he is on a fairly rare island in the Caribbean, there is a good chance he is where he says he is. But remember one thing, Hugh: If I haven't worked a particular country, that's DX for me and the chap visiting is on a valid DXpedition. The bottom line is fun . . . the fun of working DX for us and the fun of being DX for you—Wayne.

OPERATOR'S LICENSE

With regard to the new flap over the tactics of Mr. Bash and his "educational services," I would like to add some additional comment.

Personally, I never could understand why someone *had* to have an understanding of the workings of electronics to become a ham. Frankly, it stems from the old days when you had to put things together (homebrew) to even get on the air. Today we are flooded with state-of-the-art rigs. Who needs home brew unless you are personally interested in doing that; why do I have to know the stuff?

Before someone jumps on me, I'd better mention that I have a background in electronics and work for an electronics firm here and was originally licensed in 1957.

Most everyone today is an appliance operator anyway. What we need is a test that makes all potential operators have a thorough knowledge of the rules of the road, proper operating procedures, proper use of radios and tuning up, and etiquette on the air. As far as I am concerned, it is no different than a license to own or operate a car, truck, gun, fishing rod, camper, or whatever. Look at all of the people out there that took a driver's test many years ago in a car and go out and buy a big camper, get behind the wheel, and create a menace on the highways. (This is not to say that many people don't drive campers well.) I fail to see a big difference. Who really cares what a MOSFET does, or a diode, or a spark plug, as long as the rig/car works. Some folks would not know a spark plug from a rotor.

I endorse and support Mr. Bash, will use his services, provide feedback, and do whatever else I can. To those that scorn him, I detect a note of jealousy (these services were not available to them) and a desire to maintain some elitist group. We should keep the code as it is, but all this theory is for the people that really like it. Heck, you can get a pilot's license without knowing how to fix the plane. Too many old folks reluctant to make change stagnate anything they are involved in. Let's wake up and revitalize ham radio. Now is the time.

Alan Davis KB7HM
Salt Lake City

Let's hear it for the code-free, theory-free license.—Wayne.

KEEP IT SHORT

I am pleased that you have seen fit to promote 10-meter FM in *73*.

As one who has been on 29.6 for many years (at the bottom of the sunspot cycle), I am disturbed at the new arrivals on 29.6 complaining about people who aren't QRP or running a converted CB. (Everyone else is using excessive power.) I welcome these newcomers and hope they will contribute to the band. The fact that most have converted a CB or old mobile rig places them among the few hams who are not merely appliance operators.

QRP contacts are an everyday thing on 29.6, but they are usually *brief*. I would hope that for the first few exchanges, the QRP operator would *keep it short*—QTH, handle, rig, signal report. As exchanges prove the band is holding up, then rag chew. Over 50% of my contacts were fading into the noise before I could get basic information, so *I* have stopped calling the marginal ones.

The newcomers are probably not aware that 1 kW and a 5-el beam on 29.6 will provide a fade margin for long, frequent contacts while they are fading into the noise.

Hopefully, everyone will be able to coexist on this small piece of 10 meters. QRP signals are great for studying propagation, and we all have lots to learn.

My hope is that some of these QRPers will see the value of power and gain before we hit a low in the sunspot cycle. There is a whole world of 600-1200-mile sporadic-E activity while 20/15 meters are closed, but a QRP will be unable to take advantage of it.

Les Whittaker Jr. WB0PXA
Miami FL

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ALASKA	14A	14	7	7	7	7	7	7	14	14A	21A	21A
ARGENTINA	14	7A	7	7B	7B	7	14A	21	21A	21A	21A	21A
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14B	21	21	21A	21A
CANAL ZONE	14	7	7	7	7	7	14	21A	21A	21A	21A	21
ENGLAND	7	7	7	7	7	7	14	21A	21A	14A	14	7
HAWAII	21A	14	7B	7	7	7	7	7B	14	21A	21A	21A
INDIA	7	7	7B	7B	7B	7B	14	14A	14	7B	7B	7
JAPAN	14A	14B	7B	7B	7	7	7	7B	7B	7B	14B	14
MEXICO	14A	7A	7	7	7	7	7	14A	21A	21A	21A	21
PHILIPPINES	14A	14B	7B	7B	7B	7B	7B	14B	14B	14B	14B	14
PUERTO RICO	14	7	7	7	7	7	14	21A	21A	21A	21	21
SOUTH AFRICA	14	7B	7	7B	7B	14	21A	21A	21A	21A	21A	14A
U. S. S. R.	7	7	7	7	7	7B	14	21A	21	7B	7B	7
WEST COAST	21	14	7	7	7	7	7	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	14	7	7	7	7	7	7	14	14A	21A	21A
ARGENTINA	21	14	7	7B	7B	7	14	21	21A	21A	21A	21A
AUSTRALIA	21A	14	7B	7B	7B	7B	7B	7B	14	21	21A	21A
CANAL ZONE	14	7A	7	7	7	7	7A	21A	21A	21A	21A	21A
ENGLAND	7	7	7	7	7	7	7B	14A	21A	14A	14	7B
HAWAII	21A	14	7	7	7	7	7	7	14	21A	21A	21A
INDIA	7B	7B	7B	7B	7B	7B	7B	7B	14	7B	7B	7B
JAPAN	21A	14	7B	7B	7	7	7	7	7B	7B	14B	21
MEXICO	14	7	7	7	7	7	7	14	21	21A	21A	21
PHILIPPINES	21A	14	7B	7B	7B	7B	7B	7	14B	14B	14B	14
PUERTO RICO	14	7	7	7	7	7	7A	21	21A	21A	21	21
SOUTH AFRICA	14	7B	7	7B	7B	7B	14	21A	21A	21A	21A	14A
U. S. S. R.	7B	7	7	7	7	7B	7B	14A	14A	7B	7B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21A	14	7	7	7	7	7	3A	7A	14	21	21A
ARGENTINA	21A	14	7A	7B	7B	7	7B	14A	21A	21A	21A	21A
AUSTRALIA	21A	21	14	7	7B	7B	7B	7B	14	21	21A	21A
CANAL ZONE	21	14	7	7	7	7	7	14A	21A	21A	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	14B	21A	14A	14B	7B
HAWAII	21A	21	14	7A	7	7	7	7	14	21A	21A	21A
INDIA	7B	14	7B	7B	7B	7B	7B	7B	14B	7B	7B	7B
JAPAN	21A	14A	14B	7B	7	7	7	7	7	7B	14B	21A
MEXICO	21	14	7	7	7	7	7	7A	21	21A	21A	21A
PHILIPPINES	21A	14A	14B	7B	7B	7B	7B	7	14B	14B	14B	14
PUERTO RICO	21	14	7	7	7	7	7	14A	21A	21A	21A	21
SOUTH AFRICA	21	14	7	7B	7B	7B	7B	14	21A	21A	21A	14A
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EAST COAST	21	14	7	7	7	7	7	14	21A	21A	21A	21A

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair G = Good P = Poor
SF = Chance of solar flares

december

sun	mon	tue	wed	thu	fri	sat
	1 F/SF	2 F/SF	3 F	4 G	5 G	6 F
7 G	8 G	8 G	10 G	11 G	12 G	13 G
14 F	15 F	16 G	17 G	18 F	18 F	20 F
21 G	22 G	23 G	24 F/SF	25 P/SF	26 F	27 F
28 G	28 G	30 G	31 G			